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Evaluating the Dynamics of Fiscal Policy: Government Expenditure, Public Debt, and Economic Growth in Tanzania (1990-2021)

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Abstract

This paper presents a detailed empirical analysis of the dynamics of fiscal policy by evaluating the impact of government expenditure and public debt on economic growth in Tanzania from 1990 to 2021, with data extracted from the World Development Indicators (WDI). The paper employed the Vector Error Correction Model (VECM) and Granger causality techniques. The paper presents the findings of a statistically insignificant unidirectional relationship between public expenditure and economic growth. It attributes the negative coefficient of government expenditure in the long run to the prevalence of recurrent expenditure over developmental expenditure, potentially acting as a hindrance to economic growth in Tanzania. Furthermore, the paper suggests a statistically significant and positive long-term relationship between public debt and Tanzania's economic growth. A one percent increase in public debt corresponds to a 2.4 percentage point increase in economic growth. The presence of a statistically significant Error-Correction Term suggests the correction of past deviations from long-run equilibrium, with 75% correction in the current period. These findings align with the Keynesian Theory, but they contradict the Adolph Wagner's hypothesis. The Johansen's co-integration test results support the existence of a long-run relationship between GDP and the public debt, and government expenditure. The paper therefore emphasizes efficient debt management and channeling borrowed funds into productive sectors in order to promote real economic growth and create opportunities, including employment. The paper also advocates for a correlation between increased borrowing and a rise in development expenditures, urging policymakers to align economic policies with macroeconomic objectives. These include promoting productive investments, employment opportunities, and sustainable economic growth. The strategic allocation of public debts to long-term projects in crucial sectors is seen as a meaningful contribution to stable economic growth, demanding effective management of public expenditures to ensure economic stability. Additional measures are proposed to control and maintain inflation levels, as well as strengthen the local currency through increased exports and domestic production.

Keywords: *Economic growth, Tanzania, Government Expenditure, Public Debt, VECM model*

1. Introduction

Borrowing and efficient public expenditure are critical tools for promoting sustainable economic growth, particularly in developing nations (Le Van et al., 2019; 2018). Governments worldwide rely on multilateral resources to strengthen their economies, but many faces a growing disparity between public debt and Gross Domestic Product (GDP) (Wibowo, 2017). High public expenditures, coupled with inadequate tax revenues, often result in budget deficits, compelling governments to borrow from domestic and external sources to finance expenditures without disrupting macroeconomic stability (Manamba and William, 2021; Ndulu and O'Connell, 2021).

While borrowing can stimulate economic growth by funding essential projects, it also poses significant challenges. Domestic borrowing often reduces credit availability for private investors thus hindering investment and economic growth (Mwamkonko, 2021; Hassan, Ongeri, and Ndolo, 2023). Similarly, external borrowing exacerbates the debt burden through high-interest

rates, inflation, and substantial debt servicing costs (Isibor et al., 2018; Jacobsa et al., 2020). In Tanzania, public debt is considered inevitable for financing socioeconomic development, but its sustainability remains a concern (Chindengwike and Kira, 2021).

Tanzania faces significant challenges in financing critical sectors such as water, agriculture, health, and education due to limited domestic revenue generation, with the tax-to-GDP ratio remaining below 20% (Babatunde, 2018; Ekinei, 2019). This revenue shortfall places a considerable strain on the government's ability to meet public service needs (MoFP, 2021). To address this gap, the government has been increasingly relying on external borrowing, resulting in a sharp rise in public debt servicing—for example, from USD 29.4 million in 2007 to USD 177.8 million in 2021. By June 2021, external debt had reached TZS 9,947.92 billion, much of which has been directed toward essential infrastructure projects such as roads, railways, the Rufiji Hydro-Electricity project, and the standard gauge railway (Ekpo, 2020).

As shown in Table 1 and Figure 1, the analysis of public expenditure and debt trends from 2017 to 2021 reveals notable inconsistencies in their relationship with economic growth. Economic growth peaked in 2017, when public debt levels were relatively low, but declined sharply in 2020 despite reduced debt levels, primarily due to the COVID-19 pandemic (Anyanwu and Salami, 2021). By 2021, growth rebounded to 4.3%, coinciding with increased public debt and public spending. However, these trends indicate no clear or consistent pattern linking public debt, expenditure, and economic growth, thus raising questions about the effectiveness of financial strategies in achieving sustained growth.

Table 1: Trends of Public Debts, Public Expenditure, and Economic Growth (GDP)

Year	Public Expenditure (TZS Billion)	Public debts (TZS Million)	GDP Growth (annual%)
2017	1,999	7,088,111	6.8
2018	2,001	790,080,000	5.4
2019	2,050	888,099,564	5.8
2020	2,003	9,036,240	2.0
2021	2,303	77,522,420	4.3

Sources: Bank of Tanzania (BoT), 2022 and World Development Indicators (WDI), 2022

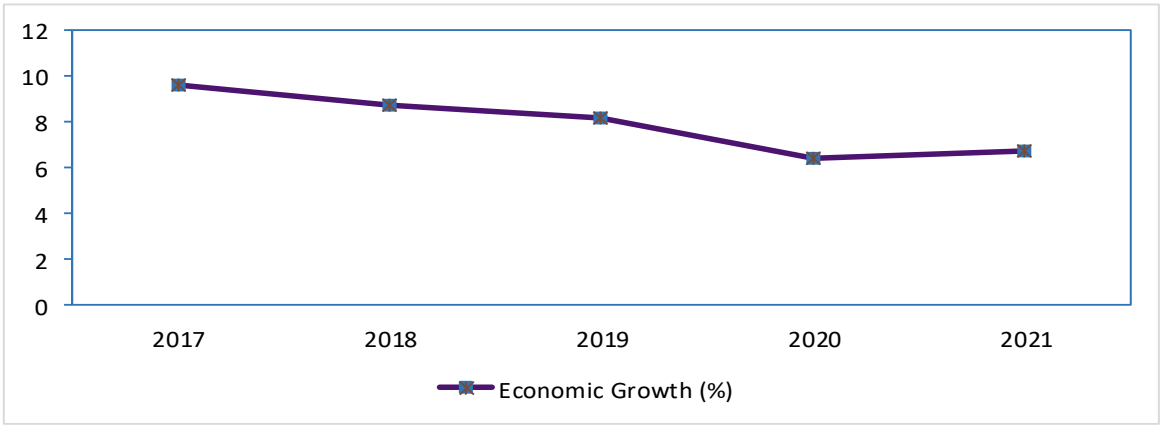

Figure 1. Economic Growth Rate trend from 2017-2021

Source: BoT, 2022

These findings suggest that factors beyond public debt and expenditure, such as external shocks and the efficiency of implemented policies, significantly influence economic growth. This highlights the need for more targeted and adaptive financial strategies to ensure public borrowing and spending are effective to support sustained economic development. Despite extensive

research, the evidence on the impact of government expenditure and public debt on economic growth remains mixed. While some studies highlight positive outcomes (Juma, Ouyang, and Cai, 2018; Coulibaly and Guei, 2022), others report negligible or even negative effects (Samson, Peter, and Agbarakwe, 2022; Akinbobola, Oderinu, and Olayiwola, 2022). Similarly, the effects of public debt vary widely depending on factors such as debt levels, funding sources, and the nature of expenditures (Kyissima, Pacific, and Ramadhan, 2017; Lotto and Mmari, 2018).

Given these conflicting findings, this study examines whether public borrowing and government expenditure foster the desired economic growth in Tanzania. Specifically, it addresses two critical questions: Does public borrowing accelerate economic growth? And does government expenditure—primarily financed through borrowing—significantly influence economic growth?

2. Literature Review

2.1 Related Theories

Adolph Wagner's Law of Increasing State Activity

The German economist Wagner (1883) has previously established that an increase in Government Expenditure (GE) contributes to economic growth within a country. Based on his research, he formulated a principle known as "The Law of Increasing State Activity," stating that "as the economy develops, the government's activities and functions expand." Consequently, the government is forced to increase its involvement in social and economic affairs, address the social welfare needs of the people, and undertake new projects (Adom et al., 2018). He further explains the view that the inherent and functional relation between the growth path of the economy and the state's activities leads to the consequence that economic growth contributes to a more rapid expansion of the government and its expenditures. However, it remains unclear whether in his views, he is referring to the growth of: (i) absolute public expenditure, (ii) public expenditure relative to GDP, or (iii) the public sector relative to the size of the economy (refer to Prakash and Chowdhury, 1995, page 30). To address the limitation of Wagner's Law, Musgrave proposed in 1959 that Wagner's Law relates to the relative size of the public sector. However, this perspective overlooks the other two aspects of relativity.

Buchanan and Tullock (1977) evaluated the empirical validity of Wagner's law with US data. They, however, related public expenditure to the output of public goods alone. Incidentally, several public goods in capitalist economies are also produced wholly or partially by the private sector. So, the output of public goods cannot be taken to be an indicator of the size of the public sector/enterprises per se; though this may represent part or whole of public expenditure on the production and/or distribution of such goods. Buchanan-Tullock discovered discrepancies between the growth of public expenditure and the growth of output of public goods. These discrepancies are defined by Buchanan-Tullock as Wagner's Squared Hypothesis. But these discrepancies are built into the data and hypothesis used by Buchanan-Tullock. So, the discovery of discrepancies is not surprising. Besides, the hypothesis overlooks the (i) more rapid growth of expenditure on administration than production, and (ii) coverage of the ever-increasing size of population by social security. Then, the output of merit and public goods is evaluated by the cost of production, which itself depends on public expenditure incurred on their production and distribution.

Keynesian Economic Theory

John Maynard Keynes established the theory in the 20th century that initially focused on public expenditure and taxation as instruments for regulating and promoting economic growth. The idea behind this theory is that if people don't spend enough money and the overall demand is low, it can lead to poor economic growth. Hence, supporters of the theory argue that economic recovery can be enhanced by adjusting expenditure and income distribution through fiscal policies. In financing government expenditure and promoting economic growth, the source of the government budget has to extend beyond taxation to include borrowing (Mariati, Yuesti and Tahu, 2022). The

government can choose to borrow from domestic sources, external sources, or a combination of the two.

Modigliani (1961) Claim on Public Debts

Modigliani argues that while public debts have current benefits, they can impose a burden on future generations by diminishing the stock of private capital, thereby reducing income streams. In cases where a substantial part of governmental activities relies on borrowing, there is a potential for significant long-term increases in interest rates. The theory asserts that the interest payments on these borrowings are covered by domestic revenue, primarily through taxes. This, in turn, results in reduced savings, a decline in capital stocks, and ultimately, a negative impact on economic growth. The Modigliani's argument suggests that public debt can only be beneficial if the borrowed funds are strategically invested in productive projects and capital formation (Modigliani, 1961).

2.3 Theoretical Framework

Based on the outlined framework below, this study examines the effects of government expenditure and public debt on economic growth. Given the varied results found in the reviewed literature regarding the effect of government expenditure and public debt on economic growth in developing countries, the researchers acknowledge the potential for diverse impacts. As a majority of studies have indicated both positive and negative effects, we expect to observe either a positive or a negative correlation between government expenditure, public debt, and economic growth. In line with the last objective, inflation and interest rates serve as moderating/control variables. Ultimately, the findings of this research will shed light on whether the proposed theories hold in the context of Tanzania.

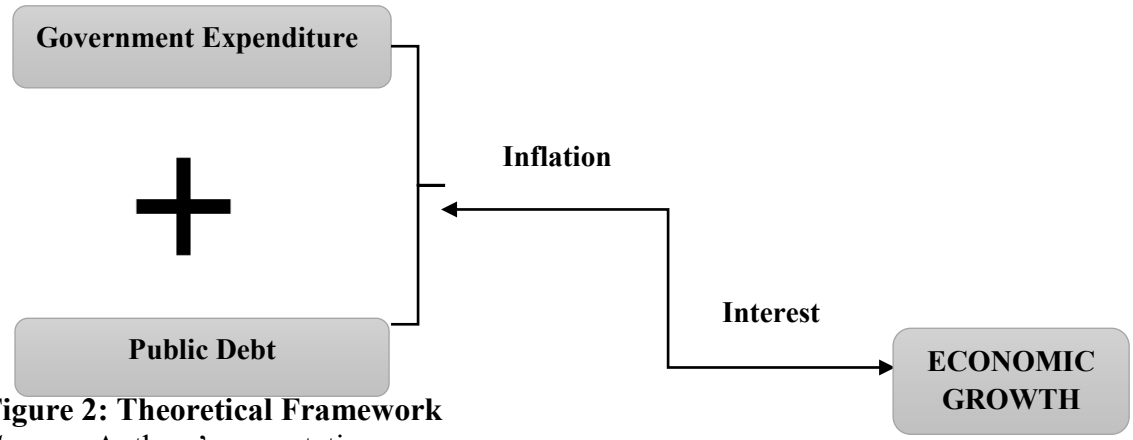

Figure 2: Theoretical Framework
Source: Authors' computation

The concluding theoretical framework sets the stage for examining the effects of government expenditure and public debt on economic growth in the context of Tanzania. Acknowledging the diverse impacts found in the literature, the study aims to uncover whether the proposed theories align with the Tanzanian economic scenario. Additionally, inflation and interest rates are included as moderating/control variables. The findings of this research will contribute valuable insights into the relationship between government fiscal policies and economic growth in the context of a developing country.

2.2 Empirical Evidence

Previous literature has revealed varying results regarding the impact of government expenditure and public debt on economic growth in developing countries.

Public Debt and Economic Growth

Pratibha and Krishna (2022a) examined the relationship between economic development and public debt accumulation in India using Structural Equation Modelling (SEM) on data from 1985 to 2018. Their results revealed a negative relationship, indicating that economic development reduces public debt accumulation. Similarly, Cynthia (2023) employed qualitative descriptive analysis and concluded that public debt negatively impacts economic growth. In Tanzania, Yusuph (2018) utilized the Vector Error Correction Model (VECM) with data from 1970 to 2015. His findings identified a negative correlation between public debt and economic growth.

Opposing findings are presented by Rahman et al. (2019), who, through systematic reviews and meta-analyses, found no consensus on the relationship between public debt and growth, suggesting the possibility of positive, negative, or non-linear effects. In their studies, Jacobsa et al. (2020) and Manamba and William (2021) found no direct causal relationship between public debt and economic growth; instead, economic growth was observed to drive public debt. They noted that low debt levels are generally neutral, while high debt levels impede growth. Supporting this argument, Siong et al. (2021) identified a threshold effect, where public debt hinders growth when it exceeds 51.65% of GDP. Similarly, Asteriou, Pilbeam, and Pratiwi (2021) used ARDL modeling to analyze selected Asian countries and their results aligned to those of Siong et al (2021).

In contrast, some studies suggest minimal or insignificant impacts of public debt on growth. Trpeski et al. (2020) and Bajrami, Tafa, and Hoxha (2020) found that public debt insignificantly affected economic growth in North Macedonia and Albania, respectively. Sansa (2020) also observed a negative but statistically insignificant relationship in Tanzania. Chindengwike and Kira (2021) highlighted a short-term positive effect of foreign debt on economic growth, though the long-term impact remained insignificant. Gómez, Sosvilla, and Martínez (2022) emphasized that the effects of public debt depend on factors like institutional quality, public expenditure structure, and debt maturity. Abedin (2020), conducting his study in Malaysia, identified a positive long-term relationship between public debt and growth, with causal links to government expenditure.

Other studies highlight the varied nature of public debt's impact. Butkus et al. (2021) and Bentour (2020) suggested that high public-debt-to-GDP ratios may not harm economic growth if private consumption and investment shares are high. However, the crowding-out effect of public debt on private investment can limit the potential for economic growth. Anachedo et al., (2022) further demonstrated the differential impacts of debt types, finding that domestic debt negatively correlated with growth in Nigeria, while external debt had a positive effect.

The two-sided nature of public debt's influence is evident in various studies. Some argue that public debt stimulates aggregate demand, boosting employment and investment (Burhanudin et al., 2017; Marobhe, 2019; Shangai and Ochieng, 2019; Lelya and Ngaruko, 2021). Others propose a non-linear relationship, where debt has both positive and negative effects depending on its level (Pegkas, 2018; Rahman et al., 2019; Gómez et al., 2022).

The nature of public debt also plays a crucial role. Domestic debt is often found to have more adverse effects on economic growth than external debt. Studies by Lotto and Mmari (2018), Mwamkonko (2021), Okoth et al. (2023), and Hassan, Ongeri, and Ndolo (2023) reinforce this perspective, emphasizing the importance of debt composition in shaping its economic outcomes.

Interest Rates, Inflation, and Economic Growth

High real interest rates have been identified as a critical factor exacerbating the negative effects of public debt on growth. Jacobsa et al. (2020) and Mwakalila (2020) argue that creditors hedge against default risks by demanding higher returns, while Manamba and William (2021) observe that elevated debt servicing costs reduce investment, further undermining growth. Similarly, Mhlaba and Phiri (2019) and Sergey et al. (2017) highlight that public debt crowds out private investment, thus negatively affecting economic growth.

The relationship between inflation and economic growth remains challenged. Sangweni and Ngalawa (2023), as well as Matandare and Tito (2018), report a negative correlation between GDP and inflation, whereas Ouyang and Cai (2018) suggest a positive correlation in the context of Tanzania. These scholars demonstrate that inflation could stimulate growth under certain conditions.

Tanzania experiences relatively high lending rates compared to other Sub-Saharan African countries, with credit costs peaking at 17.5% in 2018, well above the regional average of 10.89%. High borrowing costs constrain investment, which in turn hampers economic growth (Mwakalila, 2020; Manamba and William, 2021). The government's domestic borrowing in 2018/2019, amounting to 4.96 trillion shillings, further escalated interest rates on treasury bills and bonds (MoFP, 2021).

This study addresses key questions from the literature, such as whether public borrowing effectively accelerates economic growth and whether debt-financed government expenditure fosters sustainable development. Focusing on Tanzania, the study adopts an integrated approach that concurrently examines government expenditure and public debt, bridging a critical gap in research that often treats these factors separately. Analyzing data from 1990 to 2021, the study examines the effects of internal and external debts on economic growth, and it uncovers the causal relationships between government expenditure, public debt, and growth in both short and long terms. The study also incorporates inflation and interest rates as control variables to ensure a more comprehensive evaluation of the factors influencing Tanzania's economic performance.

3. Econometric Methodology and Data Sources

3.1 Data, Sources of Data, and Variables

The present paper investigates the impact of public expenditure and public debt on Tanzania's economic growth, utilizing secondary data from the Bank of Tanzania (BoT) and the World Bank Development Indicators (WDI) for the financial years 1990 to 2021. Spanning 32 years, this period is considered sufficient for analyzing trends in government expenditure and public debt. During this time, Tanzania experienced significant political changes under four different presidents, who are likely to have an influence on fiscal policies and their economic impact. These variations provide a robust context for examining how government expenditure and public debt have shaped the country's economic growth.

In addition to public expenditure and public debt, the study incorporates inflation rates and interest rates as control variables, drawing on findings from the existing literature. The Vector Error Correction Model (VECM) is employed to analyze the data, with GDP growth rate as the dependent variable. Government expenditure is categorized into current and development expenditure, while public debt includes domestic and external components. The analysis hypothesizes a positive relationship between economic growth and government expenditure as well as public debt, while inflation and interest rates are expected to have negative effects.

3.2 Econometric Model Specification

The current study used Johansen co-integration test and the Error-Correction Model (ECM). This model assists to minimize the risk of estimating spurious relations, while preserving long-run information in the data (Ramírezetal., 2002).

An econometric equation for the effect of the public debt and government expenditure on economic growth is specified as follows:

$$GDP_t = f(GE, PD, INF, ITR) \quad \text{(i)}$$

Furthermore,

$$GDP_t = \alpha + \beta_1 GE_t + \beta_2 PD_t + \beta_3 IR_t + \beta_4 INF_t + \theta_t \text{ ……………………………… (ii)}$$

Whereby:
GDP_t = Gross Domestic Product ; GE_t = Government Expenditure ; PD = Public Debt ; INF = Inflation rate; ITR = Interest Rate; α = Constant term
$\beta_1 - \beta_4$
= coefficients of governement expenditure, inflation rate, inflation rate and interest rate
ε_t = Error Term
From (ii), un-restricted Error-Correction Model (ECM) could be expressed as:

$$\Delta GDP_t = \beta_1 \Delta GE_{t-1} + \beta_2 \Delta PD_{t-1} + \beta_3 \Delta INF_{t-1} + \beta_4 \Delta ITR_{t-1} + \theta_t \text{ ……………………….. (iii)}$$

$$\Delta GDP_t = \beta_1 \Delta GE_{t-1} + \beta_2 \Delta PD_{t-1} + \beta_3 \Delta INF_{t-1} + \beta_4 \Delta ITR_{t-1} - \lambda_y (GDP_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \theta_{t-1} \text{ ……………………………………………………………….(iv)}$$

$$\Delta X_{t-1} = \beta_1 \Delta GE_{t-1} + \beta_2 \Delta PD_{t-1} + \beta_3 \Delta INF_{t-1} + \beta_4 \Delta ITR_{t-1} - \lambda_x (GDP_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \theta_{t-1} \text{ …………………………………………………………….. (v)}$$

Whereby:

EC_{t-1} $\alpha_0 - \alpha_1 X_{t-1}$ is a long run co-integration relationship between economic growth GDP *(Y)* that is dependent variable and independent variables *(Xs)* which include government expenditure, public debt as well as control variables that are inflation rate and interest rate.
λ_y and λ_x are the error correction parameters which quantify how *dependent (Y)* and *independent (X)* respond to deviations from the long run equilibrium. The disturbance term (θ_t) is presumed to be identically independent and normally distributed i.e., $\theta_t \sim iid(0,\sigma^2)$ and t is the index time (in years). To estimate the long run relationship, the bound co-integration test grounded on critical values derived from Pesaran *et al.* (2001) is employed with null hypothesis (H_0) and an alternative hypothesis (H_1) as follows: H_0 = β_1 *to* β_4 = *zero (0)* = the variables do not exhibit long-run relationship, and H_1 = β_1 *to* β_4 = different from zero (0) = Long run relationship exists among the study's variables.

3.2.1 Granger Causality Test

The Granger Causality test is a method employed to examine the existence of a lagged relationship among variables. It is used to ascertain the direction of causality among variables in the long run using the t-statistic and in the short run using the F-statistic. The determination of the optimal lag length for the VAR (Vector Autoregression) model is accomplished through the Akaike Information Criterion (AIC).

In the context of economic growth, one variable is said to Granger-cause another (such as government expenditure or public debt) when both the present and past values of dependent variable (economic growth) aid in predicting the behavior of the other variable. The model is estimated based on a pair of regression equations, typically denoted as equations (iii) and (iv), with the assumption that the variables involved are stationary. This stationary condition is crucial for the accurate estimation and interpretation of the Granger Causality test results.

$$\Delta GDP_t = \alpha \sum_{i=1}^{4} \lambda_i \Delta GDP_{t-i} + \alpha \sum_{i=1}^{4} \alpha_i X_{t-i} + \varepsilon_{1t} \text{ ……………………… (vi)}$$

$$\Delta X_t = \beta \sum_{i=1}^{4} \gamma_i \Delta GDP_{t-i} + \alpha \sum_{i=1}^{4} \theta_i X_{t-i} + \varepsilon_{2t} \text{ ………………;………. (vii)}$$

Whereby:

$\alpha\Sigma$ and $\beta\Sigma$ are the intercepts, while λ_i, γ_i and Θ_i indicate each lagged observation's contributions to the predicted values of the Gross Domestic Product, government expenditure and public debt (X's) variables, and ε_{1t} andε_{2t} are predicted disturbance (error) terms for each series. When assuming that the error terms; ε_{1t} andε_{2t} are not serially correlated, then causality testing and the joint hypotheses; $\theta i = 0$ for $i = 1 \_\_ m$ and $\gamma i = 0\ i = 1 __ m$are often tested. The test statistics follow a Chi-2 distribution, having (k-m) degree of freedom. The independent variables (Xs) are believed not to Granger-cause the dependent variable (*Gross Domestic Product)* if all the coefficients of the lagged independent variable (X) in equation ***(vi)*** are non-significantly different from zero (0). When all null hypotheses are accepted (none is rejected), it indicates the claims that the independent variables (Xs) are not Granger causing *dependent variable (DGP)* similarly. The *Gross Domestic Product* does not Granger cause *independent variables* implying that they are independent of one another. Finally, a bi-directional causality between *X's* and *GDP* is assumed if all hypotheses of the model are rejected.

3.3 Diagnostic Test and Time Series Features

Before drawing any conclusions from the findings, the significance of diagnostic tests was appropriately emphasized, as they play a vital role in verifying the statistical robustness of the models. This step is essential to ensure that the models can be relied upon for policy implications. Notable references in this regard include Hanck et al. (2019) and Hill et al. (2018).

3.3.1 Unit Root Test

In the estimation of econometric models using time series data, it is important that the data series remain stationary. To assess stationarity, this paper employs the Augmented Dickey-Fuller (ADF) test. The ADF unit root test not only makes a parametric correlation for higher-order correlation but also it tends to control this correlation by incorporating the lagged difference terms of the study's dependent variable (GDP) on the regression model's right-hand side (Gujarati, 2014). If the ADF statistics exceed the absolute asymptotic critical values, the null hypothesis is rejected, indicating that the data series is stationary. A null hypothesis, in this context, suggests the presence of a unit root and non-stationarity. On the contrary, the rejection of the null hypothesis signifies stationarity, eliminating the need for differencing in the series.

Heteroscedasticity

Addressing homoscedasticity is crucial as it ensures that the regression coefficients remain unbiased and reliable. When residuals exhibit heteroscedasticity, it can lead to biased and less efficient coefficient estimates. To assess and rectify this issue, a Heteroskedasticity test was conducted using the White's test. The null hypothesis (Ho) posits homoskedasticity, while the alternative hypothesis (H1) suggests unrestricted heteroskedasticity. This test aims to determine whether the assumption of equal variance in the residuals, which can impact the validity of the regression results, is violated.

Autocorrelation Test

In adherence to time series assumptions, it is imperative that error terms exhibit no serial correlation. To assess the presence of serial correlation, the present paper employs the Durbin-Watson (DW) Test. The null hypothesis (H0) posits no autocorrelation, while the alternative hypothesis (H1) suggests the presence of autocorrelation. As a rule of thumb, a DW value greater than or equal to 2 indicates the absence of autocorrelation, aligning with the assumption of independent error terms in the model. The goal of this test is to ensure that the errors are not systematically correlated over time, which is essential for the reliability of time series regression results.

Normality Test of the Residuals

The Shapiro-Wilk W test was employed to assess the normality of the dataset. The null hypothesis for this normality test asserts that the residuals follow a normal distribution. The test involves rejecting the null hypothesis if the p-value is less than or equal to the chosen significance level, often set at 5%. In other words, if the p-value is below 0.05, it indicates evidence against the normality assumption for the residuals. This test is crucial for evaluating whether the residuals conform to a normal distribution, an assumption that is fundamental for the validity of various statistical analyses.

Multicollinearity

Multicollinearity problem happens when explanatory variables in the model are highly correlated (Gujarati, 2014). To assess the presence of multicollinearity in the current study, the Variance Inflation Factor (VIF) was employed. The VIF test is based on the premise that predictors with VIF values greater than 10 could pose a threat to the reliability of the results, while VIF values between 1 and 10 are generally considered tolerable. This test is essential for identifying and addressing issues related to multicollinearity, which can impact the precision and stability of the regression coefficients.

Testing Co-integration

The co-integration test is employed to determine if there exists a long run relationship among the variables under investigation. Variables are considered to be co-integrated when their linear combination is integrated to any order lower than '*d*'. In this study, the Johansen co-integration test is used to assess the long-run relationship among the variables. This test helps to ascertain if there are various co-integrating vectors, facilitating the exploration of all dynamic short run and long run interactions or effect of co-integrated variables. Alternatively, it can be used to explore only the short-term effects that are not co-integrated (Hill et al., 2018). The null hypotheses (H_0) suggest as follows: $H_0 = \beta_1$ to β_4 = *not different from zero (0)* = No long run relationship among the variables (no co-integration). The alternative hypothesis (H1) posits that $H_1 = \beta_1$to β_4 = different from zero (0), indicating the presence of a long-run relationship. Both trace (trace) and maximum Eigen-value (max) statistics were used, whereby, the null hypothesis is rejected if the value of trace statistic is higher than the 5% critical value.

The equations for λ_{trace} and λ_{max} statistics respectively in Equations (viii) and (ix) are as follow:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{k}\log(1\lambda_i) \quad \text{(viii)}$$

$$\lambda_{trace}(r) = -T\log(1-\lambda_{r+1})\ \ 1\log \quad \text{(ix)}$$

Whereby: T = Observations; and λ = Eigen value

4. Empirical Results

4.1 Descriptive Statistics and Correlation Analysis

Table 2 presents descriptive statistics for the variables used in this study. The variables have been converted into their first difference to lessen the potential issues of serial correlation as well as multicollinearity. Additionally, Table 3 reports the estimates of the correlation coefficients.

4.1.1 Descriptive Statistics

The mean GDP, approximately 5.5%, suggests that despite the shock of the COVID-19 pandemic, Tanzanian GDP has generally exhibited an increasing trend throughout the study period. The GDP standard deviation rate, approximately 2%, indicates that the majority of observations were

narrowly spread out within a 1% standard deviation on each side of the mean. Additionally, the minimum GDP during the study period was 0.4%, while the maximum GDP reached 7.8%. These statistical measures reinforce the evidence that Tanzania has consistently experienced incremental growth in GDP over the years. These findings align with projections from the African Development Bank Group (2022) and Tanzania-invest (2022), both of which anticipate continued GDP growth in the country from 2021 onward.

The mean and median of public debt, reflecting the proximity or dispersion of the average and middle values, indicate that the average public debt during the study period was 701,597.9 TZS billion, pointing to a substantial amount of borrowing by the country. The standard deviation for public debt, 772,703.9 TZS billion, suggests that observations were somewhat spread out or deviated from one another. The minimum and maximum values for public debt were 1,489 and 2,351,540 TZS billion, respectively. Overall, these findings suggest a continuous increase in the value of public debt in the country over the years, consistent with the findings of a previous study by Marobhe (2019). During the study period, the average interest in Tanzania was 20.39394 TZS billion, indicating a significant burden on the economy in efforts to service borrowed loans. The standard deviation for interest on loans during the period, 6.521782 TZS billion, suggests a slightly higher risk associated with public debt servicing (Chindengwike and Kira, 2021). The present study reveals that the mean government expenditure for the studied period was 1,340,871 TZS billion. The positive correlation between government expenditure and economic growth aligns with findings from Cristina and Rother (2017), Palaniappan (2020), and Sansa (2020), suggesting that as GDP increases, public expenditure also tends to increase. The minimum and maximum values for government expenditure were 9,439.4 and 8,173,749 TZS billion, respectively, with a standard deviation of 2,110,835 TZS billion. Public expenditure encompasses payments of internal or external debts and investments into GDP.

Table 2 also indicates a mean interest rate of 20.39%, with minimum and maximum values of 4.1% and 35.95%, respectively. The standard deviation is 6.5%. These results imply the existence of a time value of money and they highlight that lenders cannot charge negative interest rates on borrowed funds. The standard deviation indicates that most observations were within 3.25 TZS billion on each side of the mean. This suggests that during the study period, the interest rates charged by lenders on borrowed funds did not vary significantly. The mean inflation rate stood at 13.21% throughout the studied period, with minimum and maximum values of 3.2% and 35.9%, respectively. However, the standard deviation, at 10.37%, reveals a high spread of 5.18% on each side of the mean, indicating higher associated risk. This supports the assertions of the Development Bank Group (2022) and Nyoni (2019), which suggest that Tanzania's inflation rate is likely to continue on an upward trajectory in the next 10 years.

Table 2 indicates that the skewness of GDP, public debt, government expenditure, interest rate, and inflation rate in the present study were -0.9, 0.7, 1.8, 1, and 0.9, respectively. All independent variables, except GDP, exhibit positive skewness. A skewness ranging between +1 and –1 is typically considered a sign of a significantly symmetrical distribution. Overall, the data displays normal distributions. Kurtosis, on the other hand, assesses whether the data distribution is more peaked or flat. A kurtosis number higher than +1 indicates a distribution that is too peaked, while a value less than –1 suggests a flat distribution. In the present study, Kurtosis values for GDP, public debt, public expenditure, interest rate, and inflation rate were 2.7, 2.1, 5.6, 3, and 2.5, respectively. All variables exhibited peaked distributions, as indicated by Kurtosis values greater than 1.

Table 2: Descriptive Statistics

Variables	*Obs*	*Mean*	*Std. Dev*	*Min*	*Max*	*Median*	*Skewness*	*Kurtosis*
GDP	32	5.527273	2.050651	0.4	7.8	6.4	-.91379	2.720361
PD	32	7,015,97.9	7,727,03.9	1489	2351540	434235	.7496378	2.170145
GE	32	1,340,871	2,110,835	9439.4	8173749	374962	1.859731	5.596474
ITR	32	20.39394	6.521782	4.1	35.95	17.21	1.091908	2.974335
INF	32	13.20606	10.37129	3.2	35.9	7.8	.9523742	2.489754

Source: Author´s compilation from STATA

4.1.2 Correlation Analysis

The correlation estimates in Table 3 reveal that GDP exhibits a negative correlation with inflation and interest rates. Interest rate and inflation rate are strongly negative correlated with the country's growth rate (GDP) at 0.82 and 0.72 respectively, indicating that as the interest rate and inflation rate increase, the country's economic growth is hindered (declines). This negative association aligns with findings from other studies (Davcev et al., 2018; Matandare and Tito, 2018; Ighodalo et al., 2020). Conversely, economic growth (GDP) is positively correlated with public debt and government expenditure, with public debt having a slightly high correlation (about 0.56) than government expenditure (about 0.33). This positive correlation implies that the increase in borrowed funds and government expenditure is likely to increase the economic growth of Tanzania. These results are in line with the expected positive influence of public debt and government expenditure on growth, while inflation and interest rates are expected to have a negative impact. Furthermore, government expenditure and public debt show a positive correlation, although weak (0.006%). This indicates that they tend to move together in the same direction, supporting the idea that increases in government expenditure are associated with increases in public debt (Sansa, 2020; Palaniappan, 2020).

Table 3: Matrix of Correlations

Variables	*GDP*	*PD*	*GE*	*ITR*	*INF*
(1) GDP	1.0000				
(2) PD	0.5595	1.0000			
(3) GE	0.3348	0.0006	1.0000		
(4) ITR	-0.8242	-0.5915	-0.3915	1.0000	
(5) INF	-0.7159	-0.5444	-0.2786	0.7671	1.0000

Source: Author´s compilation from STATA

4.2 Diagnostics Test Results

Normality Test

The Shapiro-Wilk W test results reported in Table 4 show a p-value of 51.6%, indicating that the residuals are normally distributed. Therefore, we fail to reject the null hypothesis. The normality of the data is further supported by the histogram plot in Figure 3, which depicts the normality of residuals.

Table 4: Shapiro-Wilk W test

Variable	**Obs**	**W**	**V**	**Z**	**Prob>z**
Residual	30	0.97129	0.980	-0.042	0.51673

Source: Authors´ compilation from STATA

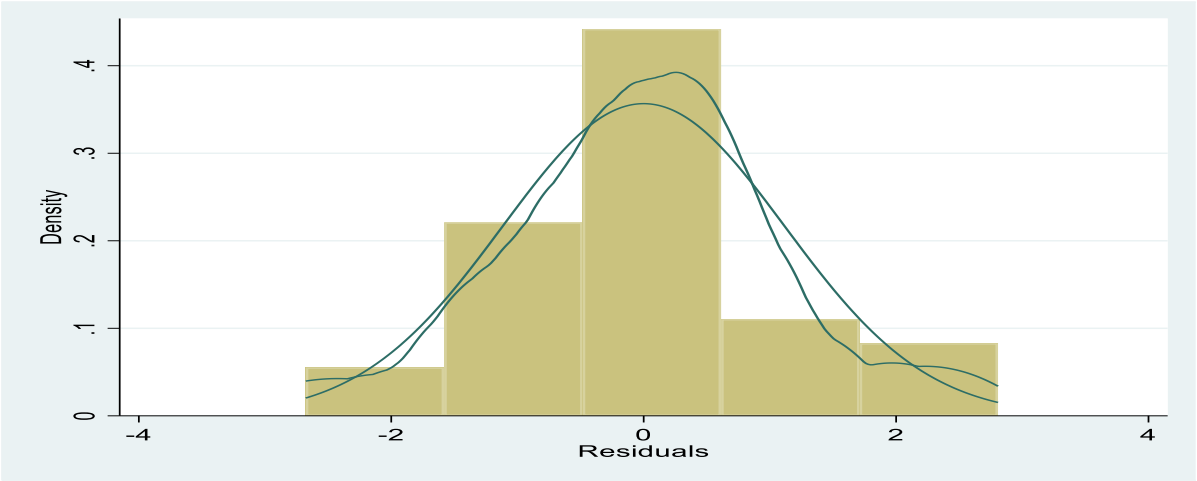

Figure 3: Normality Tests for Residuals
Source: Authors from STATA17output

Autocorrelation Test
The Durbin-Watson test result shows a DW value of 2.09. As a result, we fail to reject the null hypothesis, and we conclude that the error terms are independent from each other (not correlated).

Table 5: Autocorrelation Test

Durbin-Watson/d-statistic (4, 28)	2.0957

Source: Authors´ compilation from STATA17

Heteroskedasticity Test
The results of White's test for heteroskedasticity reported in Table 6 show p-values above the 5% significance level. Consequently, we fail to reject the null hypothesis thus concluding that the data are free from the heteroskedasticity problem.

Table 6: Heteroskedasticity test (White's test)

Sources	***chi2***	***Df***	***p***
Heteroskedasticity.	14.89	14	0.3854
Skewness.	8.20	4	0.0844
Kurtosis.	1.61	1	0.2050
Total.	24.70	19	0.1706
chi2(14) = 14.89			
Prob > chi2 = 0.3854			

White's test for H_o: homoskedasticity against H_1: unrestricted heteroskedasticity

Source: Authors´ compilation, from STATA17

Multicollinearity test
The observed VIF test results in Table 7 indicate a "no-multicollinearity" issue among explanatory variables. Both the mean VIF and each variable's VIF are below 10, with a lower VIF mean of 2.18 (less than 3), highlighting that a model is multicollinearity problem-free and the predictors' standard errors are not inflated. This is supported by the values of 1/VIF, which are all less than one.

Table 7: Test for Multicollinearity

Variable	VIF	1/VIF
INT	3.16	0.316650
INF	2.51	0.398766
PD	1.76	0.569688
GE	1.31	0.764419
Mean VIF	**2.18**	

Source: Author´s compilation, from STATA17

Stationarity Test

The trend must undergo integration of order *d*, denoted as *I(d)*, through successive differencing *d* times until stationarity is achieved. In cases where the data at the initial level are stationary (integrated of order zero), no further differencing is necessary. The ADF results presented in Table 8 reveal that, at the initial level, all the study data were non-stationary (presence of a unit root), as evidenced by ADF calculations greater than the critical values. Consequently, the first differencing was applied, as illustrated in Table 9. Following this procedure, all variables in the study were found to be stationary after the first difference, denoted as I(1).

Table 8: **Unit root Test at Initial Level**

Variables	Augmented Dickey-Fuller Test			
	ADF Calculated	**ADF Critical at 5%**	**MacKinnon approximate p-value**	**Conclusion**
GDP	-1.861	-2.980	0.3507	Non-stationary
PD	-0.479	-2.980	0.8961	Non-stationary
GE	-2.123	-2.980	0.2353	Non-stationary
ITR	-1.128	-2.980	0.7039	Non-stationary
INF	-1.672	-2.980	0.4454	Non-stationary

Source: Authors´ compilation, 2022

Table 9: Stationarity test at the first difference

Variables	Augmented Dickey-Fuller Test			
	ADF Calculated	**ADF Critical at 5%**	**MacKinnon's approximate p-value**	**Conclusion**
GDP	-7.294	-2.983	0.0000	Stationary
PD	-7.154	-2.983	0.0000	Stationary
GE	-5.864	-2.983	0.0000	Stationary
ITR	-5.028	-2.983	0.0000	Stationary
INF	-5.395	-2.983	0.0000	Stationary

Source: Author´s compilation, 2022

Co-integration Test

Before conducting the co-integration test, the study applied the lag order selection criteria to determine the maximum lag length for the model. For the purpose of the current study, three (3) lags were deemed superior based on the Akaike Information Criterion (AIC), which, as suggested by Luetkepohl and Bårdsen (2014), holds theoretical advantages over other selection criteria.

The results of Johansen's co-integration test in Table 10 indicate that the trace statistics are greater than 5%. Consequently, the null hypothesis of no co-integration was rejected, signifying a long-term relationship between the dependent variable and the independent variables. The results for Max statistics and Trace statistics also aligned accordingly, in which the null hypothesis of no co-integration was also rejected at 5% level of significance. These findings are consistent with

prior research by Yusuph (2018), Marobhe (2019), and Chindengwike and Kira (2021), which also established co-integration between public debt, government expenditure, and economic growth in Tanzania.

Table 10: Co-integration Test (Trace and Max Value Statistic) Results

Trend: constant	**Sample: 1990 - 2021**		
Number of obs = 32	**Lags = 3**		
No. of CE(s)	**Eigen value**	**Trace statistic**	**0.05% Critical**
None		118.5633	68.52
At most one	0.83105	65.2184	47.21
At most two	0.69954	29.1456*	29.68
At most three	0.44214	11.6360	15.41
At most four	0.30306	0.8042	3.76
At most five	0.02645		
(Maximum Eigen value)			
No. of CE(s)	**Eigenvalue**	**Max statistic**	**5% critical**
None	-	53.3449	33.46
At most one	0.83105	36.0728	27.07
At most two	0.69954	17.5096	20.97
At most three	0.44214	10.8318	14.07
At most four	0.30306	0.8042	3.76
At most five	0.02645		

Source: Authors´ compilation from STATA17

4.3 Vector Error Correction Model (VECM) Estimation Results

The findings presented in Table 11 indicate that the F-statistic is very significant (at 1%), leading to the rejection of the null hypothesis of this paper that "all the explanatory variables have coefficients not different from zero". Specifically, the F-statistic of 0.67% suggests that the explanatory variables, including public debt, government expenditure, interest rate, and inflation rate, jointly affected the GDP during the study period. Furthermore, the goodness of fit of the model (the R-squared), which reports the goodness of fit of the variables, is 0.801 (larger than 50%). This suggests that, under the study period, approximately 81% of the variations in economic growth in Tanzania were jointly defined or explained by the model predictors (public debt, government expenditure, interest rate, and inflation rate). The remaining 20% was attributed to other factors not considered in the study's model.

Table 11 presents the results of the econometric analyses. The VECM estimation results revealed significant effects for the error correction term d-ECT ($p = 0.004$), ITR-1 ($p = 0.000$), and INF-1 ($p = 0.004$), while the remaining variables did not exhibit any significant impact. In particular, the focus on economic growth was centered on the regression of the error correction mechanism, describing how quickly the equilibrium can be restored once disturbances occur among the variables. The coefficient of the Error-Correction Term (d-ECT) for the estimated GDP equation is both statistically significant and negative. This implies that it will effectively act to correct past deviations from the long-run equilibrium. The coefficient of -75% indicates that whenever a disequilibrium shock occurs, a 75% estimated correction can be made to adjust the independent variables' circumstances. The adjustment will occur in the system by 75% in response to any long-run disturbance occurrence. In essence, 75% of any past variations (deviations) will be corrected in the present (current) period. These findings deepen our understanding of how the system dynamically responds to shocks and corrects deviations over time.

The results presented in Table 11 indicate that public debt was statistically insignificant in the short run, suggesting that an increase in public debt by one billion Tanzanian Shillings (TZS) would result in a decrease in economic growth in Tanzania by an average of 4.39 billion TZS, all else being equal. However, in the long run, public debt had a positive coefficient of 2.4207 with a

10% significance level. This implies that, in the long run, when other factors remain constant, an increase in public debt by one billion TZS results in an increase in economic growth by 2.4207 billion TZS. This finding rejects the null hypothesis one, and it establishes that public debt has a significant impact on economic growth, particularly in the long run. The results are in line with the Keynesian Theory, which suggests that financing expenditure and promoting economic growth should involve not only taxation but also borrowing from domestic and external sources. The findings contradict the argument by Modigliani, who posits that public debts impose a burden on future generations. Moreover, these results align with previous studies (for example, Shangai and Ochieng, 2019; Abedin, 2020; Lelya and Ngaruko, 2021) and differ from those of other studies (for example, Yusuph, 2018; Ogu and Agu, 2019; Ajayi, 2020; Sansa, 2020; Anachedo et al., 2022; Siong et al., 2021; Siriwardhane and Sandamali, 2021; Cynthia, 2023).

The results in Table 11 revealed that the government expenditure is statistically insignificant in both the short run and long run. In fact, keeping other factors constant, an increase in public expenditure by one TZS results in an average decrease in the economic growth in TZS-*6.2708 billion* in the long run. These results led us to accept the null hypothesis of no significant impact of government expenditure on economic growth. These findings support the prior research studies undertaken in different developing countries, which claimed that government expenditure had no significant impact on economic growth (see, for instance, Kimea and Kiangi, 2018; Akinbobola, Oderinu, and Olayiwola, 2022; Ekpo, Daniel, and Okon, 2022; Zeynalli and Hasanoğlu, 2022; Bardakas, Doulos, and Zombanakis, 2023). The findings also do not comply with Adolph Wagner's hypothesis. These results might be the outcome of what Awwad (2021) claimed, that the largest proportion of public debt is spent on the non-productive consumer aspects, which are not directly concerned with real economic growth and production, hence imposing an insignificant impact of public expenditure on economic growth. The current study reveals that the coefficient estimates of lending interest rate are positive and statistically insignificant in the short run. However, in the long run, the interest rate is negative and attains statistical significance at the 1% level. Specifically, the analysis indicates that, when other factors are held constant, a 1% increase in lending interest rate results in a 24.1% decrease in economic growth in the long run. This suggests that the payment of lending interest rates has an adverse impact on growth, leading to a decrease in economic growth. These findings are in line with previous studies by Isibor et al. (2018), Mhlaba and Phiri (2019), Jacobsa et al. (2020), Mwakalila (2020), Manamba and William (2021), Mitrašević, Lukovic, and Pjanić (2022), and Pratibha and Krishna (2022b). Additionally, Mhlaba and Phiri (2019) argue that since interests must typically be paid in the currency in which the loan is borrowed, external debts can significantly impact the economies of borrowing countries negatively.

The coefficient estimates of the inflation rate, as presented in Table 11, are found to be statistically insignificant in the short run. However, in the long run, the inflation rate exhibits a negative and statistically significant impact at the 1% significance level. This suggests that, with other factors held constant, a one percent increase in inflation is associated with a 4.2 percent decrease in economic growth (GDP). This result aligns with the correlation results in Table 3, which highlighted an inverse relationship between inflation and economic growth. These findings are consistent with the results of Matandare and Tito (2018), Ajayi and Edewusi (2020), and Ehikioya et al. (2020). It is worth noting that these results differ from the findings of Ouyang and Cai (2018).

Table 11: VECM Estimation Results

Variable	Coefficient	Std. Error	T-Statistic	Probability
PD-1	2.4207	1.3507	1.79	0.073*
GE-1	-6.2708	4.6308	1.36	0.175
ITR-1	-0.2408521	.0248534	9.69	0.000***
INF-1	-0.0424529	.0147688	2.87	0.004***
DPD	- 4.3907	6.4007	-0.69	0.499

Variable	Coefficient	Std. Error	T-Statistic	Probability
DGE	1.0107	1.4607	0.69	0.496
DITR	0.1218221	.0829249	-1.47	0.154
DINF	0.0112307	.0560088	-0.20	0.843
d- ECT	-0.7500787	.2357099	-3.18	0.004***
Dependent Variable: GDP		Observations 1990-2021		
F (5, 26) = 2.44		Prob > F = 0.0067		
R-squared = 0.8198		Adj R-squared = 0.6890		
Root MSE = 1.1879				
*** = Significant at 1%		** = Significant at 5%	* = Significant at 10%	

Source: Researchers' computations, 2022 (from STATA17)

Granger Causality Test

The presence of co-integration implies the existence of Granger causality. Understanding the direction of causality among the studied variables is crucial for policy-making. In this study, the null hypotheses are as follows: (i) the lagged values of economic growth do not cause public debt and government expenditure; (ii) the lagged values of public debt do not cause economic growth; and (iii) the lagged values of government expenditure do not cause economic growth. The reported results in Table 11 indicate that the null hypothesis stating that the lagged value of economic growth does not cause public debt and government expenditure failed to be rejected at (P= 0.103 > 0.05) and (P= 0.652 > 0.05), meaning that economic growth does not cause either public debt or government expenditure in Tanzania. Additionally, the Granger-Wald causality test results show that the hypothesis that public debt does not cause economic growth failed to be rejected (P=0.977 > 0.05), meaning that public debt does not Granger-cause economic growth in Tanzania. However, the results revealed the rejection of the null hypothesis of no Granger causality between government expenditure and economic growth (P=0.024 < 0.05), supporting that public expenditure influences economic growth in Tanzania. This indicates a unidirectional causality between government expenditure and economic growth, running from government expenditure to economic growth. These findings align with the findings by Marobhe (2019).

Table 12: Granger Causality Wald Tests

Dependent variable*: Economic growth*			
Excluded	**Chi-sq**	**Prob Value**	**Decision:**
PD	6.1864	0.103	**Do not reject H_0**
GE	1.6335	0.652	
ITR	1.45	0.694	
INF	34.58	0.000	
ALL	61.282	0.000	
Dependent variable*: Public debt*			
GDP	.20297	0.977	**Do not reject H_0**
GE	3.5683	0.312	
ITR	.27187	0.965	
INF	1.0128	0.798	
ALL	10.12	0.605	
Dependent variable*: Public expenditure*			
GDP	9.4244	0.024	**Reject H_0**
PD	7.9245	0.048	
ITR	1.0115	0.798	
INF	7.5356	0.057	
ALL	22.297	0.034	

Source: Researchers' computations, 2022 (from STATA17)

5.0 Conclusion and Policy Implications

The main objective of this paper was to examine the impact of government expenditure and public debt on economic growth in Tanzania from 1990 to 2021, using the Vector Error Correction Model (VECM) and Granger causality techniques. The results indicate a unidirectional causality from public expenditure to economic growth; however, this association is statistically insignificant. The negative coefficient of government expenditure in the long run could be attributed to the dominance of recurrent government expenditure compared to developmental expenditures, potentially acting as a hindrance to economic growth. This insight provides us with a deeper understanding of the important dynamics between government spending components and their overall impact on the economic growth pattern in Tanzania during the specified period.

In contrast, the results indicate that public debt has a statistically significant and positive impact on the economic growth of Tanzania in the long run. Specifically, a one percent increase in public debt is associated with a 2.4 percentage point increase in economic growth. The presence of a statistically significant Error-Correction Term implies that past deviations from the long-run equilibrium will be corrected, with 75% of any past deviations being rectified in the current period. These findings highlight the active role of public debt in contributing positively to Tanzania's economic growth over time, emphasizing the continuous adjustments required to maintain equilibrium despite past deviations. These findings align with the Keynesian Theory, but they are in contrast with Adolph Wagner's hypothesis. The Johansen's co-integration test results support the presence of a long-run relationship between the dependent variable (GDP) and independent variables (public debt and government expenditure). The paper has underscored that the results are in line with the observations of previous studies, such as those by Were and Mollel (2020) and Chindengwike and Kira (2021). Tanzania's public debt is traditionally linked to multilateral and bilateral creditors. The authors acknowledge the inevitability of public debts for developing countries like Tanzania, emphasizing that relying solely on domestic resources may not be sufficient for economic growth and for the provision of quality services and infrastructure. Importantly, the paper does not advocate for refraining from borrowing or reducing expenditure, but it emphasizes the need for effective debt management and directing borrowed funds toward productive sectors and projects that contribute to real economic growth and create opportunities, such as employment. To achieve this, the authors recommend a focus on sectors like education, investment, healthcare, agriculture, physical infrastructure, energy, economic affairs, services, human resources, research and development, communication, and general administration. The researchers stress the importance of conducting thorough analysis and feasibility studies before allocating public debts to specific projects. The results, indicating the significance and positive impact of public debt in the long run, suggest that allocating public debt to long-term projects and development expenditures could be beneficial.

The paper also emphasizes the correlation between government expenditure and public debt, suggesting that an increase in borrowing should be accompanied by a rise in productive expenditures. In managing control variables, particularly inflation and interest rates, the authors recommend measures to control and maintain inflation levels to boost economic growth. Additionally, given that interest rates are paid in the currency of the borrowed loan, the paper suggests strengthening the local currency through measures such as increasing exports and domestic production with subsidies. These recommendations are aligned with the findings from the correlation matrix and the econometric analysis presented in Table 11. The paper has highlighted the control variables, inflation, and interest rates, pointing out that the correlation matrix indicates an inverse relationship between these variables and economic growth. In other words, when inflation and interest rates increase, the GDP growth tends to decrease. Table 11 further supports this observation by showing a highly negative significant impact (at the 1% significance level) of both inflation and interest rates on economic growth in the long run.

The policymakers are urged to align economic policies with the main macroeconomic goals of promoting productive investments, employment opportunities, price stability, sustainable equilibrium in the balance of payments, and sustainable economic growth. By adhering to these guidelines, Tanzanian policymakers can harness the potential benefits of public debts and government expenditures, thus steering the nation towards a path of sustained economic growth while mitigating risks associated with inflation and interest rates.

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