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Government Spending on Agriculture and Economic Growth Nexus in Nepal: An ARDL Bounds Testing Approach

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Abstract

This study investigates the relationship between government spending on agriculture and economic growth in Nepal using the Autoregressive Distributed Lag (ARDL) bounds testing approach with annual data spanning from 1990 to 2023. As an agrarian economy where agriculture contributes approximately one-quarter of GDP and employs nearly two-thirds of the population, understanding the growth implications of agricultural public expenditure is critical for development policy formulation. Our empirical findings reveal several key insights: First, government spending on agriculture exhibits a positive and statistically significant long-run relationship with economic growth, with elasticity estimates suggesting that a ten percent increase in agricultural expenditure raises GDP growth by approximately one percentage point. Second, the relationship displays diminishing returns, indicating optimal expenditure thresholds beyond which additional spending generates progressively smaller growth dividends. Third, the composition of agricultural spending matters significantly, with expenditure on irrigation infrastructure and rural roads demonstrating substantially stronger growth impacts compared to agricultural subsidies. Fourth, cointegration analysis confirms stable long-run equilibrium relationships despite short-term fluctuations, with adjustment speeds indicating that deviations from equilibrium are corrected within two to three years. The study contributes to the development economics literature by providing robust empirical evidence on the agriculture-growth nexus in a least developed country context, with important implications for public expenditure prioritization, sectoral resource allocation, and rural development strategy.

Keywords: agricultural expenditure, economic growth, public investment, ARDL bounds testing, cointegration

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Introduction

Agriculture has long sat at the centre of development economics. The foundational work of Lewis (1954), Schultz (1964), and Mellor (1976) established the sector as the ground on which broader economic transformation tends to be built, particularly in low-income, largely rural settings (Johnston & Mellor, 1961; Timmer, 1988). Where most households still depend on farming, agriculture absorbs the bulk of the labour force and adds meaningfully to national output (Kuznets, 1966). It also pulls the rest of the economy along through forward and backward production linkages (Hirschman, 1958; Haggblade et al., 2007).

Nepal fits this description closely. Even with gradual structural change underway, agriculture continues to shape livelihoods and the wider economic structure of the country (Pant, 2012; Adhikari, 2008). In 2023, the sector accounted for roughly twenty-three percent of GDP, and its footprint is far larger in rural areas, where more than eighty percent of Nepalis live (Central Bureau of Statistics, 2023). The farming itself is quite varied: rice in the Terai plains, maize and millet across the hills, and horticulture and livestock spread across ecological zones (Nepal & Thapa, 2009). What happens in agriculture, then, feeds directly into poverty reduction, food security, and macroeconomic stability (Thapa & Gaiha, 2011; World Bank, 2008; Godfray et al., 2010).

Public spending on agriculture in Nepal, however, has followed an uneven path since 1990 (Ministry of Finance, 2023). The sector took in around seven percent of total public expenditure during the 1990s, dipped to under six percent between 2000 and 2010 amid the internal conflict (Koirala & Sinha, 2019), and has since climbed back to roughly eight percent (Government of Nepal, 2015). The composition has shifted too, moving away from input subsidies and towards irrigation, rural roads, and market infrastructure (Fan et al., 2008; Ghimire & Huang, 2016). Current policy puts the emphasis on commercialisation, value chains, credit support, and crop insurance (Agriculture Development Strategy, 2015; Gardner, 2005).

Whether these allocations are paying off in terms of growth, though, is a question that has not been settled.

Literature Review

The theoretical case for agriculture-led growth was sketched most clearly by Lewis (1954), Schultz (1964), and Mellor (1976), who together argued that productivity gains in farming release labour, generate savings, and feed demand for goods produced elsewhere in the economy. Johnston and Mellor (1961) pushed this further by laying out the specific contributions agriculture makes during structural change, while Timmer (1988) and later Gollin et al. (2002) showed how the sector continues to matter even in economies that are well into transition. The underlying mechanism, in most of this work, runs through linkages and multipliers (Hirschman, 1958; Haggblade et al., 2007; Hazell & Haggblade, 1991).

On the empirical side, the literature on public spending and agricultural performance is now reasonably large but its conclusions are mixed. Fan and Rao (2003) examined developing-country expenditure patterns and found that the productivity payoff of public spending depends heavily on what is being funded, with research and rural infrastructure outperforming general subsidies. Fan et al. (2008) and Mogues et al. (2012) reached similar conclusions in syntheses across Africa and Asia, and Alston et al. (2000) reported high social returns on agricultural research and development in their meta-analysis. Benin et al. (2012), by contrast, found that the growth effect of agricultural spending in Africa was modest and sensitive to country context, an observation that lines up with the broader cautions raised by Rajkumar and Swaroop (2008) and Reinikka and Svensson (2004) about how governance quality mediates the impact of public expenditure.

A separate strand looks at the composition of agricultural budgets. Irrigation has been consistently linked to higher yields and lower rural poverty (Lipton et al., 2003), and rural roads have been shown to expand market access and farm incomes in several Asian and African settings. Input subsidies, on the other hand, have produced more uneven results. Jayne and Rashid (2013) reviewed sub-Saharan experience and concluded that subsidy programmes often deliver smaller and less durable gains than is commonly assumed. Ravallion and Datt (1996), Christiaensen et al. (2011), and Ligon and Sadoulet (2018) have, meanwhile, drawn out the indirect channels through which agricultural growth tends to reduce poverty more effectively than equivalent growth in other sectors.

For Nepal specifically, the existing work is thinner and tends to sit on the productivity side of the debate. Thapa and Gaiha (2011) and Nepal and Thapa (2009) have studied smallholder transformation and the determinants of agricultural commercialisation, while Pant (2012) traced the longer arc of agricultural transformation in the country. Koirala and Sinha

(2019) examined fiscal deficits and growth using an ARDL framework but did not isolate agricultural spending. The direct question of whether and how government expenditure on agriculture moves Nepal's GDP growth has, to our knowledge, not been treated systematically. There is also little work on whether the returns to spending follow a non-linear pattern, even though the theoretical literature on public capital and growth (Aschauer, 1989; Barro, 1990) suggests this is plausible. It is in this gap that the present study is situated.

Research Problem

Despite sustained public outlays on agriculture over the past three decades, the evidence on whether this spending actually lifts economic growth in Nepal remains thin and unsettled (Pant, 2012). Most of the existing literature focuses either on agricultural productivity (Thapa & Gaiha, 2011; Nepal & Thapa, 2009) or on broader fiscal policy and growth (Koirala & Sinha, 2019), and the direct link between agricultural expenditure and GDP growth has been left largely unexplored. Cross-country findings are themselves inconsistent: some studies report clearly positive effects, others find weak or even negative impacts (Fan & Rao, 2003; Benin et al., 2012; Mogues et al., 2012). A further issue is that the composition of agricultural spending has shifted considerably in Nepal since 1990, yet we have very little national evidence on which categories — irrigation, rural roads, research and extension, subsidies, credit — are pulling the most weight. For a country that allocates scarce resources under tight fiscal constraints, this gap is not just academic; it has real budgetary consequences, since policymakers continue to make allocation decisions without solid empirical guidance.

Research Objectives

Building on the gap identified above, the broad objective of this study is to examine the relationship between government spending on agriculture and economic growth in Nepal over the period 1990 to 2023. More specifically, the study sets out:

i. To estimate the long-run and short-run relationship between agricultural public expenditure and GDP growth in Nepal using the ARDL bounds testing approach;

ii. To test whether a stable cointegrating relationship exists between the two variables after controlling for relevant macroeconomic factors;

iii. To disaggregate agricultural spending into irrigation, rural roads, research and extension, input subsidies, and credit programmes, and to identify which of these categories contributes most to growth;

iv. To investigate whether the spending–growth relationship is non-linear and exhibits diminishing returns at higher levels of expenditure; and

v. To translate the empirical findings into practical policy guidance on the size and composition of Nepal's agricultural budget.

The choice of the ARDL bounds testing approach of Pesaran et al. (2001) is deliberate. It accommodates variables with mixed orders of integration, performs comparatively well in the small-sample setting typical of developing-country time series, and lets short-run and long-run dynamics be estimated together (Narayan, 2005).

Limitations of the Study

Several limitations should be acknowledged at the outset. First, the analysis rests on thirty-four annual observations, which inevitably constrains the complexity of the models that can be reliably estimated. Second, the data are drawn from several official sources whose definitions and classifications have shifted over time, and this introduces a degree of measurement noise that is hard to fully remove. Third, the disaggregated spending categories have not been classified consistently across all the years in the sample, so the composition results should be read with that caveat in mind. Fourth, the study is concerned with aggregate national outcomes; it does not pick up provincial or household-level variation, which may matter quite a lot for distributional questions. Finally, while the ARDL framework supports strong inferences about long-run relationships, establishing strict causality with observational macroeconomic data is always difficult, and the findings here are best read as conditional empirical regularities rather than as definitive causal claims.

Research Methods and Materials

This study applies the ARDL bounds testing procedure developed by Pesaran et al. (2001). Unlike Engle and Granger (1987) or Johansen (1988) cointegration, ARDL does not require uniform integration orders, which suits this analysis because GDP growth is typically stationary while spending variables often are not (Narayan, 2005). The bounds procedure also performs well in small samples, and the error correction representation captures short run and long run adjustment simultaneously.

The baseline specification is:

$$\Delta Y_t = \alpha + \Sigma\beta_i\Delta Y_{t-i} + \Sigma\gamma_i\Delta AGEXP_{t-i} + \Sigma\delta_i\Delta X_{t-i} + \lambda_1 Y_{t-1} + \lambda_2 AGEXP_{t-1} + \lambda_3 X_{t-1} + \varepsilon_t$$

where Y is real GDP growth, AGEXP is government agricultural spending, X is a vector of controls, and ε_t is white noise. The error correction term (ECT) captures deviations from long run equilibrium, with its coefficient φ indicating the adjustment speed. The bounds test uses an F-statistic on the null of no cointegration (λ_1 = λ_2 = λ_3 = 0), compared against the I(0) and I(1) critical bounds in Pesaran et al. (2001). An F-statistic above the upper bound rejects the null, a value below the lower bound fails to reject it, and a value between the bounds is inconclusive.

The baseline model is extended in two directions. First, total agricultural expenditure is disaggregated into irrigation (IRRIG), rural roads and electrification (ROADS), research and extension (RESEXT), and input subsidies (SUBSID) to examine composition effects. Second, a quadratic specification including $AGEXP^2$ tests for diminishing returns, where a positive linear and negative squared coefficient would indicate an inverted U shape with an optimal expenditure level.

The analysis uses annual observations from 1990 to 2023, giving thirty four data points. The dependent variable is real GDP growth, measured as the annual percentage change in real GDP at 2010 constant prices, taken from the Central Bureau of Statistics and the World Bank World Development Indicators. Agricultural expenditure, measured as a percentage of GDP using actual outturns rather than budget allocations, is drawn from Ministry of Finance budget reports, Financial Comptroller General Office records, and Nepal Rastra Bank fiscal statistics. Controls include physical capital formation (% of GDP), secondary school enrollment (human capital proxy), trade openness, inflation, and a binary for political stability coded zero for the 1996-2006 conflict period. All nominal variables are deflated, and missing observations are filled using linear interpolation.

Estimation proceeds in five steps. First, unit root tests including Augmented Dickey-Fuller (Dickey & Fuller, 1981), Phillips-Perron (Phillips & Perron, 1988), and KPSS (Kwiatkowski et al., 1992) establish integration orders. Second, lag length is chosen using AIC, SBC, and HQC. Third, the ARDL bounds test checks for cointegration, with F-statistics compared to critical values in Pesaran et al. (2001) and Narayan (2005). Fourth, long run coefficients are obtained by normalizing the cointegrating equation, and an error correction model captures short run dynamics. Fifth, diagnostic tests cover serial correlation (Breusch-Godfrey), heteroskedasticity (Breusch-Pagan-Godfrey), normality (Jarque-Bera), and functional form (Ramsey RESET), while CUSUM and CUSUMSQ tests assess parameter stability (Brown et al., 1975). Robustness is checked through alternative specifications, extra controls, and sub-sample analyses.

Results and Discussion

Descriptive statistics in Table 1 show main variables in 1990-2023. The average GDP growth of Nepal was 4.23 per annum with a standard deviation of 1.87 percentage points which is indicative of the fluctuating nature of a developing economy (Kuznets, 1966). The growth was as low as 0.17 percent following the 2015 earthquake and border blockade and almost nine percent in years of good monsoons and political peace. The average growth of agriculture was 2.89 percent, a little lower than the overall growth in GDP, which is in line with the structural transformation patterns by Timmer (1988) and Chenery and Syrquin (1975). The industry was also not as stable as the economy as a whole because it is sensitive to weather, pests and market fluctuations. There was an average agricultural expenditure of 1.89 percent of GDP without much fluctuation indicating a moderate but comparatively small budgetary allocation.

Table 1

Descriptive Statistics (1990-2023)

Variable	Mean	Std. Dev	Min	Max	Observations
GDP Growth (GDPG, %)	4.23	1.87	0.17	8.98	34
Agricultural Growth (AGGR, %)	2.89	2.34	-2.45	8.12	34
Agric. Expend. (AGEXP, % GDP)	1.89	0.34	1.32	2.48	34
Investment (INVEST, % GDP)	27.34	5.67	18.23	39.45	34
School Enrollment (EDUC, %)	58.67	18.23	32.45	89.34	34
Trade Openness (TRADE, % GDP)	42.56	10.23	26.78	61.45	34
Inflation (INF, %)	7.89	3.45	2.34	17.23	34
Remittances (REM, % GDP)	13.45	8.67	1.89	28.56	34
India Growth (GDPG_IND, %)	6.12	2.34	-5.89	10.23	34

Note. All variables at annual frequency. Growth rates and ratios as defined in Section 2.

The correlation matrix is shown in Table 2. The growth in agricultural output has a very strong correlation with total GDP growth (0.58) as was anticipated due to the proportion of the sector to the economy (Johnston and Mellor, 1961; Mellor, 1976). Agricultural expenditure is positively correlated with agricultural growth (0.51) and GDP growth (0.42), which provides an initial clue to the growth enhancing impacts (Schultz, 1964; Barro, 1990). Naturally, these correlations do not provide causality. Openness to investment and openness to trade also have significant correlations with growth (0.61 and 0.34) whereas the relationship between remittances and growth is weak (probably due to the fact that they primarily finance consumption as opposed to productive investment).

Table 2

Correlation Matrix (Selected Variables)

	GDPG	AGGR	AGEXP	INVEST	TRADE	REM
GDPG	1.00					
AGGR	0.58***	1.00				
AGEXP	0.42**	0.51***	1.00			
INVEST	0.61***	0.39**	0.28	1.00		

	GDPG	AGGR	AGEXP	INVEST	TRADE	REM
TRADE	0.34*	0.21	0.31*	0.52***	1.00	
REM	0.19	0.06	0.27	0.41**	0.67***	1.00

Note*. *, *, * denote significance at 1%, 5%, 10% levels respectively.*

Results of unit root tests are in Table 3. The rates and percentages of GDP growth, agricultural growth, inflation and the growth of India are stationary at levels, I(0). Only after a first difference, agricultural spending, investment, education, openness to trade, and remittances become stationary taking their place at I(1). It is this combination of orders of integration that the ARDL bounds testing approach excels at as traditional cointegration tests demand that the orders of integration be the same (Pesaran et al., 2001; Narayan, 2005).

Table 3

Unit Root Test Results

Variable	ADF (Levels)	ADF (First Diff)	PP (Levels)	PP (First Diff)	KPSS (Levels)	Order
GDPG	-4.12***	-	-4.23***	-	0.28	I(0)
AGGR	-3.67**	-	-3.89***	-	0.34	I(0)
AGEXP	-1.89	-5.67***	-1.76	-6.23***	0.76**	I(1)
INVEST	-2.34	-5.89***	-2.45	-6.45***	0.68**	I(1)
EDUC	-0.98	-4.56***	-1.12	-5.12***	0.89***	I(1)
TRADE	-2.12	-5.34***	-2.23	-5.78***	0.71**	I(1)
INF	-3.45**	-	-3.56**	-	0.31	I(0)
REM	-1.67	-4.89***	-1.78	-5.34***	0.82**	I(1)
GDPG_IND	-3.78***	-	-3.92***	-	0.29	I(0)

Note*. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests assume the null hypothesis of unit root; Kwiatkowski-Phillips-Schmidt-Shin (KPSS) assumes the null of stationarity. *, *, * *denote rejection at 1%, 5%, and 10% significance levels. Tests include constant term and trend component where appropriate based on visual inspection. Critical values from MacKinnon (1996) for ADF/PP and Kwiatkowski et al. (1992) for KPSS.*

Table 4 reports information criteria of alternative ARDL specifications. The ARDL(2,1,1,1) was chosen based on the minimal AIC. It incorporates two GDP growth lags and one lag of the agricultural expenditure, investment, and the other controls. This specification is a dynamic structure that is well behaved without overfitting and later diagnostic measures prove that the residuals are well behaved.

Table 4

Lag Length Selection Criteria

ARDL Specification	AIC	SBC	HQC	Adj. R^2
ARDL(1,0,0,1)	-2.134	-1.867	-2.034	0.612
ARDL(2,1,1,1)	-2.456	-2.023	-2.278	0.683
ARDL(2,2,1,1)	-2.389	-1.889	-2.201	0.692
ARDL(3,2,1,2)	-2.301	-1.678	-2.089	0.704

Note. Bold indicates selected specification. ARDL(p,q_1,q_2,q_3) notation represents p lags of dependent variable, q_1 lags of agricultural expenditure, q_2 lags of investment, and q_3 lags of other control variables. Lower values of AIC, SBC, and HQC indicate better fit.

Table 5 presents the results of the bounds test. The F-statistic of 5.234, which is greater than the upper bound at the five percent mark and is nearly the one percent mark is a strong indicator of a long run relationship between the variables. T-statistic of the error correction term at -3.89 justifies the same and justifies the estimation of both long run coefficients as well as an error correction model (Pesaran et al., 2001).

Table 5

ARDL Bounds Test for Cointegration

Test Statistic	Value	I(0) Bound	I(1) Bound	Conclusion
F-statistic	5.234***	2.86 (5%)	4.01 (5%)	Cointegration
		3.74 (1%)	5.06 (1%)	
t-statistic (ECT)	-3.89***	-2.86 (5%)	-3.99 (5%)	Cointegration

*Note. *** denotes significance at 1% level. Critical values from Pesaran et al. (2001) for unrestricted intercept and no trend (Case III). Null hypothesis: No long-run relationship. F-statistic tests joint significance of lagged levels; t-statistic tests significance of error-correction term.*

Table 6 shows long run estimates. The coefficient of agricultural spending is 1.267, significant at the one percent level, which indicates that a one percentage point rise in the agricultural spending as a proportion of GDP is linked to an approximately 1.27 percentage point of long run growth. This value is a little higher than the 0.5 to 1.0 range in cross country work (Fan and Rao, 2003; Benin et al., 2012), which is consistent with Nepal specific characteristics of large share of employment in agriculture, wide productivity dispersion and allocations that are biased towards infrastructure, as opposed to recurring subsidies. Findings are consistent with Schultz (1964) regarding the transformative nature of government investment in agriculture, and with endogenous growth arguments of Aschauer (1989) and Barro (1990).

Table 6

Long-Run ARDL Estimates (Dependent Variable: GDP Growth)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Agricultural Expenditure (AGEXP)	1.267***	0.412	3.076	0.004
Investment (INVEST)	0.189***	0.056	3.375	0.002
School Enrollment (EDUC)	0.043**	0.018	2.389	0.023
Trade Openness (TRADE)	0.067*	0.036	1.861	0.072
Inflation (INF)	-0.123**	0.053	-2.321	0.027
Remittances (REM)	0.051	0.041	1.244	0.223
India Growth (GDPG_IND)	0.234***	0.067	3.493	0.001
Rainfall Deviation (RAIN)	0.089**	0.038	2.342	0.025
Political Stability (STAB)	1.456***	0.478	3.046	0.005
Constant	-5.678**	2.345	-2.421	0.021

*Note. ***, *, * denote significance at 1%, 5%, 10% levels. Standard errors computed using delta method. Agricultural expenditure measured as % of GDP.*

The effect of agricultural spending has a number of channels that have been reported in the literature. The benefits are productivity in terms of improved irrigation, rural access and diffusion of technology (Lipton et al., 2003; Evenson and Gollin, 2003). The agricultural demand spills over to rural non-farm activity as multiplier effects (Mellor, 1976; Hirschman, 1958). The move to greater productivity, Structural transformation alters labour to more productive areas (Lewis, 1954; Gollin et al., 2002), and more stable food supplies moderate pressures on prices and lower the import bill (Godfray et al., 2010). The impacts of poverty reduction are also noteworthy since agricultural benefits directly raise rural income (World Bank, 2008; Christiaensen et al., 2011).

Investment is a positive and significant control (0.189) as would be expected in a regular capital accumulation theory. The enrollment in schools is good yet small (0.043) which indicates the lags in returns to education as well as the fact that the quality is a well known issue (Bardhan and Udry, 1999). The openness to trade is low (0.067), probably by an import-intensive trade structure, as well as due to a limited access to global value chains (Anderson, 2009). Inflation is negative (-0.123) as predicted. The India growth spillage is very strong into Nepal (0.234), which operates through the trade, remittance and sentiment (McMillan and

Rodrik, 2011). Rainfall is important (0.089) and the sector remains climate sensitive. The political stability has a large coefficient (1.456), indicating that the conflict in 1996-2006 lowered the annual growth by approximately 1.5 percentage points. The size of remittances does not matter, as it is in line with their consumption and housing purposes (Ligon and Sadoulet, 2018).

Table 7 shows short run dynamics. The error correction value is -0.367 and significant which means that about 37 percent of any deviation of the long run equilibrium is being adjusted every year and it takes two or three years to complete full convergence. It is possible that this is a reasonable rate of adaptation of a macroeconomic system.

Table 7

Short-Run Dynamics and Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	p-Value
ΔGDPG(-1)	0.234*	0.123	1.902	0.067
ΔAGEXP	0.456**	0.189	2.413	0.022
ΔINVEST	0.134**	0.058	2.310	0.028
ΔEDUC	0.028	0.023	1.217	0.233
ΔTRADE	0.045	0.041	1.098	0.281
ΔINF	-0.089**	0.038	-2.342	0.026
ΔREM	0.034	0.046	0.739	0.466
ΔGDPG_IND	0.178***	0.056	3.179	0.003
ΔRAIN	0.067**	0.029	2.310	0.028
ECT(-1)	-0.367***	0.098	-3.745	0.001
Constant	1.234	0.789	1.564	0.128

Note. Δ denotes first difference. ECT is error correction term (lagged residuals from long-run equation). ***, *, * *denote significance at 1%, 5%, 10% levels.*

The short run effect of agricultural spending is positive and significant (0.456) approximately a third of the long run effect. This is a pattern that is intuitive in nature. The short-run stimulus is through the activity of construction and the demand-side externality, and the greater productivity gains are only realized with the operation of the infrastructure (Aschauer, 1989; Fan et al., 2002). India is an important short run investment, growth, rainfall investment, whereas education, trade and remittances work via long term horizons. Once again, inflation takes its toll on growth.

The model was re-estimated to analyze the effects of composition with agricultural spending decomposed into the main components. Findings are contained in Table 8, and they indicate impressive disparities in categories. The coefficient of research and extension is the highest (3.267), which is consistent with broader evidence that the returns of agricultural R&D are frequently more than half a year (Alston et al., 2000; Evenson and Gollin, 2003). Since agricultural research yields certain knowledge that diffuses among all farmers and cannot easily be privately owned, it is not provided systematically other than through government investment (Bardhan and Udry, 1999).

Table 8

Long-Run Effects by Agricultural Spending Category

Expenditure Category	Coefficient	Std. Error	t-Statistic	p-Value
Irrigation Infrastructure	2.145***	0.623	3.443	0.002
Rural Roads & Electrification	1.834***	0.587	3.124	0.004
Research & Extension	3.267***	1.023	3.194	0.003
Input Subsidies	0.423	0.378	1.119	0.272
Credit Programs	1.156*	0.634	1.823	0.078

Note. Extended ARDL model with category-specific spending as % of GDP replacing aggregate agricultural expenditure. Control variables included but not reported for brevity.

Irrigation infrastructure also generates a significant coefficient (2.145) as per its well established impacts on yields, crop diversification and risk reduction (Lipton et al., 2003). The rural roads and electrification (1.834) are significant as they reduce transaction costs, markets and facilitates processing and mechanization (Fan et al., 2002; Haggblade et al., 2007). The credit programs present an inferior, slightly significant impact (1.156), and the impact is very much dependent on design, targeting and discipline of repayment (Feder et al., 1990). In contrast, input subsidies have virtually no effect (0.423, not significant) which is consistent with international evidence that subsidy programs tend to leak to non-target groups, create market distortions, and are exploited by larger farmers (Jayne and Rashid, 2013; Binswanger and Deininger, 1997). This seems to be the case with Nepal fertilizer subsidies.

Combined, the results of the composition have obvious policy implications. A redirection of resources in low payoff subsidies to research, infrastructure and institutional capacity would lead to higher growth payoffs. Similar observations in India (Fan et al., 2008), China (Fan and Zhang, 2008), and in certain parts of Africa (Mogues et al., 2012) indicate that the lesson is being passed down agrarian economies.

Table 9 summarizes the results of diagnostic tests that supports the model. Serial correlation, heteroscedasticity, non normality and functional form misspecification are not present. CUSUM and CUSUMSQ tests report the stability of the parameter over the sample period (Brown et al., 1975) and hence the estimates can be used to make policy inferences.

Table 9

Diagnostic Test Results

Test	Statistic	p-Value	Conclusion
Serial Correlation (LM Test)	F = 0.876	0.427	No serial correlation
Heteroscedasticity (B-P-G)	F = 1.234	0.312	Homoscedastic
Normality (Jarque-Bera)	χ^2 = 1.567	0.457	Normal residuals
Functional Form (RESET)	F = 1.123	0.338	Correct specification
CUSUM	Stable at 5%	-	Parameter stability
CUSUMSQ	Stable at 5%	-	Parameter stability

Note. LM = Lagrange Multiplier; B-P-G = Breusch-Pagan-Godfrey; RESET = Ramsey Regression Specification Error Test. All tests fail to reject null hypotheses of well-specified model.

The main conclusions are reinforced with robustness checks. The agricultural expenditure coefficient is 1.189 (significant at five percent) when the years of conflict (1996-2006) are excluded and 1.314 (significant at one percent) when the pandemic years (2020-2023) are excluded. Qualitatively similar results are obtained with the use of logged real expenditure or per capita spending. Inclusion of political freedom and quality of governance and foreign direct investment control fails to significantly alter the agricultural spending coefficient. The structural break tests indicate that there are likely structural breaks in 2000 and 2015, although the sub-sample estimates are positive and significant in both directions. By substituting GDP growth with agricultural growth as the dependent variable, the coefficient on agricultural spending increases to 1.678 (significant at one percent), which is in line with the running of the transmission channel in which agricultural expenditure leads to sectoral growth to aggregate outcomes (Ravallion and Datt, 1996; Christiaensen et al., 2011).

A quadratic (non-tabulated) specification implies a decreasing marginal returns and the estimated optimum is around 2.0 percent of GDP, which is very close to the recent allocation of Nepal. This is not a fixed threshold. It probably increases with the improvement of governance and implementation capacity (Rajkumar & Swaroop, 2008). Although the proportion of agriculture in the GDP is on a downward trend, the sectoral performance is still influencing the aggregate outcomes by virtue of the weight of agriculture in employment and incomes in the rural areas (World Bank, 2008). The findings also highlight the key role of regional integration with India and domestics political stability (McMillan and Rodrik, 2011).

Conclusion

This study examined the relationship between government agricultural spending and economic growth in Nepal using the ARDL bounds testing approach with annual data from 1990 to 2023. The method accommodates mixed integration orders, supports robust inference with small samples, and captures both short run and long run dynamics.

Agricultural expenditure shows a significant positive long run effect on growth, with a one percentage point increase in the spending share of GDP raising long run growth by about 1.27 percentage points. The effect operates through direct productivity gains, multiplier effects, structural transformation, and macroeconomic stability. Composition matters considerably. Research and extension, irrigation, and rural roads yield the highest returns (coefficients between 1.8 and 3.3), while input subsidies show minimal and statistically insignificant effects. Current allocation patterns are therefore suboptimal, with too many resources directed to subsidies relative to their growth contribution. The quadratic specification points to an optimal spending level around two percent of GDP, close to Nepal's current allocation, though this threshold likely rises with stronger governance and complementary investments.

Several policy recommendations follow. Agricultural budget allocations should be maintained or modestly increased, since current spending is close to the growth optimizing threshold. More importantly, composition should shift sharply toward research and extension, irrigation, and rural connectivity, while input subsidies should be phased down. Governance and implementation capacity must be strengthened to ensure budgets translate into results. Agricultural spending should also be coordinated with rural education, health, financial access, and market infrastructure, and should incorporate climate adaptation given the growth sensitivity to rainfall. Political stability is equally essential, since agricultural investments require long horizons to deliver.

Nepal faces new pressures on the sector, including climate change, shrinking farmland, youth outmigration, and volatile global markets. Meeting these challenges will require climate resilient technologies, labor saving mechanization, and better supply chains linking farmers to remunerative markets. Agriculture remains central to Nepal's development due to its employment base, rural linkages, and role in poverty reduction. Translating public spending into realized growth depends on strategic allocation, effective implementation, and continuous learning and adaptation.

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