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Impact of Value Added by Agriculture Sub-Sectors on National Income of Tanzania from 1990 to 2023

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KEYWORS

GDP, Agriculture sub-sectors, National Agricultural policy

ABSTRACT

Contribution of agricultural share to GDP has been declining from 42% in 1990 to 26.5% in 2023 in Tanzania, posing a necessity to assess impact of agricultural sub-sectors' value added on national income from 1990 to 2023 meanwhile testing the causal effect of the 2013 National Agriculture Policy. The study applied ADF unit root test to test for stationarity, Johansen test for co-integration to test presence of long-run relationship, VECM to test for short-run adjustments, and the Granger causality test to test existence of causal relationships. Results showed that in the long-run, value added by livestock production, fishing production influenced negatively GDP, while value added by crop production and inflation influenced positively GDP. Furthermore, in the short-run, value added by crop sub-sector influenced negatively GDP, while presence of the 2013 national agricultural policy influenced positively GDP. Also, results from Granger causality test showed that there was a bi-directional relationship between inflation and GDP; and uni-directional relationship between agricultural policy and GDP. The study recommended the need to intensify contribution of every agriculture sub-sector in the GDP through re-designing of profitable value chain activities.

1. Introduction

Agriculture is among the sub-sectors of the economy that offer employment mainly through private sector participation (World Bank, 2023). The global agriculture value added increased by 2.9 percent on average each year from USD 3.0 trillion in 2013 to USD 3.8 trillion in 2022. After surging in 2020, the global share of agriculture value added in GDP resumed its declining trend and reached 4.3 percent in 2022, which is still above the pre-pandemic level (FAO, 2024). In 2023, Agriculture, forestry, and fishing value added (% of GDP) in the World was reported at 4.1031% (World Bank, 2024).

In 2023, the agricultural sector contributed 1.3% to the EU's GDP, which is the same percentage as 15 years earlier (World Bank, 2024). The contribution of the agricultural sector to the GDP in South Asia was 16.02% (World Bank, 2024). In the case of Africa, from 2020 to 2022, Sierra Leone registered the agricultural sector's highest contribution to the GDP in Africa, at over 60 percent. Niger and Ethiopia were followed, accounting for approximately 42 percent and 38 percent of the GDP, respectively. On the other hand, Libya, Botswana, Djibouti, Equatorial Guinea, and South Africa were the African countries with the lowest percentage of the GDP generated by the agricultural sector (Galal, 2024).

On the other hand, in the year 2022, the agriculture sector contributed 26.2 percent of the Tanzanian GDP. The contribution of the crop sub-sector to the GDP was 15.0 percent, Livestock 6.7 percent, Fisheries 1.8 percent and Forest 2.7 percent. The sector is the main source of employment, food production, raw materials for industries, as well as foreign earnings in the country (NBS, 2023). The trend of agricultural shares to GDP tends to decrease from 27.4% in year 2018 to 26.5% in 2023 as shown in Figure 1.1. The graph reveals that the share of the agricultural sector decreased from 27.4% in year 2018 to 26.7% in 2020, in year 2021 increased to 26.7% and fell again to 26.2% in year 2022 while in 2023 the share was 26.5% as in Figure 1.

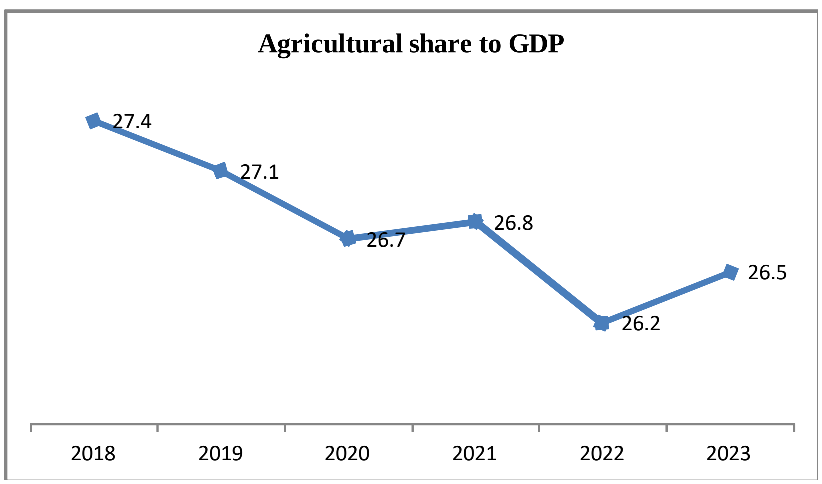

Figure 1: Share of the Agricultural sector to GDP in Tanzania

Source: Tanzania National Bureau of Statistics (2024).

Although several studies by Chongela (2015), Runganga & Mhaka (2021), Sertoglu et al. (2017), Matandare et al. (2021), Ugboh & Azu (2023), Ehighebolo (2023), Mhagama et al. (2023), and Walla and Minja (2025) explain the contribution of the agriculture sub-sectors to Tanzania's economic growth, they do not address the impact of agricultural policy on Gross Domestic Product

(GDP), as recommended by Awokuse and Xie (2020), Oyakhilomen and Zibah (2014), and Mubita (2019). Therefore, this study aims to fill that gap by including the National Agriculture Policy of 2013 as a dummy variable in the analysis to evaluate the effect of the agriculture subsectors' value added on economic growth in Tanzania from 1990 to 2023.

2. Materials and Methods

2.1 Study Area

The study area is Tanzania, a country located along the coast of East Africa with a population of about 61,741,120 (NBS, 2022). Tanzania is located at a latitude of -6.369028 and a longitude of 34.888822. It is part of Africa and the southern hemisphere (Mbululo & Nyihirani, 2012). Tanzania experienced a decreasing contribution of the agricultural sector to GDP over time, giving an opportunity to analyse the impact of value added by agricultural sub-sectors on economic growth from 1990 to 2023.

2.2 Research Design

The study was a quantitative one that used time series techniques to analyse the impact of agricultural sub-sectors' value added on the economic growth of Tanzania from 1990 to 2023. This design has also been applied by Mhagama *et al.* (2023) and Matandare *et al.* (2021).

2.3 Data Sources

The study used secondary data from the National Bureau of Statistics of Tanzania, the World Bank, and the Ministry of Agriculture, as indicated in Table 1.

Table 1: Variables and their measurement scales and data source

Variable	Description	Measurement Unit	Scale	Data Source
GDP	Gross Domestic Product as a measure of National Income	Million TZS	Ratio	NBS
INF	Inflation Rate	Index (Percentage)	Ratio	WB
CR	Crop Value Added	Million TZS	Ratio	NBS
LS	Livestock Value Added	Million TZS	Ratio	NBS
FR	Forestry Value Added	Million TZS	Ratio	NBS
FS	Fishing Value Added	Million TZS	Ratio	NBS
D	Agriculture Policy	D=1 Policy implementation from 2013, D=0 otherwise	Nominal	MoA

Source: Authors' compilation (2025).

2.4 Data Analysis

2.4.1 Stationarity test

The study used the ADF test to analyse stationarity of the studied variables in order to conclude whether a unit root is present (non-stationary) or not (stationary) at a 5% significance level. If the p-value obtained from the test was less than 5% significance level, the null hypothesis claiming non-stationarity was rejected in favour of the alternative hypothesis (stationarity) (Meyer, 2019; Mpojota *et al.*, 2025). In general, the ADF equation is given as follows:

$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \Sigma_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t$ …………………………………………… (1)

Where:

ΔY_t = the first difference operator of Y_t ,
Y_{t-1} =lagged value of Y_t
δ = the estimated slope coefficient
ε_t = white noise error,
t =time or trend
β_1 =the constant,
β_2=coefficient of the time variable
m =number of lags used.

Equation (1) is stationary when the null hypothesis is rejected in favor of the alternative hypothesis, thus:

H_o: If $\delta = 0$ then Y_t is non-stationary (unit root)
H_a: If $\delta =< 0$ then Y_t is stationary (unit root)

2.4.2 Selection of lag length

The optimal lag length is essential to strike a balance between capturing relevant patterns and avoiding over-drafting to build a robust and accurate time series model, and to determine the number of lags to be used in the model to avoid the risk of multicollinearity (Mabagala and Mzimbiri, 2025; Mpojota *et al.*, 2025). Optimal lag selection is determined using several selection criteria, which include the Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC).

2.4.3 Johansen tests for co-integration/Co-integration test

The Johansen co-integration test was used to test the presence of a long-run equilibrium relationship among variables.

To investigate the impact of value added by agriculture sub-sectors on national income of Tanzania from 1990 to 2023, the study specified the following mathematical relation:

GDP=f(INF,CR,LS, FR,FS,D) ………………………………………………………..… (2)

$\ln(GDP)_t = \alpha + \beta_1 \ln(CR)_t + \beta_2 \ln(LS)_t + \beta_3 \ln(FR)_t + \beta_4 \ln(FS)_t + \beta_5 \ln(INF)_t + \beta_6 D_t + \varepsilon_t$...... (3)

Furthermore, VECM model was specified as follows:

$$\Delta\ln(GDP)_t = \beta_0 + \sum_{k=1}^{p} \Delta\ln(GDP)_{t\text{-k}} + \sum_{k=1}^{p} \Delta\ln(CR)_{t\text{-k}} + \sum_{k=2}^{p} \Delta\ln(LS)_{t\text{-k}} + \sum_{k=3}^{p} \Delta\ln(FR)_{t\text{-k}} + \sum_{k=4}^{p} \Delta\ln(FS)_{t\text{-k}} + \sum_{k=5}^{p} \Delta\ln(INF)_{t\text{-k}} + \sum_{k=6}^{p} \Delta D_{t\text{-k}} + \varepsilon_t \quad (4)$$

Whereby:

Δ represents the first difference;
ε_t is a random error term;
p is the maximum number of lags
β_0 represents the intercept of the VECM;
β_1, β_2, β_3, β_4, β_5 and β_6 represents the coefficients of the variables under the study
ECT_{t-1} represents the coefficient of the error term.

Analysis of shocks in the short run, which ought to affect movement in the co-integration relationship, was conducted via the Error Correction Model (ECM) so as to check if they would converge in the long run.

2.4.4 Granger Causality Test

Granger causality is used to show the direction of short-run and long-run causal relationships between variables (Magoti & Mtui, 2020). Furthermore, the Granger causality test seeks to ascertain whether a causal relationship exists between two variables of interest (Chukwu, 2023). The Granger causality model for the study was specified as follows:

$$\Delta\begin{bmatrix} lnGDP_t \\ lnINF_t \\ lnCR_t \\ lnLS_t \\ lnFR_t \\ lnFS_t \\ D_t \end{bmatrix} = \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \\ \eta_6 \\ \eta_7 \end{bmatrix} + \sum_{i=1}^{\rho} \Delta \begin{bmatrix} \vartheta_{1i} & \varphi_{1i} & \psi_{1i} & \xi_{1i} & \rho_{1i} \\ \vartheta_{2i} & \varphi_{2i} & \psi_{2i} & \xi_{2i} & \rho_{2i} \\ \vartheta_{3i} & \varphi_{3i} & \psi_{3i} & \xi_{3i} & \rho_{3i} \\ \vartheta_{4i} & \varphi_{4i} & \psi_{4i} & \xi_{4i} & \rho_{4i} \\ \vartheta_{5i} & \varphi_{5i} & \psi_{5i} & \xi_{5i} & \rho_{5i} \\ \vartheta_{6i} & \varphi_{6i} & \psi_{6i} & \xi_{6i} & \rho_{6i} \\ \vartheta_{7i} & \varphi_{7i} & \psi_{7i} & \xi_{7i} & \rho_{7i} \end{bmatrix} \times \begin{bmatrix} \ln(GDP)_{t-1} \\ \ln(INF)_{t-1} \\ \ln(CR)_{t-1} \\ \ln(LS)_{t-1} \\ \ln(FR)_{t-1} \\ \ln(FS)_{t-1} \\ D_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \\ \eta_5 \\ \eta_6 \\ \eta_7 \end{bmatrix} [ETC_{t-1}] + \begin{bmatrix} \epsilon_{1t} \\ \epsilon_{2t} \\ \epsilon_{3t} \\ \epsilon_{4t} \\ \epsilon_{5t} \\ \epsilon_{6t} \\ \epsilon_{7t} \end{bmatrix} \quad (5)$$

Where Δ is a lag operator, ETC_{t-1} is a one-period lagged error term derived from a long-run co-integration; $\epsilon_{1t}, \epsilon_{2t}, \epsilon_{3t}, \epsilon_{4t},$
$\epsilon_{5t}, \epsilon_{6t}$ and ϵ_{7t} are white noise error terms and ρ is the number of lags.

3. RESULTS AND DISCUSSION OF FINDINGS

3.1 Descriptive Statistics of the studied variables

Results represented in Table 2 show that descriptive statistics for the study variables from 1990 to 2023 reveal substantial variability across sectors. Value added by the crop sub-sector had a mean value of 8,068,548 million TZS and similarly high variability (SD = 8,744,743 million TZS).

Table 2: Descriptive statistics of the studied variables

	Million Tanzania Shillings					
Statistics	**GDP**	**FS**	**CR**	**LS**	**FR**	**INF**
Mean	50,500,000	901,030	8,068,548	3,460,135	1,367,646	11.4
Std. Dev	58,600,000	1,042,854	8,744,743	4,217,719	1,580,429	9.41
Minimum	781,271	53,283	448,252	115,999	74,723	3.29
Maximum	189,000,000	3,117,865	30,400,000	11,700,000	4,804,019	35.8
Observations	34	34	34	34	34	34

Source: Authors' Computations (2025).

Results represented in Table 2 show that the value added by the livestock sub-sector had a mean of 3,460,135 million TZS with a standard deviation of 4,217,719 million TZS, suggesting moderate yet significant volatility, possibly influenced by environmental or market conditions. On the other hand, results represented in Table 2 show that the value added by forestry and fishing sub-sectors had lower mean values (1,367,646 million TZS and 901,030 million TZS, respectively) but exhibited notable variability, especially forestry, which reached a maximum value of 4,804,019 million TZS.

Also, results represented in Table 2 show that the inflation rate averaged 11.36% across the period, with a wide range between 3.29% and 35.83%, highlighting episodes of macroeconomic instability. Also, results show that GDP had a strong upward trend, with a mean value of 50,500,000 million TZS with a notably large standard deviation of 58,600,000 million TZS, suggesting significant economic growth over time. Generally, results presented in Table 2 suggest that both variables, mainly value added by agriculture sub-sectors, and macroeconomic indicators demonstrate considerable fluctuations, something which has to be considered in subsequent econometric modeling and interpretation.

3.2 Unit Root Test

Results represented in Table 3 show that based on the ADF unit root test without a drift, all variables were not stationary at the level, reflecting the presence of a unit root at the 5% significance level. Also, Figure 2 presents each variable at the level.

Table 3: ADF Unit Root Test for Stationarity at level I(0)

Variable	N	Lags	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value	Stationary
LNGDP	32	1	-2.658	-3.702	-2.980	-2.6220	0.082	Non Stationary
LNCR	30	3	-0.818	-3.716	-2.980	-2.6240	0.814	Non Stationary
LNLS	32	1	-0.510	-3.702	-2.980	-2.6220	0.890	Non Stationary
LNFR	32	1	-0.282	-3.702	-2.980	-2.6220	0.928	Non Stationary
LNFS	32	1	-0.115	-3.702	-2.980	-2.6220	0.948	Non Stationary
LNINF	32	1	-1.661	-3.702	-2.980	-2.622	0.451	Non Stationary
D	32	1	-0.633	-3.702	-2.980	-2.622	0.863	Non Stationary

Source: Author's Computations (2025).

Based on the ADF test, the test statistics for every variable were greater than the critical values at conventional significance levels. Also, the associated MacKinnon p-values ranged from 0.082 to 0.948, all exceeding the 0.05 threshold, suggesting that every variable is non-stationary at the level, hence they have to be differenced before testing for cointegration (Lütkepohl and Krätzig, 2004; Mpojota *et al*., 2025).

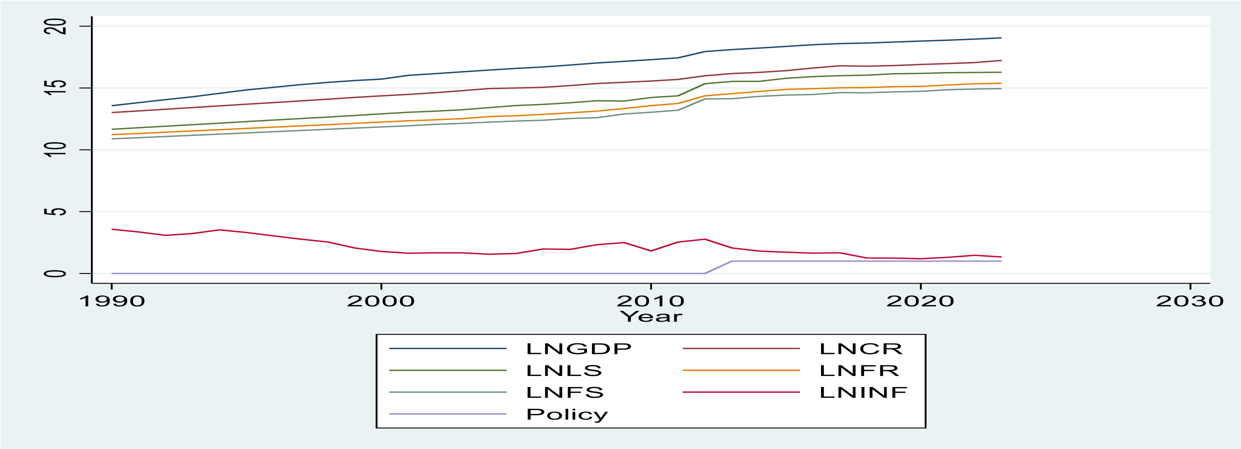

Figure 2: Graph of the Variables at the Level.

Source: Authors' Computations (2025).

Furthermore, results represented in Table 4 show that every series was stationary after the first difference based on the ADF unit root test without a drift. Furthermore, results show that for all variables (D_LNGDP, D_LNCR, D_LNLS, D_LNFS, D_LNFR, D_LNFR, D_D) the test statistics exceeded the 1%, 5%, and 10% critical values, and their respective MacKinnon p-values were below the 0.05 significance threshold. This suggests that the null hypothesis of a

Table 4: ADF Unit Root Test for Stationarity at first difference I(1)

Variable	N	Lags	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	p-value	Stationary condition
ΔLNGDP	32	0	-3.969	-3.702	-2.980	-2.622	0.0016	Stationary
ΔLNCR	30	0	-4.159	-3.716	-2.980	-2.624	0.0008	Stationary
ΔLNLS	32	0	-5.213	-3.702	-2.980	-2.622	0.0000	Stationary
ΔLNFS	32	0	-5.795	-3.702	-2.980	-2.622	0.0000	Stationary
ΔLNFR	32	0	-3.960	-3.702	-2.980	-2.622	0.0016	Stationary
ΔLNFR	32	0	-5.509	-3.702	-2.980	-2.622	0.0000	Stationary
ΔD	32	0	-5.657	-3.702	-2.980	-2.622	0.0000	Stationary

Source: Authors' Computations (2025).

The null hypothesis of the unit root test was rejected in every case. Therefore, it can be concluded that all variables achieved stationarity after first difference, supporting their integration of order one, I(1). Further stationarity was checked by using graphs presented in Figure 3, which suggest that variables are stationary at first difference.

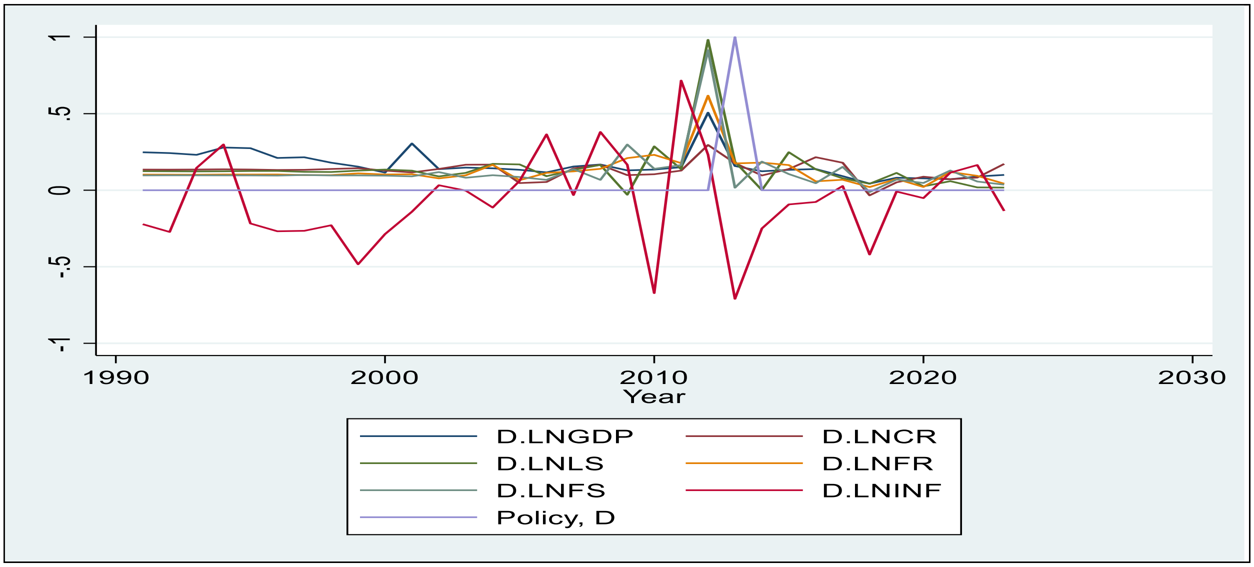

Figure 3: Graph of the Variables at First Difference.

Source: Authors' Computations (2025).

3.3 Diagnostic test

The result represented in Table 5 shows that the Lagrange-Multiplier (LM) test was performed to assess the presence of autocorrelation in the residuals at different lag orders. The null hypothesis (H_0) for the test states that there is no autocorrelation at the specified lag order.

Table 5: Lagrange-Multiplier Test for Autocorrelation

Lag	Chi-Square	Degrees of Freedom	P-value
1	73.810	64	0.188
2	81.703	64	0.067

Source: Authors' Computations (2025).

For lag 1, the chi-squared statistic was 73.8104 with 64 degrees of freedom, yielding a p-value of 0.18817. Since the p-value is greater than the commonly used significance level of 0.05, we fail to reject the null hypothesis. This suggests that there is no significant autocorrelation at lag 1.

For lag 2, the chi-squared statistic was 81.7025 with 64 degrees of freedom, and the corresponding p-value was 0.06710. While this p-value is slightly above the typical 0.05 threshold, it is still suggestive of a marginal lack of autocorrelation at lag 2, as the result is not statistically significant at the 5% level but could be noteworthy for further investigation.

Thus, the LM test results indicate that there is no significant autocorrelation at either lag 1 or lag 2, supporting the assumption of no residual autocorrelation at these lag orders. This finding strengthens the validity of the model by suggesting that the residuals do not exhibit autocorrelation, a common assumption in time-series analysis.

3.4 Jarque-Bera Test for Normality

The result represented in Table 6 shows that most of the variables in the model, such as D_LNCR, D_LNINF and D_LNFS, show no significant deviation from normality, with p-values well above 0.05. However, some variables like D_LNLS and D_LNFR have p-values close to 0.05, indicating mild departures from normality. Overall, the Jarque-Bera test suggests that the residuals for most equations in the model are approximately normally distributed, supporting the assumption of normality for further statistical inference.

Table 6: Jarque-Bera Test for Normality

Equation	Chi-Squared (χ^2)	Degrees of Freedom (df)	P-value	Normal?
ΔLNGDP	4.683	2	0.097	Normal
ΔLNCR	0.597	2	0.742	Normal
ΔLNLS	10.319	2	0.068	Marginally Normal
ΔLNINF	2.269	2	0.322	Normal
ΔLNFR	6.299	2	0.073	Marginally Normal
ΔLNFS	0.575	2	0.750	Normal
ΔD	2.976	2	0.226	Normal

Source: Authors' Computations (2025).

3.5 Selection of lag length

Results presented in Table 7 show lag length selection was done based on the Information Criteria (IC). Results indicate that a lag order of one (lag = 1) was optimal. Thus, Lag 1 minimized the FPE (0.0067) and produced the lowest AIC (-2.1616), HQIC (-2.1317), and SBIC (-2.0682) values compared to higher lag orders.

Table 7: Lag length selection

Lag	LL	LR	df	p-value	FPE	AIC	HQIC	SBIC
0	-52.103	–	–	–	2.018	3.5402	3.5551	3.5869
1	34.424	173.050*	1	0	0.0067*	-2.1616*	-2.1317*	-2.0682*
2	34.536	0.224	1	0.636	0.0072	-2.1024	-2.0576	-1.9623
3	34.544	0.016	1	0.899	0.0077	-2.0363	-1.9765	-1.8495
4	34.5443	0.000	1	0.990	0.0082	-1.9697	-1.8949	-1.7361

Source: Authors' Computations (2025).

Additionally, the likelihood ratio (LR) test was highly significant at lag 1 (LR = 173.05, $p < .001$), further supporting the selection of one lag. Beyond lag 1, the LR statistics for higher lags were not significant, and information criteria values increased, indicating that additional lags did not improve model fit. Therefore, a lag length of one was selected for subsequent modeling, ensuring an efficient balance between capturing dynamic relationships and maintaining model parsimony.

3.6 Johansen tests for co-integration

Results presented in Table 8 show that all variables under study have a long-run relationship, thus they co-move in the long run (Magai, 2021). Furthermore, results presented in Table 6 show that there are three co-integrating equations at 5% significance level, implying that the linear combination of these variables may be stationary. Hence, the null hypothesis at none*, at most 1*, and at most 2* is rejected as p <0.05.

Table 8: Results for Johansen Co-integration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.** Critical Value
None *	0.930482	208.5811	125.6154	0.0000
At most 1 *	0.786266	123.2635	95.75366	0.0002
At most 2 *	0.619442	73.88680	69.81889	0.0228
At most 3	0.511050	42.97108	47.85613	0.1333
At most 4	0.371342	20.07520	29.79707	0.4178
At most 5	0.107556	5.221836	15.49471	0.7848
At most 6	0.048191	1.580501	3.841465	0.2087

Trace test indicates 3 cointegrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors' Computations (2025).

3.7 Long-run relationship between variables

Results presented in Table 9 show the existence of the long-run relationship between variables. The coefficient of determination is 0.917, implying that about 91.66% of the variation in the GDP in Tanzania has been strongly explained by the independent variables in the model which are value added by the crop sub-sector, value added by the livestock value sub-sector, value added by the forestry sub-sector, value added by the fishing sub-sector, inflation rate, and the National Agriculture Policy of 2013. The remaining variation is due to the error term, which is meant to include any variable that affects the economic growth in the model.

Table 9: Long-run relationship between variables

Variables	Coefficients	P-value
ΔLNCR	0.543	0.081*
ΔLNLS	-0.443	0.009**
ΔLNFR	-0.315	0.497
ΔLNFS	-0.562	0.019**
ΔLNINF	0.105	0.014**
ΔD	0.038	0.653
Constant	0.025	0.523
R-Squared	0.917	

Note: (**) denotes significance at the 5% level, (*) significance at the 10% level, respectively

Source: Authors' Computations (2025).

Furthermore, results presented in Table 9 show that value added by the crop sub-sector was statistically significant at 10% with a positive value of 0.543, which implies that the 1 percent increase in crop value added causes an increase in GDP by 0.5 percent. These findings are similar to Ugboh & Azu (2023) but contrary to Walla and Minja (2025), who found that the value added by the crop sub-sector had a negative impact on GDP, while Mhagama *et al.* (2023) found no significant impact on the GDP.

Moreover, results presented in Table 9 show that value added by the livestock sub-sector was statistically significant at 5% with a negative value of 0.443, which implies that an increase of 1 percent in livestock value added causes a decrease in GDP by 0.4 percent. The findings are similar to Chongela (2015) but contrary to Walla and Minja (2025), who found that value added by the crop sub-sector had a positive impact on GDP.

Also, results presented in Table 9 show that the value added by the fishing sub-sector was statistically significant at 5% with a negative value of 0.562, which implies that an increase of 1 percent of fishing value added causes a decrease in GDP by 0.6 percent. This is similar to the findings of Ehighebolo (2023) and Mhagama *et al.* (2023) but contrary to the findings obtained by Chukwu (2023) and Ugboh & Azu (2023), who found that the value added by the fishing sub-sector on GDP was not statistically significant.

Lastly, results presented in Table 9 show that the inflation rate was statistically significant at 5% with a positive value of 0.105 percent, which implies that an increase of 1 percent in Inflation causes an increase in GDP by 0.105 percent. These findings concur with Runganga & Mhaka (2021) and Awan (2015) but contrary to Oyakhilomen and Zibah (2014), who found that the effect of inflation on GDP was statistically insignificant.

3.8 Short-run relationship between variables

Table 10: Short-run relationship between variables

Variables	Coefficients	P-value
ECM (-1)	- 0.082	
ΔLNCR (-1)	-0.547	0.008**
ΔLNCR (-2)	-0.315	0.187
ΔLNLS(-1)	-0.199	0.112
ΔLNLS(-2)	-0.018	0.937
ΔLNFR(-1)	0.331	0.269
ΔLNFR(-2)	0.509	0.181
ΔLNFS(-1)	-0.004	0.985
ΔLNFS(-2)	0.221	0.507
ΔLNINF(-1)	0.008	0.680
ΔLNINF(-2)	0.004	0.820
Δ(D(-1)	0.440	0.001***
ΔD(-2))	0.096	0.015
Constant	-0.323	0.296
R-Squared	0.999	

Note: (**) denotes significance at the 5% level and (***) 1% level, respectively

Source: Authors' Computations (2025).

Results presented in Table 10 show that the previous year's error (deviation from long-run equilibrium) is corrected within the current year at a convergence speed of 8.2%. Furthermore, results presented in Table 10 show that the value added by the crop sub-sector had a negative effect on GDP and this was statistically significant at 5% level. This implies that in the short-run, an increase of 1 percent of crops value added causes a decrease in GDP by 0.5 percent. This concurs with the findings of Ehighebolo (2023) and Mhagama *et al.* (2023) but contrary to Matandare *et al*. (2021).

Also, results presented in Table 10 show that the national agricultural policy of 2013 had positive effect on GDP and this was statistically significant at 1% level. This implies that in the short-run presence of the national agricultural policy of 2013 causes an increase in GDP by 0.4 percent. The findings are similar to Awokuse and Xie (2020), Oyakhilomen and Zibah (2014) and Mubita (2019), who suggested that agricultural policy had an impact on economic growth; hence, the findings confirm that the policy has a positive impact of GDP growth in the short-run.

3.9 Granger Causality

Results of the pairwise Granger causality test in Table 11 show that there is a bi-directional relationship between GDP growth and inflation. These findings concur with (Mubita, 2019; Chukwu 2023).

Table 11: Pairwise Granger Causality test results

Equations	Observation	Chi2	P-value
CR does not granger cause GDP	32	1.620	0.203
GDP does not granger cause CR		0.930	0.335
LS does not granger cause GDP	32	0.010	0.932
GDP does not granger cause LS		1.420	0.234
FR does not granger cause GDP	32	0.850	0.355
GDP does not granger cause FR		0.480	0.488
FS does not granger cause GDP	32	1.420	0.234
GDP does not granger cause FS		0.010	0.932
INF does granger cause GDP	32	4.250	0.039**
GDP does granger cause INF		3.470	0.063*
D does granger cause GDP	32	29.590	0.000**
GDP does not granger cause D		0.200	0.652

Note: (**) denote significance at the 5% level, (*) significance at the 10% level
Source: Authors' Computations (2025).

Also, results show that there is a uni-directional relationship between the national agricultural policy of 2013 and GDP growth. These findings are similar to (Meyer, 2019; Ugboh & Azu, 2023).

4. CONCLUSION AND POLICY IMPLICATIONS

The study sought to assess the impact of agricultural sub-sectors value added on Tanzanian national income from 1990 to 2023 by incorporating the National Agriculture Policy of 2013 as a dummy variable in the analysis. The study used annual time series data from the National Bureau of Statistics of Tanzania, the World Bank, and the Ministry of Agriculture in Tanzania. Findings showed that in the long-run, GDP was influenced significantly by value added by crop sub-sector, value added by livestock sub-sector, and value added by fishing sub-sector, and as well as by inflation. Furthermore, findings showed that in short-run, GDP was influenced significantly by the value added by the crop sub-sector and the presence of the 2013 National Agriculture Policy.

This implies that there is a need to formulate strategies for improving the contribution of every agricultural sub-sector to GDP. Also, results from the Granger causality test showed that there was a bi-directional relationship between inflation and GDP, and a uni-directional relationship between the 2013 National Agricultural Policy and GDP. This suggests the need to monitor inflation and implementation of agricultural policy objectives so as to promote investment and exports in the agriculture sector and other sectors that constitute the agriculture sector in their value chains. This ought to promote and sustain per capita economic growth in accordance with national circumstances as per SDG 8.1.

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