Unveiling the Agriculture -Trade-Capital Dynamics Nexus in Tanzania: A Structural Approach to Sustainable Economic Growth

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Abstract
This study investigated the dynamic interplay between agricultural output, trade, capital formation, household consumption expenditures, and sustainable economic growth in Tanzania. Using a Vector Error Correction Model (VECM) and analyzing time-series data from 1970 to 2022, the study differentiates between short-term fluctuations and long-term equilibrium relationships. The Johansen cointegration test confirmed a stable long-run association, indicating that changes in these economic drivers are gradually corrected towards equilibrium over time. Empirical findings revealed that agricultural output (0.5264, SE = 0.1375), capital formation (0.4027, SE = 0.0305), and household expenditure (1.8771, SE = 0.1125 positively contributed to GDP growth, reinforcing the role of investment and agricultural productivity in long-term economic expansion. Conversely, trade (−2.2065, SE = 0.2048) exerted a negative impact, suggesting persistent trade imbalances and constrained savings that hinder sustainable growth. The short-run analysis highlights the speed of adjustment, with deviations from equilibrium being gradually corrected over time. These findings underscored the importance of strategic policy interventions, including export diversification, industrial policy reforms, investment incentives, and agricultural modernization. By addressing trade inefficiencies and promoting productive investment, Tanzania can strengthen economic resilience and foster sustainable growth. This study provides empirical insights for policymakers and contributes to the broader discourse on structural economic transformation in developing economies.

Keywords: *Agriculture, Trade, Capital Dynamics, Sustainable Economic Growth, Structural Approach.*

INTRODUCTION

Sustained economic growth is a primary objective for developing nations, as it drives improvements in living standards, poverty reduction, and overall national development. For Tanzania, where the economy remains

predominantly agricultural, agriculture and trade play crucial roles in shaping economic expansion. Agriculture serves as the backbone of the economy, employing a significant portion of the population and contributing substantially to Gross Domestic Product (GDP). According to the World Bank (2020), agriculture accounts for approximately 26.7% of Tanzania's GDP and employs nearly 65% of the workforce. Beyond employment, the sector is essential for food security, industrial raw material supply, and foreign exchange earnings. However, persistent challenges, including low productivity, inadequate infrastructure, and climate change vulnerabilities, continue to constrain its growth (Mtui, 2023).

Trade, particularly international trade, is equally instrumental in Tanzania's economic trajectory. Through specialization and comparative advantage, trade enhances economic efficiency and growth (Loff, 2010). Trade liberalisation and export-oriented policies have been integral to Tanzania's economic strategy, yet the persistent trade deficit raises concerns regarding their sustainability (Utouh & Tile, 2024). Despite deeper integration into the global economy, Tanzania's imports have consistently exceeded exports, leading to structural trade imbalances (Utouh, 2024). These imbalances, and their potential implications for long-term economic sustainability and agricultural sector performance, warrant deeper investigation.

A critical research question thus emerges: how do trade imbalances affect the long-term sustainability of economic growth in Tanzania, particularly within the agricultural sector? The nexus between agriculture, trade, and capital dynamics is complex and multifaceted. On one hand, agricultural exports generate crucial foreign exchange, facilitating the import of essential goods and promoting macroeconomic stability. On the other, trade policies that prioritise industrial over agricultural products may inadvertently stifle agricultural sector growth (FAO, 2017; World Bank, 2020; Malek & Sayef, 2024). Understanding these interactions is vital for developing policies that promote balanced and sustainable economic growth. Moreover, distinguishing between short-run and long-run economic dynamics is essential, as short-term fluctuations (driven by market shocks and policy interventions) may have different implications than long-term structural transformations.

This study employed Vector Error Correction Model (VECM) to examine these relationships, distinguishing between short-run adjustments and long-term equilibrium trends among agriculture, trade, and economic growth. The use of VECM is particularly suitable as it accounts for cointegration and

corrects disequilibrium in the long-run relationship, providing a robust analytical framework for policy implications.

Despite the recognised significance of agriculture and trade in Tanzania's economic development, existing studies tend to analyse these sectors in isolation, limiting the understanding of their interconnected effects. Furthermore, many prior studies have relied on outdated datasets, leading to gaps in assessing recent economic trends (Mtui, 2023; Utouh, 2024). This study addresses these shortcomings by integrating agricultural and trade dynamics within a single empirical model, offering new insights into their collective impact on Tanzania's economic growth.

The primary objective of this study was to examine the interplay between agriculture, trade, and capital dynamics in shaping Tanzania's economic growth using VECM methodology. Specifically, this study contributes to the literature by: providing empirical evidence on the short-run and long-run relationships between agriculture, trade, capital formation and economic growth, addressing a key gap in existing research: enhancing policy formulation by identifying optimal strategies for maximising the benefits of trade and agricultural development: extending economic development literature, by demonstrating the synergies and trade-offs between agricultural and trade policies in a developing economy context.

The remainder of this paper is structured as follows: Section 2 reviews relevant literature, Section 3 outlines the data and methodology, Section 4 presents empirical results and discussion, and Section 5 concludes with policy implications.

LITERATURE REVIEW

Theoretical Literature Review

The nexus between agriculture, trade, and capital dynamics in fostering sustainable economic growth has been extensively explored in both classical and contemporary economic literature. While the significant role of agriculture and trade in stimulating economic growth is widely acknowledged, there remains ongoing debate regarding their precise contributions to the economic growth trajectories of different nations, especially in the context of developing economies like Tanzania. Several theoretical perspectives have emerged to explain this complex relationship.

David Ricardo's theory of comparative advantage in 1817 traditionally underpins the notion that trade enables countries to achieve greater efficiency and economic growth by specializing in goods and services where they hold a

comparative advantage. However, this theory's application in today's dynamic global economy is increasingly debated, especially in developing countries where weak infrastructure and volatile trade conditions limit its effectiveness. Recent studies, such as those by Deardorff (2019) and Rahman (2022), argue that comparative advantage often fails to account for the nuanced trade dynamics in emerging economies, where industrial policy and sectoral shifts play a significant role.

Expanding on Ricardo's work, the Heckscher-Ohlin model and contemporary endogenous growth theories, such as those proposed by Krugman (1996), underscore how trade openness can promote efficient resource allocation, technological spillovers, and economies of scale. However, these models tend to overlook the challenges that developing nations face, such as inadequate infrastructure and political instability, which may undermine the expected benefits of trade liberalization.

The neoclassical growth model, pioneered by Solow (1956) and Swan (1956), posits that capital accumulation, labour, and technological progress are fundamental to long-term economic growth. While the model remains a cornerstone of economic growth theory, it often simplifies the complexities of developing economies, where factors such as governance quality and access to capital can significantly hinder the capital accumulation process (Webb, 2024)

More recent endogenous growth theories, such as those by Romer (1990) and Lucas (1988), place greater emphasis on human capital, technological innovation, and knowledge diffusion. These theories argue that economic development is primarily driven by internal processes, which can be influenced by trade policies and agricultural advancements. In the Tanzanian context, technological innovations in agriculture, supported by trade, are seen as critical drivers of productivity and long-term economic growth.

Despite these theoretical advancements, several gaps remain in understanding the interplay between agriculture, trade, and capital dynamics in Tanzania. Existing models often fail to incorporate the role of external shocks, such as; fluctuations in global commodity prices, and the impact of institutional quality, which can significantly affect the outcomes of trade and agricultural reforms. Moreover, while endogenous growth theories highlight the importance of technological progress, empirical evidence on how innovations in agriculture contribute to economic growth in Tanzania is sparse. This study seeks to address these gaps by applying the Vector Error Correction Model (VECM) to provide empirical evidence on the interactions between

agriculture, trade, and capital dynamics in Tanzania, thus offering valuable insights into the mechanisms of sustainable economic growth.

Empirical Literature Review

The relationship between agriculture, trade, and economic growth has been widely debated, particularly in developing economies such as Tanzania. While agriculture provides the foundation for industrialization, trade openness is believed to enhance efficiency and economic expansion. Empirical evidence supports these claims but highlights significant outcomes disparities, driven by country-specific conditions, institutional quality, and trade structures (Rasoanomenjanahary et al., 2022). This section critically examines empirical studies on the agriculture-trade-growth nexus and identifies gaps requiring further investigation.

Trade and Economic Growth

Empirical studies reveal mixed findings on the impact of trade on economic growth. Some studies suggest that trade openness fosters growth by enhancing productivity and capital accumulation (Gabriel & David, 2021; Kong et al, 2020). Others, however, report negative effects, particularly where trade liberalization leads to import dependency and deindustrialization (Sule et al, 2023; Bunje & Wang, 2022). In the context of sub-Saharan Africa, Malefane (2020) found a positive relationship between trade openness and economic growth in Botswana, consistent with Zahonogo (2017) in Sub-Saharan Africa (SSA) and Malefane & Odhiambo (2018) in South Africa. In the context of Tanzania, Miku et al. (2023) found that trade openness positively and significantly affects economic growth. Similarly, Hye & Lau (2015) observed a positive influence on India's economic growth in the short run, while having a detrimental effect in the long run. These findings align with classical trade theories but also indicate that the benefits of trade depend on macroeconomic stability and institutional frameworks.

Agriculture and Economic Growth

The agricultural sector is regarded as a key driver of economic growth in developing countries. Several studies confirm a positive correlation between agricultural expansion and GDP growth. Nyamekye (2021) demonstrated a long-term cointegration between agriculture and economic growth in Ghana. Raza et al. (2012) found that all agricultural sub-sectors, except forestry, contributed positively to Pakistan's GDP. Sertoglu et al. (2017) reported a statistically significant relationship between agricultural productivity and economic expansion in Nigeria.

Similar findings are reported for Tanzania. Lyatuu et al. (2015) confirmed agriculture's role in GDP growth using time-series analysis, and Mhagama et al. (2023) found a positive correlation between agriculture and GDP growth. However, Alam & Myovela (2019) noted that while agricultural exports influenced GDP in Tanzania, the reverse causality was weak, suggesting that GDP growth did not significantly boost agricultural exports. These findings highlight structural inefficiencies in the sector, such as low mechanization, poor infrastructure, and limited access to credit.

Capital Dynamics in Agriculture and Trade

The role of capital accumulation and investment in agriculture and trade remains debatable. While capital-intensive agricultural models have driven economic growth in some countries, inadequate investment hinders Tanzania's agricultural transformation. Epaphra & Mwakalasya (2017) found no significant relationship between FDI inflows and agriculture's contribution to Tanzania's GDP, indicating that investment policies may not sufficiently prioritize agricultural modernization. Similar to Han et al. (2024), which highlight that while FDI fosters economic growth in many sectors, its effects on agriculture are often constrained by structural inefficiencies, inadequate technological adoption, and weak institutional frameworks. While Fatima et al. (2020) found a negative correlation between trade and economic growth.

Challenges and Policy Implications

Despite positive linkages between agriculture, trade, and economic growth, several challenges persist. Global market volatility, climate change, and geopolitical risks significantly impact agricultural productivity and trade competitiveness (Gray et al. 2020; Blanc & Schlenker, 2017; Kolstad & Moore, 2020). Additionally, trade liberalisation does not guarantee economic growth unless accompanied by value addition and industrial upgrading (Miku et al. 2021). These challenges underscore the need for integrated policies that enhance agricultural productivity while leveraging trade opportunities.

Methodological Limitations in Existing Literature

Many empirical studies rely on simple regression models or Vector Autoregression (VAR), which may not fully capture equilibrium relationships among variables. Lütkepohl (2006) emphasised that such models may fail to distinguish between short-run adjustments and long-term equilibrium. Given the evidence of cointegration between agriculture, trade, and economic growth, the application of a Vector Error Correction Model (VECM) is more appropriate. The VECM framework allows for a

comprehensive analysis of both short-term fluctuations and long-run adjustments, addressing gaps in previous studies.

While existing empirical literature provides valuable insights into Tanzania's economic growth dynamics, several gaps remain. First, there is limited research on the combined impact of agriculture and trade using advanced econometric techniques. Second, few studies assess the role of governance and institutional quality in shaping the agriculture-trade-growth relationship. Third, mechanistic analyses that integrate climate risks and global trade shocks are scarce. Addressing these gaps requires a multidisciplinary approach, including advanced econometric modelling, policy simulations, and comparative studies across developing economies.

METHODOLOGY

This study employed the Vector Error Correction Model (VECM) to examine the interrelationships between agriculture, trade, and economic growth in Tanzania. VECM is well-suited for this analysis as it captures both short-run dynamics and long-run equilibrium relationships among variables, making it a powerful tool for time-series analysis (Johansen, 1988). Compared to alternative methods such as the Autoregressive Distributed Lag (ARDL) model and Bayesian Vector Autoregression (BVAR), VECM is more appropriate when dealing with multiple non-stationary variables that exhibit cointegration.

The study utilises annual time series data spanning from 1970 to 2022, sourced from the Ivan Statistics Database. The selection of this time frame is based on the following justification: Time-series models such as VECM require long-term data to establish stable cointegration relationships and ensure robust parameter estimation (Engle & Granger, 1987). Using data from 1970–2022 helps capture multiple phases of economic growth, stagnation, and recovery, making the results more generalisable.

Unit Root Test

Since this study utilised time series data, it is essential to test for stationarity to avoid the issue of spurious regression (Granger & Newbold, 1974). If the variables are integrated in different orders, the estimation results may be misleading. Therefore, the study employed the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) and the Phillips-Perron (PP) test (Phillips & Perron, 1988) to determine the stationarity properties of the variables. The null hypothesis for both tests states that the series contains a unit root, indicating non-stationarity, while the alternative hypothesis suggests stationarity.

Furthermore, selecting an appropriate lag length is crucial before conducting the unit root test to ensure that the residuals are white noise. The study used the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC) to determine the optimal lag length. If the variables are found to be non-stationary at levels, they will be first differentiated to achieve stationarity before proceeding with the cointegration analysis.

Testing for the Cointegrating Rank r

Once it is established that the variables are integrated in the same order, the study applies Johansen's (1988) cointegration test to determine the presence of a long-run equilibrium relationship among agriculture, trade, and capital accumulation in Tanzania. Cointegration implies that despite short-term fluctuations, the variables move together in the long run.

Johansen's cointegration approach is based on the maximum likelihood estimation of a **vector** autoregressive (VAR) model. The test identifies the number of cointegrating vectors **(r)** using two test statistics:

Trace Statistic (1)

$$Trace = -T \sum_{i=r+1}^{p} In(1 - \lambda_i)$$

where: λ_i represents the eigenvalues of the system. If the trace statistic exceeds the critical value**,** the null hypothesis of no cointegration is rejected

Maximum Eigenvalue Statistic (2)

$$LR_{Max} = -T \sum_{i=r+1}^{p} In(1 - \lambda_{i+1})$$

This statistic tests whether the number of cointegrating vectors is exactly **r** against the alternative hypothesis of r+1 cointegrating vectors.

The decision criteria indicate that if either test statistic exceeds the corresponding critical value, the null hypothesis is rejected, confirming the existence of cointegration. Once cointegration is established, the study proceeds to estimate a Vector Error Correction Model (VECM) to capture both the short-run and long-run dynamics.

Model Specification

To investigate the impact of agriculture and trade on economic growth in Tanzania, the study specified the following mathematical function:

Economic Growth = F(Agriculture, Trade, Household Consumption Expenditure, Capital Formation) which translates into the following empirical model:

$$\mathbf{GDP} = \mathrm{F}(\mathrm{AGR}, \mathrm{TRD}, \mathrm{HHE}, \mathrm{CF}) \quad (3)$$

where GDP **(**Gross Domestic Product) represents economic growth, and the independent variables include agriculture (AGR), trade (TRD), household consumption expenditure (HHE), and capital formation (CF)**.** GDP, AGR, TRD, HHE, and CF are expressed in millions of US dollars**.**

To estimate the model efficiently using EViews, equation (4) is transformed into an econometric model as follows:

$$GDP_t = \alpha + \beta_1 \mathrm{AGR}_t + \beta_2 \mathrm{TRD}_t + \beta_3 \mathrm{HHE}_t + \beta_4 \mathrm{CF}_t + \epsilon_t \quad (4)$$

where: α is the intercept, β_1, β_2, β_3, and β_4 are coefficients capturing the effect of independent variables on GDP, ε_t is the error term.

Given that economic relationships often exhibit nonlinear patterns, this study applied the log-log transformation, which enhances model stability, reduces heteroscedasticity, and allows coefficients to be interpreted as elasticities (Gujarati & Porter, 2021). The transformed model is:

$$InGDP_t = \alpha + \beta_1 \mathrm{InAGR}_t + \beta_2 \mathrm{InTRD}_t + \beta_3 \mathrm{InHHE}_t + \beta_4 \mathrm{InCF}_t + \epsilon_t \quad (4)$$

Justification for Using the Vector Error Correction Model (VECM)

Since the Johansen cointegration test confirms a long-run relationship among GDP, AGR, and TRD, this study employs the VECM to assess both short-run adjustments and long-run equilibrium dynamics **(**Nkoro & Uko, 2016)**.** The VECM specification is as follows:

$$\triangle \boldsymbol{GDP_t} = \boldsymbol{\alpha} + \sum_{i=1}^{p} \boldsymbol{\gamma_i} \triangle \boldsymbol{GDP_{t-i}} + \sum_{i=1}^{p} \boldsymbol{\Theta_i} \triangle \boldsymbol{AGR_{t-i}} + \sum_{i=1}^{p} \boldsymbol{\delta_i} \triangle \boldsymbol{TRD_{t-i}} + \boldsymbol{\lambda ECT_{t-1}} + \boldsymbol{\epsilon_t}$$

where: **Δ** represents first differences, capturing short-term fluctuations; **ECT** (Error Correction Term) adjusts deviations from the long-run equilibrium; **λ** is the speed of adjustment parameter.

Diagnostic Tests for Model Validity

To ensure the robustness of the Vector Error Correction Model (VECM), the study conducted several diagnostic tests. First, the Breusch-Godfrey LM test is applied to detect the presence of serial correlation in the residuals, ensuring that the model does not suffer from autocorrelation issues. Second, the White test is used to assess heteroscedasticity, verifying whether the variance of the residuals remains consistent across observations. Third, the study employed

the Variance Inflation Factor (VIF) to examine multicollinearity among independent variables, ensuring that no severe correlation exists, which could distort the reliability of coefficient estimates. Finally, the Jarque-Bera test was conducted to determine whether the residuals follow a normal distribution, which is essential for valid statistical inference. By performing these diagnostic tests, the study enhanced the credibility and reliability of the VECM results.

EMPIRICAL RESULTS

Diagnostic Test Results

To ensure the robustness of the Vector Error Correction Model (VECM), the study conducted the following diagnostic tests:

The Breusch-Godfrey LM test

The test is used to detect the presence of autocorrelation in the residuals. The null hypothesis (H_0) states that there is no serial correlation in the residuals. Table 1 shows that the p-values for the LM test at both lag 1 and lag 2 are greater than the 5% significance level (α=0.05). This suggests that there is no significant serial correlation in the residuals, confirming that the VECM does not suffer from autocorrelation issues.

Table.1: Results of the Breusch-Godfrey LM Test

Lags	LM Statistic	p-value	Decision
1	3.271	0.071	Fail to Reject H_0
2	4.582	0.102	Fail to Reject H_0

Source: Author's Computation, 2024

White Test

The White test is applied to examine whether the variance of the residuals is constant. The null hypothesis (H_0) states that there is homoscedasticity (no heteroscedasticity). The results in Table 2 show that the p-value (0.278) is greater than 0.05, indicating that the null hypothesis of homoscedasticity is not rejected. This means that the residuals exhibit constant variance, confirming the absence of heteroscedasticity, which strengthens the reliability of the VECM estimates.

Table 2: Results of the White Test

Test Statistic	p-value	Decision
8.146	0.278	Fail to Reject H_0

Source: Author's Computation, 2024

Variance Inflation Factor

The Variance Inflation Factor (VIF) is used to check for multicollinearity among independent variables. A VIF value exceeding 10 suggests severe multicollinearity. All VIF values in Table 3 are below 5, indicating no severe multicollinearity among independent variables. This confirms that the independent variables are not highly correlated, ensuring reliable coefficient estimation.

Table 3: Results of the VIF Test

Variable	VIF Value
Trade (TRD)	2.45
Agriculture (AGR),	3.12
Household consumption expenditure (HHE)	1.98
Capital formation (CF)	2.75

Source: Author's Computation 2024

Jarque-Bera Test

The Jarque-Bera test assesses whether the residuals follow a normal distribution. The null hypothesis (H_0) states that the residuals are normally distributed. The results in Table 4 show that the p-value (0.235) is greater than 0.05, meaning the null hypothesis cannot be rejected. This suggests that the residuals are normally distributed, which is crucial for valid statistical inference.

Table 4: Results of the Jarque-Bera Test

Test Statistic	p-value	Decision
2.893	0.235	Fail to Reject H_0

Source: Author's Computation 2024

Empirical Findings and Discussion

This section presents the empirical findings of the study and discusses their implications within the context of Tanzania's economic growth dynamics, focusing on agriculture, trade, and capital formation.

Unit Root Test Results

A unit root test was conducted using the correlogram technique to determine the stationarity properties of the variables. The results indicate that all variables are non-stationary at levels, signifying that they are integrated of order one, I(1). However, after first differencing, all variables become stationary, confirming that they are integrated of order zero, I(0). This outcome ensures that the regression analysis does not produce spurious results, as all models formulated in the study adhere to the same order of integration.

Lag Length Selection Criteria

The optimal lag length for the Vector Autoregressive (VAR) model was determined using five selection criteria: the sequential modified Likelihood Ratio (LR) test statistic, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan-Quinn (HQ) Criterion. Table 5 presents the lag selection results. While two criteria (SC and HQ) suggested one lag, with the lowest SC (-11.6049) and HQ (-12.3414) values and three criteria (LR, FPE, and AIC) recommended four lags as it has the highest significant LR statistic (37.77), the smallest FPE value (1.94e-12), and the lowest AIC (-13.1189). Since AIC, FPE, and LR tests are typically more reliable in VAR modelling, the optimal lag length is 4 **(**Liew, 2004).

Table 5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	113.37	NA	6.84e-09	-4.6113	-4.4145	-4.5373
1	330.47	36.74	1.94e-12	-12.7858	-11.6049*	-12.3414*
2	351.00	31.46	2.43e-12	-12.5959	-10.4309	-11.7812
3	379.15	37.13	2.35e-12	-12.7299	-9.5808	-11.5449
4	413.29	37.77*	1.94e-12*	-13.1189*	-8.9856	-11.5235

Source: Author's Computation 2024

Johansen Cointegration Test Results

Having confirmed that all variables were integrated in the same order, Johansen's cointegration test was applied to assess the existence of long-run relationships among GDP, agriculture, trade, household consumption expenditure, and capital formation.

Table 6 presents the Johansen Cointegration Test results, which assess the presence of long-run equilibrium relationships among the variables in the Vector Autoregressive (VAR) framework. The test provides both Trace Statistics and Maximum Eigenvalue Statistics, comparing them against their corresponding critical values at a 5% significance level to determine the number of cointegrating equations (CEs**)**. The results show that the Trace Statistic (32.71) is higher than the critical value (29.79), with a p-value of 0.0225, indicating at least three cointegrating relationships and the Max-Eigen Statistic (22.06) marginally exceeds the critical value (21.13), with a p-value of 0.0369, confirming the third cointegrating equation. Both the Trace and Max-Eigenvalue test statistics indicate the presence of three cointegrating equations at a 5% significance level, confirming stable long-term equilibrium relationships. Since both tests consistently reject the null hypothesis, the findings strongly suggest the presence of three long-run equilibrium

relationships among the variables. These results suggest that agricultural productivity significantly influences economic growth. Furthermore, trade has a bidirectional relationship with economic growth, implying that an increase in trade activities can stimulate GDP growth and vice versa. Policymakers should, therefore, consider agricultural and trade policies that enhance economic sustainability.

Table 6: Johansen Cointegration Test Results

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value (5%)	Prob.	Max-Eigen Statistic	Critical Value (5%)	Prob.
None*	0.6396	111.78	69.82	0.0000	47.98	33.88	0.0006
At most 1*	0.4840	63.81	47.86	0.0008	31.09	27.58	0.0169
At most 2*	0.3745	32.71	29.79	0.0225	22.06	21.13	0.0369

Source: Author's Computation, 2024

Long-Run Coefficients Results

The long-run relationship among economic growth (GDP), agriculture (AGR), trade (TRD), household expenditure (HHE), and capital formation (CF) is captured through the normalized cointegrating coefficients presented in Table 7. These coefficients provide insights into the magnitude and direction of the impact of each independent variable on economic growth in Tanzania. The results showed that Agriculture (lnAGR) had a Positive and Significant Impact on economic growth (GDP) (0.5264, SE = 0.1375). The coefficient suggests that a 1% increase in agricultural output led to a 0.5264% increase in GDP in the long run. This confirms the fundamental role of agriculture as a key driver of Tanzania's economic growth. The positive and significant relationship aligns with findings from Nyamekye (2021), Sertoglu et al. (2017), and Mhagama et al., (2023) who observed that agriculture contributes significantly to GDP in developing economies, particularly in Sub-Saharan Africa. Agriculture remains a major source of employment and food security in Tanzania, and the results emphasize the need for enhanced investments in agricultural productivity, mechanization, and value addition to sustain economic growth. However, the coefficient is below unity, implying that while agriculture is important, its impact is not as strong as expected. This aligns with studies like Thurlow et al (2009) which suggest that structural weaknesses such as low productivity, climate variability, and limited access to modern technology constrain agriculture's full potential.

Trade (lnTRD) indicates a negative and significant impact on GDP (-2.2065, SE = 0.2048). The coefficient suggests that a 1% increase in trade volume leads to a 2.2065% decline in GDP**,** indicating an inverse long-run relationship. This

finding contradicts traditional trade-growth theories (Solow's Growth Model and Heckscher-Ohlin Trade Theory), which emphasize the positive impact of trade liberalization on growth. This could be attributed to Tanzania's trade structure, where imports exceed exports, leading to negative trade balances. The negative coefficient for trade is consistent with Fatima et al. (2020), who noted similar patterns in developing economies. The result suggests that Tanzania's trade policies may not be effectively promoting local industries and exports, leading to a net outflow of resources. Policymakers should focus on export diversification, import substitution strategies, and strengthening regional trade agreements to mitigate adverse effects.

The results on Household Expenditure (lnHHE) show a positive and significant impact on GDP (1.8771, SE = 0.1125). The coefficient indicates that a 1% increase in household expenditure leads to a 1.8771% increase in GDP in the long run**.** The findings align with Keynesian economic principles, which emphasize aggregate demand as a driver of GDP. Since household consumption is a major component of aggregate demand, an increase in consumer spending fuels economic growth (Akmal & Fayzullokh, 2023). While household consumption is a key driver of GDP, overreliance on it may not be sustainable. A balanced growth strategy should also strengthen investment, exports, and industrial production to ensure long-term stability The results on Capital Formation (lnCF) show a Positive and highly significant Impact on GDP (0.4027, SE = 0.0305). The coefficient suggests that a 1% increase in capital formation leads to a 0.4027% increase in GDP**,** reinforcing the classical economic argument that capital accumulation drives economic growth. This finding is consistent with studies by Javed (2021**)** and Prasetyo (2020)**,** which emphasize the importance of investment in physical and human capital for long-term economic expansion.

Table 7: Normalized Cointegrating Coefficients

Variable	lnGDP	lnAGR	lnTRD	lnHHE	lnCF
Coefficient	1.0000	0.5264	-2.2065	1.8771	0.4027
Std. Error	-	(0.1375)	(0.2048)	(0.1125)	(0.0305)

Source: Author's Computation, 2024

Short-Run Dynamics and Error Correction Term (ECT)

The estimated Vector Error Correction Model (VECM) equation provides insights into the short-run adjustments towards long-run equilibrium. The error correction term (ECT) is negative and statistically significant, confirming that GDP adjusts towards equilibrium in response to shocks in agriculture, trade, and capital formation. This result underscores the

importance of policy interventions that promote agricultural productivity and trade efficiency to ensure long-term economic stability.

CONCLUSION AND POLICY IMPLICATIONS

This study employed a Vector Error Correction Model (VECM) to investigate the dynamic interrelationships between agricultural output, trade activities, household consumption expenditure, capital formation, and economic growth in Tanzania using time-series data spanning from 1970 to 2022. The Johansen cointegration test confirmed the presence of a long-run relationship among these variables, suggesting a stable equilibrium over time. The normalized cointegrating coefficients reveal that Agriculture (lnAGR), Household Expenditure (lnHHE) and Capital Formation (lnCF) have a positive and significant impact on GDP growth, while Trade (lnTRD) has a negative and significant impact on GDP growth.

The results strongly support the Heckscher-Ohlin model, which posits that countries tend to specialize in sectors where they have a comparative advantage. Tanzania's agricultural sector, abundance in natural resources and labour, demonstrates its role as a fundamental driver of trade and capital formation. Furthermore, the study corroborates endogenous growth theories, particularly the role of capital accumulation and technological progress in sustaining long-term economic expansion. The results suggested that capital formation through foreign direct investment (FDI), domestic savings, and infrastructure development serves as a crucial conduit for translating agricultural and trade growth into sustained economic advancement.

Cointegration among GDP, agricultural output, and trade volumes highlights the importance of these sectors in driving economic growth in Tanzania. Policy implications drawn from these findings indicate that agriculture and capital formation remain fundamental drivers of Tanzania's economic growth. Therefore, enhancements in agricultural productivity have a substantial positive impact on economic growth. This suggests that policies aimed at improving agricultural practices, technology, and infrastructure can significantly boost GDP. The strong link between agricultural output and GDP is well-documented in the literature, emphasizing agriculture's role in economic development. Furthermore, the findings indicate the importance of capital accumulation in driving economic growth. The policy should emphasise the importance of investment in physical and human capital for long-term economic expansion, which could stimulate higher economic growth. In addition, capital formation plays a pivotal role in economic expansion, necessitating policies that attract foreign direct investment (FDI), enhance domestic savings mobilization, and improve access to credit for

industrialisation and infrastructure development. Policymakers should prioritise strategies that link agricultural productivity with industrialisation, ensuring value addition across supply chains.

Despite providing valuable insights into the nexus of agriculture, trade, and capital dynamics in Tanzania's sustainable economic growth, this study has several limitations. First, data limitations, including availability, frequency, and potential inconsistencies, may affect the robustness of the findings. Second, the Vector Error Correction Model (VECM) relies on the assumption of cointegration, which, if weak, may impact the validity of long-run relationships

Future research should explore the role of institutional quality, financial sector development, and climate change resilience in shaping the nexus between **a**griculture, trade, and economic growth. Additionally, employing alternative methodologies such as Structural VAR, Bayesian VAR, or panel VECM could provide deeper insights and enhance the robustness of the findings.

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