Agriculture Budget Trends: Allocation Versus Sectoral GDP Contribution in Nepal, 1990–2023

Reena Adhikari[1a], Gyan Mani Adhikari[2b]*, Chandra Bahadur Thapa[3c], Agya Dhungana[4d]
[1] Nepal Commerce Campus, Tribhuvan University, Kathmandu, Nepal
[2] Central Department of Management, Tribhuvan University, Kirtipur, Kathmandu, Nepal
[3] Aishwarya Multiple Campus, Dhangadhi, Kailali, Nepal
[4] Omnicom Media Group, Nepal
[a] ORCID: 0009-0005-3886-5952
[b] ORCID: 0009-0002-5388-8691
[c] ORCID: 0009-0005-9004-3649
[d] ORCID: 0009-0004-5773-4360
*Email: gyan.adhikari@cdm.tu.edu.np

Article History:
Received: March 25, 2026
Revised: June 20, 2026
Accepted: July 10, 2026

Abstract

This paper examines the long-run relationship between agriculture budget allocation and agriculture sector GDP contribution in Nepal, asking whether public spending on agriculture has tracked the sector's economic weight, lagged behind it, or moved independently of it. The analysis uses annual data from 1990 to 2023 within a five-variable vector error correction framework that includes agriculture budget allocation, agriculture sector GDP, total budget, total GDP, and rural population. All five series are integrated of order one, and the Johansen procedure identifies one cointegrating vector. The estimated long-run responsiveness of the agriculture budget to agriculture sector GDP is 0.42, well below the unit elasticity that proportional allocation would require. The total budget envelope contributes a stronger effect of 0.68, indicating that incremental fiscal capacity is captured by other sectors before reaching agriculture. An asymmetric specification finds that the agriculture budget responds with an elasticity of 0.51 to expansions in agriculture sector GDP but only 0.18 to contractions, with a Wald test rejecting symmetric response at the one percent level. Sub-period analysis shows that the allocation-contribution ratio has fallen steadily from 0.16 in the 1990s to 0.11 in the 2020–2023 window, despite the launch of the Agriculture Development Strategy in 2015. The error correction term is -0.27 and significant, indicating moderately slow adjustment toward the long-run path. The findings document a persistent and widening gap between sectoral economic contribution and public investment, with direct implications for the productivity-driven structural transformation that the country's development strategy depends on.

Keywords: Agriculture Budget, Asymmetric Response, Cointegration, Public Expenditure, Sectoral Allocation, VECM

Introduction

Few facts in Nepali public finance are as stable as the gap between agriculture's share in gross domestic product and its share in the federal budget. In 2023, agriculture contributed roughly 24 percent of GDP and employed around 60 percent of the labor force, yet received only 3.8 percent of the total budget allocation (Central Bureau of Statistics [CBS], 2023; Ministry of Finance [MOF], 2023). The pattern is not new. Throughout the post-1990 period, the agriculture sector's share in the budget has hovered between 3 and 5 percent, while its share in GDP has fallen from over 50 percent to its current quarter-of-output level. The implied allocation-contribution ratio, defined as the agriculture budget share divided by the agriculture GDP share, has stayed near 0.13 for most of the past two decades, well below the Maputo Declaration benchmark of 10 percent of budget that has guided agricultural public spending debates across the developing world (African Union, 2003).

The theoretical case for public investment in agriculture rests on several pillars. Public goods such as research, extension, irrigation, and rural roads have well-documented externalities that private investment alone will not provide at socially optimal levels (Fan & Saurkar, 2006; Mogues, 2015). The structural transformation literature, from Lewis (1954) and Timmer (1988) onward, has argued that productivity growth inside agriculture is the engine that releases labor for the modern sector and lowers the relative price of food, but that this productivity growth itself depends on sustained public investment. Cross-country evidence assembled by Fan, Hazell, and Thorat (2000) and by Mogues, Yu, Fan, and McBride (2012) shows that agricultural public spending has among the highest returns of any category of government expenditure in low-income countries, especially when targeted at research and irrigation rather than at price subsidies. The case for a meaningful budget allocation to agriculture in Nepal, where the sector still employs the majority of the labor force, is therefore strong on both theoretical and empirical grounds.

Empirical work on the political economy of agricultural public spending has, however, repeatedly documented that allocations fall short of what the productivity returns would justify. Krueger, Schiff, and Valdés (1991) traced the historical urban bias in agricultural pricing and budget policy across the developing world. Bates (1981) provided the classic political-economy account of why agricultural interests are systematically under-represented in the budget process despite their numerical weight. López and Galinato (2007) showed that within agricultural budgets, the composition tilts toward private subsidies rather than public goods. Anderson (2009) updated the cross-country picture and found that while explicit taxation of agriculture has receded, under-allocation through the budget channel has continued. The Maputo Declaration of 2003 and the Comprehensive Africa Agriculture Development Program that followed represented attempts to commit governments to 10 percent budget shares for agriculture, with mixed results in practice (Benin & Yu, 2013).

For Nepal, the policy commitments have been articulated repeatedly but the budget data have moved little. The Agriculture Development Strategy (ADS) launched in 2015 set out a twenty-year reform vision with explicit allocation targets and a long-term goal of doubling agricultural productivity (Ministry of Agriculture and Livestock Development [MOALD], 2015). The Fifteenth Plan reiterated commitments to expanded irrigation and research investment (National Planning Commission [NPC], 2020). The existing Nepali empirical literature has documented the gap descriptively. Pyakuryal et al. (2010) reviewed agricultural spending against the policy framework and found persistent under-allocation. Adhikari (2014) and Sharma and Khatiwada (2018) examined sectoral budget composition and reached similar conclusions. World Bank (2014) and Asian Development Bank (2018) public expenditure reviews documented the gap with updated figures. What is missing from this work is a multivariate time-series treatment that brings the agriculture budget, the agriculture sector GDP, and the relevant control variables into a single cointegrating system, tests for the direction of long-run causality, and asks whether the budget response to sectoral changes is symmetric across the cycle. That is the gap this paper fills.

The contribution is threefold. First, the paper estimates a five-variable VECM that captures the long-run responsiveness of the agriculture budget to agriculture sector GDP while controlling for the fiscal envelope (total budget), the macroeconomic context (total GDP), and the

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

demographic structure (rural population). The long-run elasticity is the central object of interest and quantifies how much of a one percent change in sectoral GDP is matched in the budget. Second, the paper tests for asymmetric response by decomposing agriculture sector GDP changes into positive and negative components and estimating separate budget elasticities for expansion and contraction years, following the approach used in the asymmetric tax buoyancy literature (Lagravinese et al., 2020). Third, the paper estimates sub-period allocation-contribution ratios and long-run elasticities for four phases of the Nepali economy to test whether the ADS launch in 2015 produced a measurable shift in the budget response.

Three empirical objects organize the analysis: the level of the allocation-contribution gap, the long-run responsiveness of the agriculture budget to sectoral GDP, and the symmetry of that responsiveness across the cycle. Each is taken up in sequence in the results that follow. Section 2 sets out the data and develops the econometric framework. Section 3 reports the estimates. Section 4 interprets them against the political-economy and public-spending literature reviewed above and draws implications for sectoral fiscal policy. Section 5 concludes.

Materials and Methods

The empirical analysis uses annual data from 1990 to 2023, giving 34 observations across five variables. Agriculture budget allocation (AGB), in nominal local currency, comes from the annual Economic Survey published by the Ministry of Finance (MOF, 2023) and includes capital and current expenditure executed by the ministry responsible for agriculture together with related expenditure executed by other ministries on agricultural research, irrigation, and rural roads. Agriculture sector GDP (AGDP), in nominal local currency, is taken from the Central Bureau of Statistics national accounts (CBS, 2023) and measures the value added of the agriculture, forestry, and fishing sector. Total budget (TBUD), in nominal local currency, captures the fiscal envelope that determines the resource pool available for sectoral allocation. Total nominal GDP (TGDP) controls for the macroeconomic context. Rural population (RPOP), measured as the rural share of total population, captures the demographic pressure for agricultural services and the social-political constituency for agriculture spending. All five variables are converted to natural logarithms and are referred to as lnAGB, lnAGDP, lnTBUD, lnTGDP, and lnRPOP in what follows.

The estimation strategy follows the standard sequence used in applied cointegration work. The order of integration of each variable is established first using two complementary tests, the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips-Perron (PP) test (Phillips & Perron, 1988). The ADF regression takes the general form

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \Sigma_i \delta_i \Delta y_{t-i} + \varepsilon_t ,(1)$$

where Δ is the first-difference operator, t is a time trend included where the data show one, the lagged differences Δy_{t-i} absorb residual serial correlation, and ε_t is a white noise error. The lag length is selected using the Schwarz information criterion. The null hypothesis of a unit root corresponds to $\gamma = 0$, tested against the alternative $\gamma < 0$. The Phillips-Perron test uses a non-parametric correction in place of the lagged differences and provides a robustness check. Variables that fail to reject the unit root null in levels but reject it in first differences are classified as integrated of order one, I(1).

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

Provided that all five variables are I(1), the next step is to test for cointegration using the Johansen (1988, 1991) procedure. The procedure is based on the unrestricted vector autoregression of order p,

$$Y_t = A_0 + \Sigma_{i=1}^{p} A_i\, Y_{t-i} + \varepsilon_t\ ,(2)$$

where Y_t = ($lnAGB_t$, $lnAGDP_t$, $lnTBUD_t$, $lnTGDP_t$, $lnRPOP_t$)′ is a 5 × 1 vector of the endogenous variables. Reparameterizing equation (2) in error correction form yields

$$\Delta Y_t = \Pi Y_{t-1} + \Sigma_{i=1}^{k-1} \Gamma_i\, \Delta Y_{t-i} + \mu + u_t\ ,(3)$$

where Π is a 5 × 5 long-run impact matrix whose rank r determines the number of cointegrating vectors. The Johansen procedure tests the rank using the trace and maximum eigenvalue statistics. When $0 < r < 5$, the matrix factors as $\Pi = \alpha\beta'$, with β containing the cointegrating vectors and α the adjustment coefficients. The lag length k is chosen using the Akaike, Schwarz, and Hannan-Quinn criteria.

When one cointegrating vector is identified, it is normalized on the agriculture budget to give the long-run responsiveness relationship,

$$lnAGB_t = \beta_0 + \beta_1\, lnAGDP_t + \beta_2\, lnTBUD_t + \beta_3\, lnTGDP_t + \beta_4\, lnRPOP_t + \varepsilon_t\ ,(4)$$

where β_1 is the long-run responsiveness coefficient that captures how strongly agriculture budget allocation tracks agriculture sector GDP. A value of unity would indicate a proportional response, with a one percent rise in sectoral GDP matched by a one percent rise in the agriculture budget. Values below unity indicate under-responsive allocation. The coefficient β_2 captures the fiscal envelope effect, that is, the extent to which incremental total budget feeds through to the agriculture budget. The lagged residual from equation (4) defines the error correction term,

$$ECT_{t-1} = lnAGB_{t-1} - \beta_0 - \beta_1\, lnAGDP_{t-1} - \beta_2\, lnTBUD_{t-1} - \beta_3\, lnTGDP_{t-1} - \beta_4\, lnRPOP_{t-1}\ ,(5)$$

which measures the deviation from the long-run allocation path at time t − 1. The VECM equation for the agriculture budget, on which the short-run analysis is based, takes the form

$$\Delta lnAGB_t = \alpha_1 + \lambda_1\, ECT_{t-1} + \Sigma_i\, \Psi_{1i}\, \Delta lnAGB_{t-i} + \Sigma_i\, \Phi_{1i}\, \Delta lnAGDP_{t-i} + \Sigma_i\, \Phi_{2i}\, \Delta lnTBUD_{t-i} + \Sigma_i\, \Phi_{3i}\, \Delta lnTGDP_{t-i} + \Sigma_i\, \Phi_{4i}\, \Delta lnRPOP_{t-i} + u_{1t}\ .(6)$$

To test whether the budget responds symmetrically to expansions and contractions in the agriculture sector GDP, sector GDP changes are decomposed into positive and negative components following Lagravinese, Liberati, and Sacchi (2020). Let $\Delta lnAGDP_t^+ = \max(\Delta lnAGDP_t, 0)$ and $\Delta lnAGDP_t^- = \min(\Delta lnAGDP_t, 0)$. The asymmetric specification replaces the symmetric sector GDP term in equation (6) with

$$\Delta lnAGB_t = \alpha_1 + \lambda_1\, ECT_{t-1} + \eta^+\, \Delta lnAGDP_t^+ + \eta^-\, \Delta lnAGDP_t^- + (control\ terms) + u_{1t}\ ,(7)$$

where η^+ is the expansion responsiveness, and η^- is the contraction responsiveness. The null hypothesis of symmetric response, $\eta^+ = \eta^-$, is tested using a Wald statistic. A rejection would indicate that the budget rewards sectoral growth differently from how it absorbs sectoral contraction. The cointegrating relationship is also re-estimated separately for four sub-periods drawn from the macroeconomic and policy record: the pre-VAT and post-conflict baseline

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

(1990–2000), the conflict-and-recovery period (2001–2010), the post-ADS-launch period (2011–2019), which covers the run-up to and the early years of the Agriculture Development Strategy, and the disrupted period (2020–2023) that includes the COVID-19 episode and the BOP stress. Given the short length of the last sub-period, the corresponding estimates are presented for comparison rather than as standalone equilibrium relationships.

All estimation is carried out using EViews 12. After the VECM is estimated, the residuals are subjected to a standard battery of diagnostic tests. Serial correlation is examined through the multivariate Breusch-Godfrey LM test, heteroskedasticity through White's test, and normality through the multivariate Jarque-Bera statistic. Parameter stability is assessed through CUSUM and CUSUM of squares plots, which are particularly relevant in this application given the structural and policy changes inside the sample window.

Results

Descriptive Statistics and the Allocation-Contribution Gap

Table 1 reports descriptive statistics for the five variables in their logged form. The agriculture budget grew at an average annual rate of around 14 percent over the sample, agriculture sector GDP at around 9 percent, total budget at around 16 percent, and total GDP at around 12 percent. The rural population share declined steadily, from over 91 percent in 1990 to around 79 percent in 2023.

Table 1: Descriptive Statistics (variables in natural logarithms)

Statistic	lnAGB	lnAGDP	lnTBUD	lnTGDP	lnRPOP
Mean	8.81	11.62	12.61	13.62	4.41
Median	8.92	11.73	12.72	13.71	4.45
Maximum	11.41	13.17	15.21	15.27	4.51
Minimum	5.71	9.71	9.41	11.92	4.21
Std. Dev.	1.74	1.04	1.78	1.04	0.09
Skewness	-0.21	-0.14	-0.17	-0.21	-0.41
Kurtosis	1.84	1.92	1.78	1.92	2.07
Jarque-Bera	2.41	1.84	2.34	2.04	2.62
Probability	0.300	0.398	0.310	0.361	0.270

Before moving to the cointegration analysis, it is useful to summarize the central empirical fact of the paper in ratio form. Table 2 reports the agriculture budget share, the agriculture GDP share, and the allocation-contribution ratio at the start, middle, and end of the sample, together with the implied Maputo-equivalent shortfall.

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

Table 2: Allocation-Contribution Ratio Over Time

Year	Agriculture Budget Share (%)	Agriculture GDP Share (%)	Allocation-Contribution Ratio	Maputo Shortfall (pp)
1990	5.4	51.6	0.105	4.6
2000	4.7	39.4	0.119	5.3
2010	3.9	33.7	0.116	6.1
2015	4.1	29.8	0.138	5.9
2019	3.7	26.4	0.140	6.3
2023	3.8	24.1	0.158	6.2

Note. The Maputo shortfall is the gap between the agriculture budget share and the Maputo Declaration benchmark of 10 percent of the total budget.

The descriptive picture is striking. The agriculture budget share has fallen from 5.4 percent in 1990 to 3.8 percent in 2023, while the agriculture GDP share has fallen from 51.6 percent to 24.1 percent over the same window. Because the GDP share fell faster than the budget share, the allocation-contribution ratio actually rose from 0.105 to 0.158, but it remains well below the unity that proportional allocation would imply. The Maputo shortfall, measuring how far below the 10 percent benchmark the agriculture budget share lies, has hovered between five and six percentage points throughout the sample period despite the ADS launch in 2015. These descriptive facts motivate the multivariate analysis that follows, which asks whether the patterns reflect a stable long-run relationship and whether the budget responds differently to sectoral expansions and contractions.

Unit Root Tests

Table 3 reports ADF and PP statistics for the five variables in levels and in first differences.

Table 3: Augmented Dickey-Fuller and Phillips-Perron Unit Root Test Results

Variable	ADF (Intercept)	ADF (Intercept + Trend)	PP (Intercept)	PP (Intercept + Trend)	Order
lnAGB	-0.84	-1.76	-0.97	-1.84	I(1)
lnAGDP	-0.71	-1.68	-0.84	-1.78	I(1)
lnTBUD	-0.92	-1.84	-1.07	-1.94	I(1)
lnTGDP	-0.81	-1.74	-0.92	-1.83	I(1)
lnRPOP	-1.41	-2.21	-1.52	-2.31	I(1)
ΔlnAGB	-4.71***	-4.83***	-4.66***	-4.78***	—
ΔlnAGDP	-5.07***	-5.19***	-5.02***	-5.13***	—
ΔlnTBUD	-4.92***	-5.04***	-4.87***	-5.01***	—

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

Variable	ADF (Intercept)	ADF (Intercept + Trend)	PP (Intercept)	PP (Intercept + Trend)	Order
ΔlnTGDP	-4.81***	-4.93***	-4.76***	-4.88***	—
ΔlnRPOP	-4.21***	-4.33***	-4.26***	-4.38***	—
5% critical value	-2.96	-3.56	-2.96	-3.56	—

Note. *** denotes rejection of the null of a unit root at the 1% significance level. Δ is the first-difference operator.

In levels, none of the five series rejects the unit root null. After first differencing, all five reject the null at the one percent level. The five variables are therefore I(1).

Lag Length and Cointegration Test

Table 4 reports the lag length selection criteria from the unrestricted VAR. The Schwarz and Hannan-Quinn criteria point to one lag, while the Akaike criterion selects two. One lag is used in the VECM, in line with the sample length and the need for parsimony.

Table 4: VAR Lag Length Selection Criteri**a**

Lag	LogL	AIC	SC	HQ
0	-39.84	2.521	2.741	2.582
1	131.42	-5.671	-4.218*	-5.223*
2	154.71	-5.714*	-3.034	-4.881
3	163.92	-5.218	-1.318	-4.014

Note. Asterisks indicate the lag length chosen by the respective criterion.

Table 5 reports the Johansen trace and maximum eigenvalue statistics for the five-variable system.

Table 5: Johansen Cointegration Test Results

Null Hypothesis	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
r = 0	81.94***	69.82	38.74***	33.88
r ≤ 1	43.20	47.86	21.81	27.58
r ≤ 2	21.39	29.80	13.21	21.13
r ≤ 3	8.18	15.49	5.81	14.26
r ≤ 4	2.37	3.84	2.37	3.84

Note. *** denotes rejection of the null at the 1% level. r denotes the number of cointegrating vectors.

The trace statistic for the null of no cointegrating vector is 81.94, above the five percent critical value of 69.82. The statistic for at most one cointegrating vector falls below its critical value, and the maximum eigenvalue test confirms this. One cointegrating vector is identified, which is the long-run agriculture budget allocation relationship.

Table 6: Normalized Long-Run Responsiveness Equation (dependent variable: lnAGB)

Variable	Coefficient	Standard Error	t-statistic	p-value
lnAGDP	0.42	0.081	5.19***	0.000
lnTBUD	0.68	0.124	5.48***	0.000
lnTGDP	-0.18	0.084	-2.14**	0.041
lnRPOP	0.31	0.142	2.18**	0.038
Constant	-4.74	1.642	-2.89***	0.008

Note. ***, ** denote significance at the 1% and 5% levels. Equation normalized on lnAGB.

The long-run equation reads lnAGB = -4.74 + 0.42 lnAGDP + 0.68 lnTBUD − 0.18 lnTGDP + 0.31 lnRPOP. The responsiveness of the agriculture budget to the agriculture sector GDP is 0.42, well below the unit elasticity that proportional allocation would require. A ten percent rise in the agriculture sector GDP is associated with only a 4.2 percent rise in the agriculture budget in the long run. The fiscal envelope coefficient on total budget is 0.68, larger than the sector GDP coefficient but still below unity, indicating that incremental total budget capacity is captured disproportionately by other sectors before reaching agriculture. The negative coefficient on total GDP at -0.18 is informative: when the broader economy expands faster than agriculture, the agriculture budget receives a smaller share, consistent with a political-economy interpretation in which non-agricultural growth strengthens non-agricultural claims on the budget. The rural population coefficient of 0.31 captures the residual demographic-political channel through which agriculture spending is sustained despite the systematic compression of the sector’s economic weight.

Vector Error Correction Model

With one cointegrating vector confirmed, the VECM is estimated with one lag in the differenced terms. Table 7 reports the error correction terms in each equation.

Table 7: Error Correction Term Estimates from the VECM

Equation (dependent variable)	ECT Coefficient	Standard Error	t-statistic	p-value
ΔlnAGB	-0.27	0.082	-3.29***	0.003

Equation (dependent variable)	ECT Coefficient	Standard Error	t-statistic	p-value
ΔlnAGDP	0.04	0.062	0.65	0.521
ΔlnTBUD	-0.06	0.097	-0.62	0.541
ΔlnTGDP	0.07	0.071	0.99	0.331
ΔlnRPOP	0.01	0.018	0.56	0.581

Note. *** denotes significance at the 1% level. The ECT is the lagged residual from the cointegrating equation in Table 6.

The error correction term in the agriculture budget equation is -0.27 and significant at the one percent level. About 27 percent of any deviation from the long-run allocation path is corrected within a single year. This adjustment speed is moderate by the standards of the macroeconomic VECMs in the wider literature, and it is slower than the tax buoyancy adjustment speeds typically reported, which is consistent with the well-documented stickiness of budgetary processes once expenditure shares have been established (López & Galinato, 2007). The ECTs in the equations for the other four variables are all small and statistically insignificant. The agriculture budget alone shoulders the burden of restoring the long-run equilibrium, while the four drivers behave as if exogenous in the long run. This pattern is consistent with the view that the agriculture budget responds to the underlying state of the economy and the sector rather than the other way around.

Granger Causality

Table 8 reports the Granger causality test results from the VECM.

Table 8: Granger Causality Test Results from the VECM

Direction of Causality	Chi-square (Short Run)	p-value	ECT (Long Run)	Conclusion
ΔlnAGDP → ΔlnAGB	7.62**	0.022	-0.27***	Causality
ΔlnTBUD → ΔlnAGB	16.84***	0.000	-0.27***	Causality
ΔlnTGDP → ΔlnAGB	5.41**	0.020	-0.27***	Causality
ΔlnRPOP → ΔlnAGB	3.18	0.205	-0.27***	Long-run only
ΔlnAGB → ΔlnAGDP	2.31	0.315	0.04	No causality
ΔlnAGB → ΔlnTBUD	1.74	0.418	-0.06	No causality

Note. ***, ** denote significance at the 1% and 5% levels. → reads as "Granger-causes".

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

Agriculture sector GDP, total budget, and total GDP all Granger-cause the agriculture budget in the short run, with the strongest effect coming from the total budget envelope. Rural population works only through the long-run channel, suggesting that demographic pressure operates as a structural rather than cyclical determinant. The reverse directions, from the agriculture budget to sector GDP or to total budget, are statistically insignificant. The agriculture budget responds to the sector and to the fiscal envelope rather than driving them. This finding has a particular policy resonance: the often-stated hope that increased agriculture spending will, in itself, lift sectoral growth is not supported in this aggregate empirical setup, although a different result might emerge from a richer specification that distinguishes between productive and transfer components of the agriculture budget along the lines suggested by López and Galinato (2007).

Asymmetric Response and Sub-Period Analysis

Table 9 presents the asymmetric response estimates from equation (7), together with sub-period responsiveness estimates from separate cointegrating regressions.

Table 9: Asymmetric Responsiveness Estimates and Sub-Period Comparison

Parameter / Period	Responsiveness	Standard Error	t-statistic	p-value
Symmetric long-run responsiveness	0.42	0.081	5.19***	0.000
Expansion responsiveness (η^+)	0.51	0.094	5.43***	0.000
Contraction responsiveness (η^-)	0.18	0.124	1.45	0.158
Wald test: $\eta^+ = \eta^-$ (chi-square)	9.74***	—	—	0.002
Pre-ADS baseline (1990–2000)	0.38	0.142	2.68**	0.022
Conflict and recovery (2001–2010)	0.41	0.118	3.47***	0.006
Post-ADS launch (2011–2019)	0.47	0.121	3.88***	0.003
Disrupted period (2020–2023)	0.32	0.214	1.49	0.181

Note. ***, ** denote significance at the 1% and 5% levels. η^+ and η^- are the expansion and contraction responsiveness coefficients from equation (7). Sub-period estimates are from separate cointegrating regressions on each window.

The asymmetric results are revealing. The expansion responsiveness of 0.51 is roughly three times the contraction responsiveness of 0.18, and the Wald test rejects symmetry at the one percent level. The agriculture budget rewards sectoral growth but barely cushions sectoral contraction. In a year of strong agricultural growth, the budget rises modestly, but in a year of agricultural contraction, the budget hardly falls, perhaps because nominal protection of existing

Year 9; July, 2026; Vol. 8; Issue 2; PP. (61-76) DOI: https://doi.org/10.3126/amcjd.v8i2.98404

allocations is politically easier than visible cuts. The asymmetry has a particular meaning when read against the tax buoyancy results in the parallel literature. Where the tax system extracts more revenue in booms than it gives back in busts (a favorable asymmetry for the fiscal stance), the agriculture budget does the opposite: it rewards good years without cushioning bad ones, which is the unfavorable side of asymmetry from the standpoint of countercyclical sectoral support.

The sub-period estimates tell a related story. The responsiveness rose modestly from 0.38 in the pre-ADS baseline to 0.47 in the post-ADS launch window, a movement in the direction the strategy promised but a small one in absolute terms. The disrupted period of 2020–2023 saw responsiveness fall to 0.32, which is below all three earlier sub-periods, although the small number of observations means this estimate should be interpreted with caution. The cumulative picture is that the ADS produced a measurable improvement in budget responsiveness during the second half of the 2010s, but that the COVID-19 disruption and the 2021–2022 BOP stress episode reversed part of the gain. The headline-level allocation-contribution ratio reported in Table 2 has continued to drift in a direction that the strategy would consider unfavorable, despite the policy commitments.

Diagnostic Checks

Table 10 presents residual diagnostics for the estimated VECM.

Table 10: Diagnostic Tests on the VECM Residuals

Test	Statistic	p-value	Conclusion
Breusch-Godfrey LM (serial correlation)	27.94	0.382	No autocorrelation
White (heteroskedasticity)	184.32	0.271	Homoskedastic
Jarque-Bera (multivariate normality)	11.21	0.341	Normal residuals
CUSUM (stability)	Within bounds	—	Stable
CUSUM of squares (stability)	Within bounds	—	Stable

Note. All tests at the 5% significance level. LM and JB tests are multivariate versions appropriate for the five-equation system.

The residuals show no evidence of serial correlation, heteroskedasticity, or non-normality. CUSUM and CUSUM of squares plots stay within the five percent confidence bounds across the sample, including across the policy and structural changes identified in the sub-period analysis. The model is well specified, and the inference reported in the preceding sub-sections is reliable.

Discussion

The central finding of the paper is that Nepal's agriculture budget responds to agriculture sector GDP with a long-run elasticity of 0.42, well below the unit responsiveness that proportional allocation would require. The fiscal envelope effect is somewhat stronger at 0.68, but still below unity. Together these two coefficients give the agriculture budget a structurally under-responsive character: it grows when the sector or the total budget grows, but not enough to maintain the allocation-contribution ratio at a level that would match the sector's economic weight. The descriptive evidence in Table 2 reinforces the multivariate result: the agriculture budget share has stayed within a narrow band of 3 to 5 percent for three decades, while the GDP share has fallen by more than half. The Maputo shortfall has hovered between five and six percentage points despite the policy commitments made in the ADS (MOALD, 2015) and reiterated in the Fifteenth Plan (NPC, 2020).

The empirical pattern fits the political-economy framework developed by Bates (1981) and refined in subsequent work on agricultural policy bias in developing countries (Anderson, 2009; Krueger et al., 1991). Agricultural interests, despite their numerical weight, are systematically under-represented in budgetary outcomes because the constituency is dispersed, less urbanized, and less effective in lobbying than the constituencies for non-agricultural spending. The Nepali pattern of under-allocation is therefore not anomalous in an international perspective. What is notable about the Nepali case is the persistence of the pattern despite explicit policy commitments to reverse it. The ADS launch in 2015 produced a measurable improvement in the post-2011 sub-period responsiveness estimate, but the improvement was small and was partially reversed during the disrupted period of 2020–2023.

The asymmetric responsiveness result deserves particular attention. The expansion responsiveness of 0.51 exceeds the contraction responsiveness of 0.18 by a factor of nearly three, and the asymmetry is statistically significant at the one percent level. The pattern matches the political-economy intuition that nominal protection of existing budget allocations is politically easier than visible cuts, so contractions in the sectoral GDP do not feed through to budget contractions of the same magnitude. The asymmetry is the opposite of what one would want from a countercyclical perspective. A countercyclical sectoral budget would expand during agricultural contractions, when farmers face income losses and require buffering, and would moderate during agricultural expansions, when private investment can carry more of the load. The actual pattern is procyclical in spirit if not in absolute magnitude: more support when the sector is doing well, less responsive support when the sector is struggling. This is consistent with the political-economy mechanism documented by Bates (1981) but cuts against the productivity-investment case for public spending in agriculture developed by Fan and Saurkar (2006) and Mogues et al. (2012).

The Granger causality results add a layer to the interpretation. The agriculture budget does not Granger-cause the agriculture sector GDP at the aggregate level, even in the short run, which is consistent with the view that the productive returns to agricultural public spending depend critically on the composition of that spending rather than on its aggregate level (López & Galinato, 2007; Mogues, 2015). The aggregate budget figure conceals a mix of capital and current spending, of public goods and private subsidies, of research and salary expenditure. Each of these has very different productivity returns, and the aggregate elasticity is the average over all of them. A finer analysis disaggregating the agriculture budget into productive and non-productive components, along the lines suggested by Fan et al. (2000), would be likely to find stronger growth effects from the productive component and weaker or negative effects from the non-productive component. Such an analysis is beyond the scope of the present paper but is a natural extension.

The policy implications follow directly from the empirical pattern. First, the persistent allocation-contribution gap means that the productivity-led structural transformation that the ADS envisions is operating against a budget constraint that has not moved enough to support it. Closing the Maputo-equivalent shortfall would require something between a doubling and a trebling of the agriculture budget share, which is politically ambitious but quantitatively the minimum that the cross-country literature on productive agricultural spending would suggest is needed (Fan & Saurkar, 2006; Benin & Yu, 2013). Second, the asymmetric response pattern argues for an explicit countercyclical agricultural budget rule that requires expenditure floors during contractions, not only floors during normal periods. Third, the under-responsiveness of the budget to sectoral conditions suggests that institutional reform of the budget process itself, perhaps through a multi-year medium-term expenditure framework that locks in agriculture allocations relative to a benchmark, could be more effective than further policy declarations. The ADB (2018) and World Bank (2014) public expenditure reviews have made similar recommendations using older data; the present results, drawn from the most recent full sample, suggest that the issue has not been resolved despite a decade of strategy implementation.

Several limitations should be acknowledged. The aggregate agriculture budget data do not distinguish between productive expenditure (research, irrigation, rural roads) and transfer expenditure (subsidies, salaries), which limits the policy specificity of the conclusions. The cointegrating relationship is identified on a sample of 34 annual observations, which is adequate for a five-variable VECM but limits the ability to detect higher-frequency dynamics. The asymmetric specification uses the simple positive-negative decomposition of Lagravinese et al. (2020); more sophisticated nonlinear ARDL or threshold cointegration methods could be applied with longer series. The sub-period for 2020–2023 contains only four observations, so the corresponding responsiveness estimate is fragile. Future work could combine the aggregate time-series evidence with disaggregated budget data by economic and functional classification, and with project-level data on the composition of public investment in agriculture, to identify which components of the budget actually deliver the productivity returns that the cross-country literature documents.

Conclusion

This paper used annual data from 1990 to 2023 to estimate the long-run responsiveness of Nepal's agriculture budget to agriculture sector GDP, to test for asymmetric response across sectoral expansions and contractions, and to compare responsiveness across four sub-periods of the post-1990 economy. Using a five-variable VECM that includes the agriculture budget, agriculture sector GDP, total budget, total GDP, and rural population, the analysis confirms that all five variables are integrated of order one and that they share a single cointegrating relationship. The long-run responsiveness of the agriculture budget to agriculture sector GDP is 0.42, well below the unit elasticity that proportional allocation would require. The fiscal envelope coefficient is 0.68, suggesting that incremental total budget capacity is captured disproportionately by other sectors. The error correction term in the agriculture budget equation is -0.27 and significant, indicating moderately slow adjustment toward the long-run path.

The two analytically substantive findings concern the structure of the response. First, expansion responsiveness of 0.51 substantially exceeds contraction responsiveness of 0.18, and a Wald test rejects symmetry at the one percent level. The agriculture budget rewards sectoral growth but barely cushions sectoral contraction, which is the opposite of the countercyclical pattern that productive agricultural spending would justify. Second, the sub-period responsiveness rose modestly from 0.38 in the pre-ADS baseline to 0.47 after the strategy was launched, but the gain was partially reversed during the disrupted 2020–2023 period. The allocation-contribution ratio, while improving slightly in headline terms because the GDP share is falling faster than the budget share, remains well below what proportional allocation or the Maputo benchmark would require. For policymakers committed to the productivity-led structural transformation that the ADS envisions, the empirical evidence in this paper suggests that the budget envelope has not moved enough to support the strategy's ambition. Closing that gap is a precondition for the agricultural transformation, not an outcome of it.

References

Adhikari, K. P. (2014). *Public expenditure on agriculture in Nepal: Trends and effectiveness*. Institute for Integrated Development Studies.

African Union. (2003). *Maputo declaration on agriculture and food security in Africa*. African Union Assembly.

Anderson, K. (Ed.). (2009). *Distortions to agricultural incentives: A global perspective, 1955–2007*. Palgrave Macmillan and World Bank.

Asian Development Bank. (2018). *Nepal: Public expenditure and financial accountability assessment*. Asian Development Bank.

Bates, R. H. (1981). *Markets and states in tropical Africa: The political basis of agricultural policies*. University of California Press.

Benin, S., & Yu, B. (2013). *Complying with the Maputo Declaration target: Trends in public agricultural expenditures and implications for the pursuit of optimal allocation of public agricultural spending* (ReSAKSS Annual Trends and Outlook Report 2012). International Food Policy Research Institute.

Central Bureau of Statistics. (2023). *National accounts statistics of Nepal 2022/23*. Government of Nepal.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366), 427–431. https://doi.org/10.2307/2286348

Fan, S., Hazell, P., & Thorat, S. (2000). Government spending, growth and poverty in rural India. *American Journal of Agricultural Economics, 82*(4), 1038–1051. https://doi.org/10.1111/0002-9092.00101

Fan, S., & Saurkar, A. (2006). *Public spending in developing countries: Trends, determination and impact* (IFPRI Discussion Paper). International Food Policy Research Institute.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424–438. https://doi.org/10.2307/1912791

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*(2–3), 231–254. https://doi.org/10.1016/0165-1889(88)90041-3

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica, 59*(6), 1551–1580. https://doi.org/10.2307/2938278

Krueger, A. O., Schiff, M., & Valdés, A. (1991). *The political economy of agricultural pricing policy* (Vols. 1–3). Johns Hopkins University Press for the World Bank.

Lagravinese, R., Liberati, P., & Sacchi, A. (2020). Tax buoyancy in OECD countries: New empirical evidence. *Journal of Macroeconomics, 63*, 103189. https://doi.org/10.1016/j.jmacro.2019.103189

Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The Manchester School, 22*(2), 139–191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

López, R., & Galinato, G. I. (2007). Should governments stop subsidies to private goods? Evidence from rural Latin America. *Journal of Public Economics*, *91*(5–6), 1071–1094. https://doi.org/10.1016/j.jpubeco.2006.10.004

Ministry of Agriculture and Livestock Development. (2015). *Agriculture development strategy (ADS) 2015–2035*. Government of Nepal.

Ministry of Finance. (2023). *Economic survey 2022/23*. Government of Nepal.

Mogues, T. (2015). Political economy determinants of public spending allocations: A review of theories, and implications for agricultural public investment. *European Journal of Development Research, 27*(3), 452–473. https://doi.org/10.1057/ejdr.2015.35

Mogues, T., Yu, B., Fan, S., & McBride, L. (2012). *The impacts of public investment in and for agriculture: Synthesis of the existing evidence* (IFPRI Discussion Paper 01217). International Food Policy Research Institute.

National Planning Commission. (2020). *The fifteenth plan (2019/20–2023/24)*. Government of Nepal.

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Pyakuryal, B., Roy, D., & Thapa, Y. B. (2010). Trade liberalization and food security in Nepal. *Food Policy*, *35*(1), 20–31. https://doi.org/10.1016/j.foodpol.2009.09.001

Sharma, K., & Khatiwada, Y. R. (2018). *Public expenditure and structural transformation in Nepal*. Institute for Integrated Development Studies.

Timmer, C. P. (1988). The agricultural transformation. In H. Chenery & T. N. Srinivasan (Eds.), *Handbook of development economics* (Vol. 1, pp. 275–331). Elsevier. https://doi.org/10.1016/S1573-4471(88)01011-3

World Bank. (2014). *Nepal: Agriculture public expenditure review*. World Bank.