Influence of Public Expenditure Budget on the Agricultural Growth in Tanzania, 2004-2018

Sikwese, N.G.[1]*, J.J. Mmasa[2] and L.Mwinuka[2]

[1]Planning and Coordination Division, Rungwe District Council, P.O. Box 148, Tukuyu, Mbeya
[2]Department of Economics, University of Dodoma, Kikuyu Avenue, 2CoBE Street, 41218 Iyumbu, Dodoma, Tanzania

*Corresponding author e-mail: *sikwese076@yahoo.co.uk*

Abstract

Public expenditure plays a crucial role in the performance and growth of the sector. This study analyzes the contribution of public expenditure to the growth of the agricultural sector in Tanzania from 2004 to 2018. Using the Error Correction and Autoregressive Distributed Lag models, the analysis employed the Augmented Dickey-Fuller unit root test, Johansen cointegration, and Granger causality to explore both short- and long-run relationships. The results revealed a positive relationship between agricultural recurrent expenditure and sector growth, with a 1% increase in the recurrent expenditure budget ratio leading to a 0.3326% increase in the growth rate. Conversely, a 1% increase in agricultural development investment expenditure corresponds to a 0.1034% decrease in the growth rate, indicating a negative long-run relationship. The study concludes that while public agricultural expenditure positively impacts sector growth, an effective synergy between increased public resources and appropriate macroeconomic policies is essential to enhance agricultural growth and investment in Tanzania. The findings underscore the importance of strategic budget allocations and policy frameworks in driving sustainable agricultural development..

Keywords: Public spending, agriculture development, sector specific growth, budget process, Tanzanian agriculture

Introduction

Public expenditure refers to the government's spending on goods and services, public debt servicing, and development investment aimed at promoting economic growth (URT, 2015). Budget allocation is crucial for the performance and growth of the agricultural sector. Worldwide, agricultural growth is measured by its contribution to the Gross Domestic Product (GDP) (FAO, 2020). Public spending on the agricultural sector is essential for its growth, as it facilitates smooth recurrent and development investment interventions to meet targets set in plans. Recurrent and development expenditures depend on each other to facilitate agricultural performance and growth (Sikwese *et al.*, 2022).

The sector's growth depends on public expenditure and investment in irrigation, agricultural input subsidies, and research and development activities (Saungweme and Matanadare, 2014). Recently, Asian and African governments have increased their agricultural spending compared to other continents. For instance, Malawi allocates 16% of its budget to agriculture, Bhutan 12.8%, and Guyana 9.8% (FAO, 2020). In contrast, East African countries allocate between 5% and 6% (EAC, 2016). Globally, agricultural performance and growth are driven by factors of production that require substantial resources, including land, capital, labor, and agricultural inputs (FAO, 2020).

Agricultural activities are the second largest sector providing employment worldwide after the services sector (FAO, 2020). The number of people engaged in agricultural activities has increased in Sub-Saharan Africa, affecting agricultural growth (Jayne *et al.,* 2017). More than 60% of Africans, primarily in rural areas, depend on agricultural activities for their livelihoods (AfDB, 2016). The agricultural sector contributes about 32% of Africa's

Gross Domestic Product (Alliance for a Green Revolution in Africa, 2013). Efforts have been made in African states to improve agricultural performance through the Malabo Declaration of 2003, in which states agreed to allocate 10% of their budgets to the agricultural sector to achieve an annual growth rate of 6% and halve poverty by 2025 (Kaarhus *et al.*, 2010; AfDB, 2016). The agricultural sector has played a significant role in Tanzania's economy since independence in 1961. However, its contribution to GDP has declined from 46% in 2004 to 28.8% in 2018, affecting agricultural activity growth (URT, 2021).

The agricultural sector employs 66.9% of Tanzanians, provides 70% of industrial raw materials, and contributes 28.8% to the GDP (URT, 2018). The sector is the backbone of the national economy and a significant source of employment, stimulating agricultural performance and economic growth (WB, 2019). The Tanzanian government needs to invest more in rural infrastructure, research, and development activities to achieve an annual growth rate of 6% and reduce rural poverty from 33.3% in 2011 to 24% by 2025 (URT, 2020).

The budget allocation for Tanzania's agricultural sector ranged from a low of 3.3% in 2018 to a high of 7.8% in 2011, impacting agricultural growth. This allocation is still below the 10% target set by the Maputo Declaration (URT, 2020). Since 2004, agricultural growth has averaged 4.2%, and the sector's contribution to GDP has declined from 44.6% in 2004 to 28.8% in 2018 (URT, 2019). Agricultural transformation in Tanzania requires efficient and effective utilization of public expenditure within the sector to foster agricultural productivity and growth (Ita *et al.,* 2013).

Public spending in the agricultural sector facilitates backward and forward linkages between agriculture and other sectors such as industry, trade, minerals, and infrastructure. The Tanzanian government has increased budget allocations to sub-sector priorities at a rising rate to meet set targets (URT, 2019). Figure 1 presents the trend of the agricultural sector budget and its contribution to GDP.

The paper is grounded in budgetary theory processes (Jones and McCaffrey, 1994), incrementalism budgetary theory (Wildavsky, 1964), Musgrave-Rostow theory (Musgrave, 1989), and endogenous growth theory (Jones, 2019), supported by empirical studies on public agriculture expenditure. These theories demonstrate the relationship between public expenditure and a productive, inclusive agricultural sector for economic growth. This theoretical background serves as a guide, integrating key points derived from the theories to underpin the foundation of the study.

This study contributes to the public expenditure allocation debates, which remain unresolved (Sikwese *et al.,* 2022). Key components of public expenditure in the agricultural sector, such as recurrent and development interventions, can have positive and negative effects on agricultural performance and growth, depending on the budget allocation to the sector relative to the national budget. In this study, it is hypothesized that there is a significant relationship between the public expenditure categories and agricultural sector growth in Tanzania.

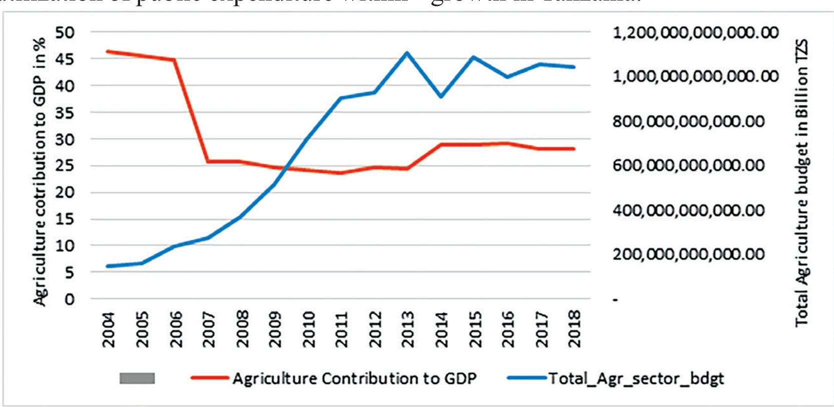

Figure 1: Trend of agricultural sector budget vs agriculture contribution to GDP

Methodology

The study used time series data covering 15 years from 2004 to 2018. Data on annual public agriculture expenditure, national budget, agriculture growth, GDP, and agricultural plans and budgets were collected. The Error Correction Model (ECM) was adopted to compute the value of variables in association with independent and dependent variables. The Augmented Dickey-Fuller test was employed to test the stationarity of the data and check for unit roots, while the Johansen cointegration technique was used for cointegration tests to establish long-run relationships and avoid false results.

Moreover, the ECM was adapted to capture both short- and long-run relationships. The ECM was applied in Model I, and the Autoregressive Distributed Lag Model was adopted for the integrated Model II to capture detailed public agriculture development expenditure.

Granger Causality Test

Based on Gujarati (2004), in time series analysis, causation can be demonstrated through the Granger causality test, provided that the error terms in the causality test are not correlated and the series are co-integrated. In this context, the influence of public agriculture expenditure on agricultural performance and growth can be revealed.

$$Y_t = \alpha_{01} + \sum_{i=1}^{p} \alpha_{1i} Y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} X_{t-i} + e_{1t}$$

$$X_t = \alpha_{02} + \sum_{j=1}^{p} \alpha_{1i} Y_{t-j} + \sum_{j=0}^{q} \alpha_{2i} X_{t-j} + e_{2t}$$

Unit Root Test

In this paper, Augmented Dickey–Fuller Test (ADF) technique was applied which is an improvement to previous Dickey-Fuller's test which assumed that the error terms are not correlated (i.e.cov(u_t,$u_{(t-1)}$))=0). The test can be used to examine the variables for indication of unit root while the errors are augmenting at Dickey-Fuller through accumulation of the dependent variable that lagged difference terms (i.e.$\sum \Delta Y_{(t-i)}$) as follows.

$$\Delta Y_t \Delta Y_t = \beta_0 + (\rho - 1) Y_{t-1} + \sum_{i=1}^{m} \Delta Y_{t-i} + u_t \quad \ldots(1)$$

If (ρ-1)=0 shown insignificant statistics from zero thus indicate rejection of null hypothesis (Y_t non-stationary series).

Auto Regressive Distributed Lags Application of ARDL Approach

The Autoregressive Distributed Lag (ARDL) model was applied to capture the first model, which involved public agriculture recurrent expenditure, development agriculture expenditure, and agriculture growth. The second model was split into irrigation, research, and development expenditure.

The First Model:

$$\Delta Agr_{gdp_t} = \alpha_0 + \alpha_{11} Agr_{gdp_{t-1}} + \alpha_{21} Agr_{rcrnt_{t-1}} + \alpha_{31} Agr_{dvlp_{t-i}} + \sum_{i=1}^{p} \alpha_{4i} \Delta Agr_{gdp_{t-i}} + \sum_{i=0}^{q_1} \alpha_{5i} \Delta Agr_{rcrnt_{t-i}} + \sum_{i=0}^{q_2} \alpha_{6i} \Delta Agr\_dvlp_{t-i} + e_{1t}$$

The second Model:

$$\Delta Agr\_gdp_t = \gamma_0 + \gamma_{11} Agr\_gdp_{t-1} + \gamma_{21} Agr\_rcrnt_{t-1} + \gamma_{31} lnirrgtn_{t-i} + \gamma_{41} lnR\&D_{t-i} + \sum_{i=1}^{p} \gamma_{5i} \Delta Agr\_gdp_{t-i} + \sum_{i=0}^{q_1} \gamma_{6i} \Delta Agr\_rcrnt_{t-i} + \sum_{i=0}^{q_2} \gamma_{7i} \Delta lnirrgtn_{t-i} + \sum_{i=0}^{q_2} \gamma_{8i} \Delta lnR\&D_{t-i} + e_{1t}$$

In this regard, the study selected p and q_i as lags while α_0 and γ_0 are the intercepts and e_{1t} is stationary series with zero autocorrelation. Thus, the other coefficients indicated both long run and short run relations. Whereby α_{11},α_{21}, and α_{31} are particularly for first model toward long run coefficient. Thus, for second model γ_{11},γ_{21},γ_{31} and γ_{41} responding long-run coefficients while short run effect accommodated through the first difference of variables of α_{4i}, α_{5i} and α_{6i} in first model and where by γ_{5i}, γ_{6i}, γ_{7i} and γ_{8i} towards short run coefficient specifically for second model. Therefore, the indicators remain constant where by the long run $Y_{(t-i)}$=Y_t and $X_{(ti)}$=X_t while other variables are in lags state in independent variables.

F-Bounds Test for Co-integration

Based on Pesaran *et al.* (2001), the application of the F-Bound test for cointegration is essential to capture series cointegration in homogeneous series, or if not, the Johansen Cointegration Test is employed for series integrated in I(I). Thereafter, the integration of order zero I(0) and order one I(I) enhances the accommodation of the Error Correction Model towards cointegrated series and allows the involvement of the ARDL model, particularly for the impact of the short run. Thus, cointegration involves a linear combination of stationary series that indicate a long-run relationship.

Thus, cointegration of F bound Test Hypothesis indicates:

H_0: $\alpha_{1i}=\alpha_{2i}=0$, (Where, i=1, 2)

H_1: $\alpha_{1i}\neq\alpha_{2i}\neq 0$

$$\Delta Y_t = \alpha_{01} + \alpha_{11}Y_{t-1} + \alpha_{21}X_{t-1} + \sum_{i=1}^{p}\alpha_{1i}\Delta Y_{t-i} + \sum_{i=0}^{q_1}\alpha_{2i}\Delta X_{t-i} + e_{1t}$$

$$\Delta X_t = \alpha_{02} + \alpha_{12}Y_{t-1} + \alpha_{22}X_{t-1} + \sum_{i=1}^{p}\alpha_{1i}\Delta Y_{t-i} + \sum_{i=0}^{q_1}\alpha_{2i}\Delta X_{t-i} + e_{2t}$$

Hence, if the F-statistic is smaller than the I(0) critical value at the 0.05 significance level, it indicates no cointegration, allowing the application of ARDL techniques towards the short run. Conversely, if the F-statistic is larger than the I(I) critical value at the 0.05 significance level, the null hypothesis is rejected, indicating the existence of a long-run relationship. In that case, the accommodation of the ECM for the long run is inevitable, along with the application of ARDL techniques to address short-run effects.

Application of Error Correction Model

As reported elsewhere, the study applied ECM to address both the short- and long-run impact of agricultural growth on its contribution to GDP. According to the Green (2003), the ECM is characterized by the existence of cointegration, ensuring that the regression techniques used for statistical inferences are valid. Granger (1987) and Engle & Granger (1987) indicated that the presence of cointegrated variables of Y_t and X_t validates the error correction of available data. Thus, the ECM, through ARDL given that:

$$\Delta Y_t = \alpha_0 + \alpha_1 \sum_{i=1}^{p}\Delta Y_{t-i} + \alpha_2 \sum_{i=0}^{q}\Delta X_{t-i} + \delta ECT_{t-1} + e_t$$

Where by:-

α_1: Dependent variable on its lagged value for Short run elasticity

α_2: Effect of other variables for short run elasticity

δ: Speed of adjustment of short-run disequilibrium toward long-run equilibrium

Thus, the $ECT_{(t-1)}=(Y_{(t-1)}-\beta_0-\beta_1X_{(t-1)})$ shows the constant of all variables in long run based on its lags status. The public agriculture expenditure time series data were exposed to lag impact instead of the same results toward short run effect thus indicating no direct impact of X_t on Y_t in the same period, thus shocks impact are realized in the next periods. Therefore, in this study the ECM estimate is given in equations to first model and second model as follows:

First Model:

$$\Delta Agr_{gdp_t} = \alpha_0 + \sum_{i=1}^{p}\alpha_{4i}\Delta Agr_{gdp_{t-i}} + \sum_{i=0}^{q_1}\alpha_{5i}\Delta Agr_{rcrnt_{t-i}} + \sum_{i=0}^{q_2}\alpha_{6i}\Delta Agr_{dvlp_{t-i}} + \delta ECT_{t-1} + e_{1t}$$

Second Model:

$$\Delta Agr_{gdp_t} = \gamma_0 + \sum_{i=1}^{p}\gamma_{5i}\Delta Agr_{gdp_{t-i}} + \sum_{i=0}^{q_1}\gamma_{6i}\Delta Agr_{rcrnt_{t-i}} + \sum_{i=0}^{q_2}\gamma_{7i}\Delta lnirrgtn_{t-i} + \sum_{i=0}^{q_2}\gamma_{8i}\Delta lnR\&D_{t-i} + \varphi ECT_{t-1} + e_{1t}$$

Whereby, δ and φ selected to corresponding speeds of adjustment term toward long-run equilibrium particularly for both first model and second model.

Results

Results of Unit Root Test (ADF)

Based on ADF, the unit root test results in Table 2 revealed that agriculture recurrent expenditure is stationary I(0) while agriculture growth, agriculture development expenditure, irrigation, research and development were not stationary at their lever but they become stationary and integrated of order one I(1).

Cointagration Results

Because the series one integrated of order zero and the rest are integrated of order one confirmed from unit test root it enables the combination of order zero and order one, when the series bond together in long run relationship Bond Cointegration test proposed by Pesaran *et al.* (2001) was utilized by using Autogressive Distributed Lag (ARDL) technique to settle ECM of different lag length. ARDL techniques was employed in this situation because it enables

Table 1: Description of the key variables used

Variable	Description
Agr_gdp	Agriculture GDP (in percent)
Agr_rcrnt	Recurrent expenditure in agriculture (Tanzania shillings in billion)
Agr_dvlp	Development expenditure in agriculture (Tanzania shillings in billion)
irrgtn	Irrigation expenditure (Tanzania shillings in billion)
R&D	Research and Development expenditure (Tanzania shillings in billion))
ECT	Error correction

Table 2: Results of Unit Root Test (ADF)

Variables	Levels		First Difference		Integration order
	Test Statistics	Critical Value	Test Statistics	Critical Value	
Agr_gdp	-2.278	-3.000	-3.356**	-3.000	I(1)
Agr_rcrnt	-4.444***	-3.000	-4.848***	-3.000	I(0)
Agr_dvlp	-2.754	-3.000	-5.105***	-3.000	I(1)
lnirrgtn	-2.156	-3.000	-6.550***	-3.000	I(1)
lnR&D	-1.678	-3.000	-4.842***	-3.000	I(1)

Note: ** and *** stand for rejection of null hypothesis at 0.05 and 0.01 respectively level of significance, respectively.

many lags length Akaike Information Criteria (AIC) and Schwarz Bayesian Information Criteria (SBIC) were used to establish optimum lags for model I and Model II.

For model I lags were 1,2,0 where by GDP 1, recurrent expenditure 2 and development expenditure 0. In model II Lags was 1,2,2,1 where by GDP 1, recurrent expenditure 2, irrigation expenditure 2, research and development expenditure 1. There was extenstion in second model where agriculture development investment expenditure split to irrigation investment expenditure, research and development expenditure. The cointegration results are presented using Table 3 for Model I and on Table 4 for Model II.

Table 3 reports a long-run relationship between the series in Model I, where the F-statistic is larger than the critical value at the 0.05 significance level, and the T-statistic is smaller than the critical value at the 0.05 significance level. This enables the rejection of the null hypothesis of no cointegration.

Based on Table 4, the F-statistic is smaller

Table 3: Model I F-Bounds test of co-integration

Null Hypothesis	F-Statistic	Critical Value		t-Statistic	Critical Value	
		Lower bound I(0)	Upper bound I(1)		Lower bound I(0)	Upper bound I(1)
k=2	13.741***	3.79	4.85	-5.848***	-2.86	-3.53

Note: *** indicates the rejection region of null hypothesis at 0.01 level of significance.

Table 4: Model II F-Bounds test for co-integration

Null Hypothesis	F-Statistic	Critical Value		t-Statistic	Critical Value	
		Lower bound I(0)	Upper bound I(1)		Lower bound I(0)	Upper bound I(1)
k=2	1.047	3.23	4.35	-0.905	-2.86	-3.78

Note: *** indicates the rejection region of null hypothesis at 0.01 level of significance.

than the critical value at the 0.05 significance level, and the T-statistic is larger than the critical value at the 0.05 significance level. This means it is not possible to reject the null hypothesis of no cointegration. In Model II, there is no long-run relationship between agricultural sector growth and public agriculture expenditure based on the agricultural allocation budget towards public agricultural expenditure, which is disaggregated into irrigation, research, and development. Over time, this second model indicates that the short-run effects could be examined by ARDL techniques rather than long-run effects. Meanwhile, these effects cannot deviate from the long-run values.

Long-run relationship

The results indicate a positive relationship of 0.3326, implying that a 1% increase in public agriculture recurrent expenditure is associated with a long-term relationship between public agriculture recurrent expenditure and agricultural growth (GDP). The coefficient of the error term for agriculture expenditure is positive (0.3326) and statistically significant at the 5% level, indicating a positive long-run relationship. In contrast, the coefficient for agriculture development expenditure is negative (-0.1034) and statistically significant at the 5% level, implying no long-run relationship (Table 5).

It was also revealed that the coefficient of the error term is negative and statistically significant at the 5% level, with a value larger than 1 but less than 2, indicating a divergence from equilibrium (Table 6). This coefficient, which measures the speed of adjustment, suggests over-correction of disequilibrium. However, this is tolerable as long as the model remains stable, supporting convergence in the long run. Therefore, there is no short-run relationship between Agr_dvlp and Agr_gdp, also there is no short-run relation between Agr_gdp and Agr_rcrnt rather than the short-run first lag of Agr_rcrnt. The interpretation behind the speed of adjustment coefficient which is -1.251 as presented using Table 6 is that, for any short-run distortion towards the long-run equilibrium the agricultural contribution on GDP adjusts itself to absorb any shock resulting from the independent variables by 125.1% annually to get back to long-run steady state, this may lead to divergence but its tolerable.

Table 5: Model I long run relationships

Variables	Agr_gdp			
	Coefficient	**Stand. error**	**t**	**P>|t|**
Agr_rcrnt	0.3326	0.0601	5.53	0.003***
Agr_dvlp	-0.1034	0.0337	-3.07	0.028**
Cons	10.39	4.2976	2.42	0.060

Note: ** and *** stand for rejection of null hypothesis at 0.05 and 0.01 respectively level of significance, respectively.

Table 6: Model I Error Correction Model

Variables	First Difference of Agr_gdp			
	Coefficient	**Stand. error**	**t**	**P>|t|**
$ECT_{(t-1)}$	-1.251	0.2139	-5.850	0.002***
ΔAgr_rcrnt$_{_t}$	0.018	0.0497	0.36	0.733
ΔAgr_rcrnt$_{_(t-1)}$	-0.232	0.0605	-3.840	0.012**
ΔAgr_dvlp$_t$	-0.035	0.0238	-1.45	0.206
ΔAgr_dvlp$_{(t-1)}$	0.041	0.0320	1.290	0.252
No. of obs	13			
R-Squared	0.9022			
d	2.0515			

Second Model

Based on the earlier F-bounds test for cointegration, the second model (Model II) was not cointegrated. Therefore, only the short-run effects can be analyzed using the ARDL approach, as the impacts do not converge to certain long-run values. Table 7 presents the short-run coefficient estimates.

Short run coefficients estimates of the model are not statistically significant different from zero at 5% level given both of their p-values are greater than 0.05 and their respective t-statistics are less than 1.964 (Table 7). This implies that there is no statistical short-run relationship between Agr_gdp and these other independent variables in the model.

The findings indicate the unilateral relationship of agriculture recurrent expenditure (Agr_rcrnt) to agriculture growth (Agr_gdp) at level 0.75 frequency at first model implying granger causality while indicating no granger causality at second model.

H_0: No granger causality

Diagnostic Tests

The study examines the consistency of heteroscedasticity, the series correlation using the LM test, and the Cusum test. Table 9 shows the null hypothesis for the LM diagnostic test, which states that there is no series correlation and no problem of heteroscedasticity in the first model. The test statistics indicate a failure to reject the null hypothesis.

H_0: No serial correlation

Table 10 indicates the rejection of null hypothesis that there is no series correlation and test statistic shows the model has homoskedasticity.

Table 7: Model II ARDL for short run relations

Variables	**First Difference of Agr_gdp**			
	Coefficient	**Stand. error**	**t**	**$P>\lvert t\rvert$**
ΔAgr_rcrnt$_t$	-0.0439	0.1003	-0.44	0.672
ΔlnR&D$_t$	0.9190	3.4819	0.26	0.798
Δlnirrgtn$_t$	- 0.9126	2.7136	-0.34	0.744
_Cons	9.7483	63.1002	0.15	0.881
No. of obs	14			
R-Squared	0.3176			
D				

Granger Causality Test

The Granger causality test assumes that all relevant information for a particular variable's parameters is based on the time series data (Table 8). This test was applied to determine whether public agriculture expenditure Granger-causes agricultural growth and vice versa. The results suggest a rejection of the null hypothesis.

Table 8: Spectral granger causality test statistics

Causality		**Wald test statistic**	**p-value**
Agr_rcrnt	Agr_gdp	11.1875	0.0037***
Agr_rcrnt	Agr_dvlp	0.1385	0.9331
Agr_dvlp	Agr_gdp	0.6783	0.7124
Agr_dvlp	Agr_rcrnt	0.4755	0.7884
Agr_gdp	Agr_rcrnt	1.7494	0.4170
Agr_gdp	Agr_rcrnt	1.4706	0.4794

Note: ** and *** indicate the rejection regions of null hypothesis at 0.05 and 0.01 levels of significance, respectively.

Table 9: Breusch-Godfrey LM test for autocorrelation

Lags(p)	Chi^2	Degree of freedom	Prob > chi^2
1	0.359	1	0.5489
2	5.442	2	0.0658
3	5.595	3	0.1330

Note: ** and *** stand for rejection of null hypothesis at 0.05 and 0.01 level of significance, respectively.

Table 10: Cameron and Trivedi's decomposition of LM test

Source	Chi^2	Degree of freedom	Prob > chi^2
Heteroskedasticity	13.00	12	0.3690
Skewness	3.05	7	0.8807
Kurtosis	1.16	1	0.2822
Total	**17.20**	**20**	**0.6398**

Note: ** and *** stand for rejection of null hypothesis at 0.05 and 0.01 level of significance, respectively.

H_0: Homoskedasticity

The CUSUM test was conducted for both the first and second models to confirm the stability of the variables used. The results confirmed that all models are stable at the 95% confidence level, indicating no structural breaks at the 5% significance level, as shown in Table 11, Table 13, Figure 2, and Figure 3. Therefore, the findings from the root estimation test, which are based on the efficiency and coefficients in the analysis of the contribution of public agricultural expenditure to growth in Tanzania, are considered reliable.

H_0: No structural break

Based on Table 12, the diagnostic test for the second model failed to reject the null hypothesis, which posits that there is no serial correlation and no heteroscedasticity, as indicated by the test statistics.

H_0: No serial correlation

Table 11: Cumulative Sum (CUSUM) test for the parameter stability

Statistic	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
OLS	0.5621	1.6276	1.3581	1.224
No. of obs	13			

Note: ** and *** indicate the rejection region of null hypothesis at 0.05 and 0.01 level of significance, respectively.

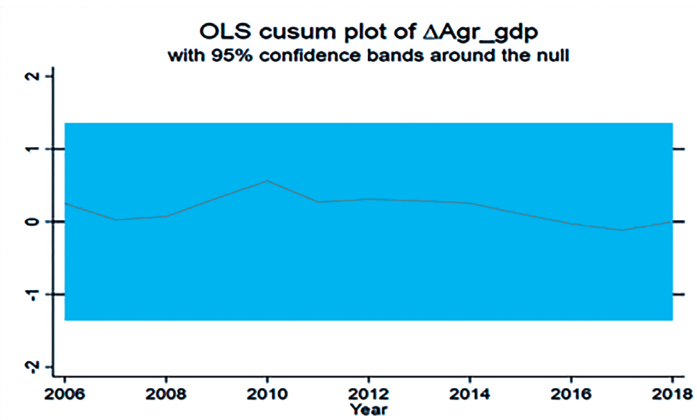

Figure 2: CUSUM plot for the parameter stability

Table 12: Model II Breusch-Godfrey LM test for autocorrelation

Lags(p)	Chi²	Degree of freedom	Prob > chi²
1	1.084	1	0.2979
2	4.855	2	0.0883

Note: ** and *** indicates the rejection region of null hypothesis at 0.05 and 0.01 level of significance, respectively.

Table 13: Cameron and Trivedi's decomposition of LM test

Source	Chi²	Degree of freedom	Prob > chi²
Heteroskedasticity	14.00	13	0.3738
Skewness	6.37	4	0.1730
Kurtosis	2.16	1	0.1417
Total	**22.53**	**20**	**0.6398**

Note: ** and *** indicates the rejection region of null hypothesis at 0.05 and 0.01 level of significance, respectively

It is also indicated by Table 13 that the rejection of null hypothesis that there is no series correlation and test statistic shows the model has homoskedasticity.

H_0: *Homoskedasticity*

Discussion and implications

Budget allocation to the productive sector, particularly the agricultural sector, is crucial for stimulating agricultural performance and growth.

Table 14: Model II CUSUM test parameter stability

Statistic	Test Statistics	1% Critical Value	5% Critical Value	10% Critical Value
OLS	0.5966	1.6276	1.3581	1.224
No. of obs	14			

Note: ** and *** indicates the rejection region of null hypothesis at 0.05 and 0.01 level of significance respectively

H_0: *No structural break*

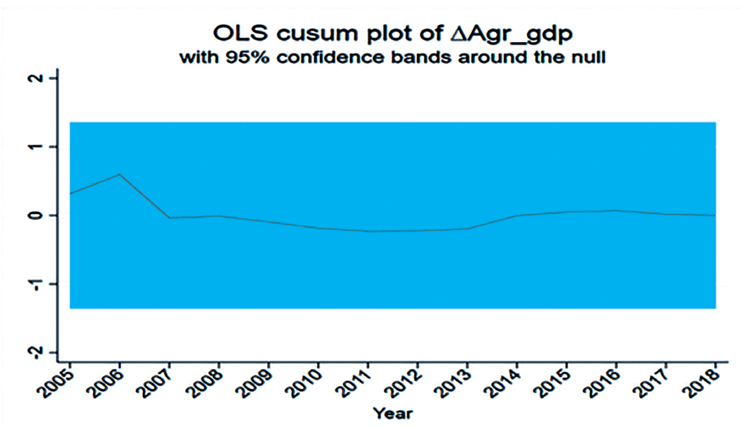

Figure 3: Model II CUSUM plot for parameter stability

Sikwese *et al*. (2022) clearly reported that recurrent and development expenditures in the agricultural sector are interdependent, with both types of expenditure playing a role in facilitating the sector's performance and growth. The agricultural sector budget increased from TZS 148.63 billion in 2004 to TZS 1,044.44 billion during the 2018/2019 financial year for agricultural interventions. Despite this increase in the sector's budget, there has been a surprising decrease in the sector's contribution to GDP over time, from 46.4% in 2003 to 29.7% in 2021 (URT, 2022).

Over the past 15 years, while the budget allocation for the agricultural sector has been increasing, it has not been sufficient to reverse the declining contribution of agriculture to GDP. The government should therefore increase budget allocation to the agricultural sector to enhance its growth. Ebere and Osundina (2014) confirmed the relationship between public spending on agriculture and economic growth.

Recurrent spending on agriculture has a positive effect on agricultural productivity and growth, as it supports administration costs, the payment of civil servants, and subsidies for fertilizers and the National Food Reserve Agency for food security. Public expenditure on the agricultural sector is essential for its growth (Reuben, 2020). For example, the Tanzanian government's subsidy for fertilizers amounted to TZS 150 billion in the 2022/23 financial year, aimed at enabling farmers to purchase fertilizers and engage more in food and cash crop production, thereby contributing to both agricultural and economic growth (URT, 2022). Recurrent expenditure in the agricultural sector facilitates the payment of personnel, supports the provision of incentives, and promotes civil servants in the sector. These findings align with Chiekezie (2020), who observed a positive relationship between public spending on the agricultural sector and economic growth.

Furthermore, microfinance institutions and cooperative societies can play a significant role in enhancing agricultural productivity through input loans and agricultural equipment loans. The government should fulfill its role in financing microfinance institutions to support the agricultural sector and boost its performance and growth (Uremadu *et al.,* 2018). Strengthening the capacity of the Tanzania Agricultural Development Bank (TADB), Saving and Credit Cooperative Societies (SACCOS), farmer groups and Agricultural Marketing Cooperative Societies (AMCOS) is vital to spearhead agricultural growth. Saleem and Jan (2011) observed that microcredit institutions impact agricultural performance and productivity.

Moreover, increasing public expenditure on the agricultural sector enhances agricultural performance and growth, as supported by Saungweme and Matanadare (2014). Mulinge (2016) also reported that recurrent public expenditure plays a crucial role in promoting economic growth by covering government administration costs, including the procurement of equipment and staff recruitment.

In line with Ita *et al*. (2013), an increase in public expenditure in the agricultural sector can facilitate the successful implementation of fertilizer subsidy programs for cash crops such as cotton, tobacco, and cashew nuts. This, in turn, accelerates productivity, agricultural investment, job creation, and the provision of industrial raw materials, thereby boosting agricultural growth. Additionally, public expenditure on agricultural development investments is vital for fostering research and development activities, as well as constructing irrigation infrastructure to ensure year-round agricultural practices independent of rainfall. This is consistent with the findings of Methew and Ben (2016), who highlighted the importance of increased government funding for specific agricultural areas, such as rural roads and irrigation schemes, to accelerate growth (Lawal, 2011).

Conclusion

Effective public expenditure in Tanzania's agricultural sector is crucial for stimulating growth and ensuring food security. It reflects the effectiveness of resource allocation in relation to the sector's performance and growth. Public expenditure has a significant positive effect on agricultural growth. From 2004 to 2018, public expenditure in the agricultural sector contributed to food security, provided about 70% of industrial raw materials, employed more than 66% of Tanzanians, and accounted for 29%

of GDP.

The agricultural sector is the mainstay of Tanzania's economy, and thus public expenditure should focus on agricultural industrialization, the use of fertilizers, and other agricultural inputs to enhance growth. The government should formulate macroeconomic policies that allocate the budget based on the sector's contribution to GDP, thereby financing agricultural sector expenditure and fostering growth. Increased budget allocation for the agricultural sector is essential to facilitate the construction of rural roads, the improvement of irrigation infrastructure, and the mitigation of climate change risks to ensure the country's food security.

Farmers' dependency on rainfall should be reduced through these initiatives. Additionally, investing in research and agricultural development activities is crucial for ensuring sustainable agricultural productivity, performance, and growth. The agricultural sector will continue to play a pivotal role in employment creation, providing raw materials for agribusiness development, and boosting exports.

Acknowledgements

The authors wish to express their sincere gratitude to the Tanzania National Bureau of Statistics (NBS) and respective Ministries for the technical support and making dataset accessible for this study. We appreciate participation of everyone as well as the anonymous reviewers. The views expressed are exclusively those of the authors and they cannot be attributed to the official position of any organization and partners.

Conflict of interest

The authors declare that they have no conflict of interest.

References

AGRA (2013). Africa Agricultural Status Report. Alliance for a Green Revelution in Africa. (2013). Africa Agricultural Status Report. Nairobi, Kenya.

Chiekezie, N,R. (2020). Economic assessment of government expenditure on agricultural sector with relevance to the economic growth (1981- 20). *International Journal of Agricultural Policy and Researc*, 8(4), 97–106.

Ebere, C. and, & Osundina, K. (2014). Government Expenditure on Agriculture and Economic Growth in Nigeria. *International Journal of Science and Research* (IJSR), 3(9):188–194.

Ita, M.N., Ukpong, I.G., & Ekpebu, I.D. (2013). Budgetary Allocations to the Agricultural Sector in Nigeria: Implications on Investment and Productivity. *Journal of Agricultural Science,* 5(11), 49–53. https://doi.org/10.5539/jas.v5n11p49

Jayne, T., Yeboah, F.K., & Henry, C. (2017). The future of work in African agriculture : Trends and drivers of change. Research Department Working Paper No 25, (25).

Kaarhus, R., Haug, R., Hella, J.P., & Makindara, J.R. (2010). Agro-Investment in Africa-Impact on Land and Livelihood in Mozambique and Tanzania. Noragric Report No. 53 (August). Norwegian University of Life Sciences (UMB).

Lawal, A. A.W. (2011). Analysis of Government Spending on Agricultural Sector and Its Contribution to GDP in Nigeria. *International Journal of Business and Social Science,* 2: 244–250.

Methew, A., & Ben, M.D. (2016). The Impact of public agricultural expenditure on Agricultural output in Nigeria (1981- 2014). *Asian Journal of Agricultural Extension, Economics & Sociology,* 11(2): 1–10.

Mulinge, J.K. (2016). Effects of Recurrent Public Expenditure on Economic Growth in Kenya. *International Journal of Economics, Commerce and Management*, IV(8), 508–540.

Saleem, M.A., & and Jan, F.A. (2011). The Impact of Agricultural Credit on Agricultural Productivity in Dera Ismail Khan (District) Khyber Pakhtonkhawa Pakistan". *European Journal of Business and Management*, 3(2), 38–44.

Saungweme T,M.M. (2014). Agricultural Expenditure and Economic Performance in Zimbabwe (1980-2005). Int.Eco.Res, v5i5, 50-(ISSN:2229-6158), 50–59.

Sikwese, N., Mmasa, J., & Mwinuka, L. (2022). The Effect of Recurrent Budget Expenditure on the Growth of Agricultural Sector in Tanzania. *Tanzania Journal of Agricultural Sciences,* 21(1), 138–148.

Uremadu, S.O., Ariwa, F.O., & Uremadu, C.E.D. (2018). Impact of Government Agricultural Expenditure on Agricultural Productivity in Nigeria. *Curr Inves Agri Curr Res,* 5(3), 679–688. https://doi.org/10.32474/CIACR.2018.05.000215

URT. (2015). Annual Report for Financial 2014/15. Dar es salaam: United Republic of Tanzania (URT).

URT. (2016). National Five Year Development Plan 2016/17-2020/21. Dar es salaam: United Republic of Tanzania (URT)

URT. (2018). Speech by The Minister for Finance and Planning , Hon. Dr. Philip I. Mpango (MP), Presenting to the National Assembly , the estimates of Government Revenue and Expenditure for 2018/19. Retrieved from http://ec.europa.eu/energy/res/legislation/doc/biofuels/2006_05_05_consultation_en.pdf%0Ahttp://dx.doi.org/10.1016/j.saa.2017.10.076%0Ahttps://doi.org/10.1016/j.biortech.2018.07.087%0Ahttps://doi.org/10.1016/j.fuel.2017.11.042%0Ahttps://doi.org/10.1016/j.

URT. (2022). Speech by the Minister for Agriculture, Hon. Hussein Mohamed Bashe (Mp), Presenting to the National Assembly, the Estimates of Government Revenue and Expenditure for 2022/2023. 265.

URT. (2019). The Economic Survey 2018. Dar es salaam: United Republic of Tanzania (URT)

URT (2021). The Economic Survey 2020. Dar es salaam: United Republic of Tanzania (URT).

World Bank. (2019). Agriculture Sector Public Expenditure Review. Transforming Agriculture - Realizing the Potential of Agriculture for Inclusive Growth and Poverty Reduction. World Bank, Washington, DC. Retrieved from https://openknowledge.worldbank.org/handle/10986/32791