THE EFFECT PUBLIC DEBTS ON ECONOMIC GROWTH IN TANZANIA: AN EMPIRICAL ANALYSIS 1993-2023

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ECONOMICS (MSc.-Econ.)

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2025

CERTIFICATION

The undersigned certifies that he has read and here by recommends for acceptance by The Open University of Tanzania a dissertation entitled**; "The Effect of Public Debts on Economic Growth in Tanzania: An Empirical Analysis 1993 – 2023**" in partial fulfilment of the requirements for the award of the Degree of Master of Science in Economics (MSc.-Econ.).

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Date

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DECLARATION

I, **Thabit Mussa Bombwe,** declared that the work presented in this dissertation is original. It has never been presented to any other University or Institution. Where other people's works have been used, references have been provided. It is in this regard that I declare this work as originally mine. It is hereby presented in partial fulfillment of the requirement for the Degree of Master of Science in Economics (MSc.-Econ).

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Signature

28/05/2025

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Date

DEDICATION

This dissertation is dedicated to my beloved family. To my dear wife Isabellah S. Luhanga, whose unwavering support and love have been my constant source of strength throughout this journey. Your encouragement has made all the difference. To my son Tyser I. Bombwe and my daughter Thelna I. Bombwe, whose smiles and laughter have provided me with joy and motivation. May this work inspire you to pursue your dreams with passion and determination.

Thank you all for being my rock and my inspiration.

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ABSTRACT

This study examines the impact of public debt on economic growth in Tanzania between 1993 and 2023. Using descriptive, causal-comparative, and econometric approaches notably the Vector Autoregression (VAR) and Vector Error Correction Model (VECM) the research explores both short-run and long-run relationships between Gross Domestic Product (GDP), domestic debt, and external debt. The findings reveal a statistically significant and positive effect of domestic debt on economic growth, implying that moderate internal borrowing can stimulate economic activity when effectively managed. Conversely, external debt exerts no significant influence on GDP in the short run and a negative effect in the long run, indicating that excessive external borrowing may undermine growth through increased debt servicing burdens. The Johansen cointegration and causality tests confirm a stable long-run equilibrium among the variables, suggesting that prudent debt management is essential for sustainable growth. The results emphasize the importance of balancing domestic and external borrowing, prioritizing productive investments, and strengthening institutional debt management frameworks to sustain fiscal stability and economic progress.

Keywords: *Public Debt, Domestic Debt, External Debt, Economic Growth, Tanzania, VAR Model, VECM, Cointegration.*

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
BOT	Bank of Tanzania
DSA	Debt Sustainability Analysis
EAC	East African Community
ETC	Error Correction Term
EU	European Union
FYDP	Five Year Development Plan
GDP	Gross Domestic Product
HIPC	Heavily Indebted Poor Countries
IMF	International Monetary Fund
IRF	Impulse Response Function
LDC's	Less Developed Countries
TEF	Medium-Term Expenditure Framework
NBS	National Bureau of Statistics
PD	Public Debt
SSA	Sub-Saharan Africa
URT	United Republic of Tanzania
VAR	Vector Autoregression
VECM	Vector Error Correction Model
WB	World Bank.

CHAPTER ONE

INTRODUCTION

1.1 Chapter Introduction

This chapter introduces the study by presenting the background of the research, the statement of the problem, objectives, hypotheses, scope, significance, and limitations of the study. It also outlines the organization of the dissertation to provide an overview of the research structure and flow.

1.2 Background of the Study

Public debt, which represents the total amount owed by a government to both domestic and foreign creditors, has long played a central role in shaping national and global economic trajectories. Historically, governments have relied on borrowing to finance major economic transformations. For instance, in 18th-century Britain, public debt significantly contributed to financing the First Industrial Revolution, indicating that, under favorable conditions, debt can facilitate long-term economic growth by enabling investments in infrastructure, innovation, and trade expansion (Ventura & Voth, 2015).

Globally, the relationship between public debt and economic growth has been widely debated. Empirical evidence uncovers mixed outcomes across different economies. Studies in the European Union (Mencinger, 2022) show that while moderate levels of debt can stimulate economic expansion, excessive debt beyond critical thresholds, typically around 80 to 90% of GDP tends to slow growth by crowding out private investment and increasing fiscal vulnerability. In developing nations such as Nepal and Nigeria, findings by (Upadhyaya & Pun, 2022) (Kalu & Boniface, 2023)

respectively indicate that public debt can support growth when invested productively but can equally hinder progress if mismanaged or used for recurrent expenditures.

At the global level, total public debt surpassed USD 92 trillion in 2022 (IMF, 2022) reflecting a rising dependency on borrowing to stimulate post-pandemic recovery and infrastructure development. However, in Sub-Saharan Africa (SSA), debt dynamics have been particularly concerning. Following major debt relief initiatives such as the Heavily Indebted Poor Countries (HIPC) program in the early 2000s, debt levels initially declined, but they have since rebounded sharply due to fiscal deficits, exchange rate variations, and external shocks (Atta-Mensah & Ibrahim, 2020; Lemaire et al., 2023) . By 2019, the median public debt to GDP ratio in SSA had risen to about 50%, raising sustainability concerns amid slow revenue growth and increased debt servicing costs.

Within this global and regional context, Tanzania provides a critical case study. The country has experienced significant economic expansion, with GDP growth averaging between 6% and 7% annually from the early 2000s to 2015 (NBS, 2017). This growth has been supported by substantial public investments in infrastructure under successive Five-Year Development Plans (FYDPs). However, it has also been accompanied by rising public debt levels. Between 2013 and 2021, Tanzania's total public debt increased from 36.8% to 52.4% of GDP (BoT, 2023), driven largely by large scale infrastructure projects financed through both domestic and external borrowing. As of June 2023, Tanzania's total public debt stood at TZS 82.14 trillion comprising 70.54% external and 29.46% domestic debt equivalent to 41.7% of GDP (MoF, 2023).

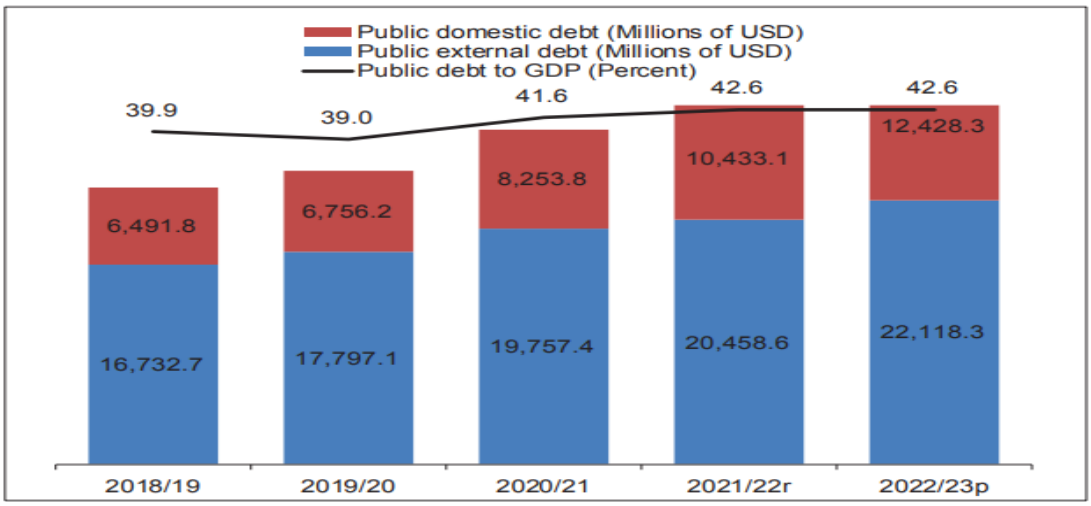

Figure 1.1: Developments in Public Debt
Source: Ministry of Finance and Bank of Tanzania.
Note: r denotes revised data; and p, provisional data.

Although the Debt Sustainability Analysis (DSA) indicates that the country's debt remains within safe thresholds, the upward trend poses risks to fiscal stability if not carefully managed. The government has financed major deficits approximately 4.2% of GDP in 2022/2023 through both domestic (TZS 4.6 trillion) and external borrowing (TZS 3.1 trillion), reflecting a growing dependence on debt as a development financing tool.

The link between public debt and economic growth is crucial for understanding Tanzania's economic trajectory. According to Keynesian theory, public debt can stimulate growth by financing productive investments such as infrastructure, health, and education that enhances aggregate demand and productivity (Otaki, 2015; Phelps, 2022). Conversely, the Classical and Ricardian perspectives (Barro, 1996; Bernheim, 1989) warn that high public borrowing can crowd out private investment, elevate interest rates, and slow long-term growth through increased future taxation burdens.

Empirical evidence in Tanzania supports both perspectives. (S. Yusuf & Said, 2018) found a negative relationship between total public debt and economic growth, while (Lotto & Mmari, 2018) showed that the impact varies depending on the composition and use of debt. Recent increases in both external and domestic borrowing for infrastructure and energy projects highlight the need to evaluate whether debt has been effectively utilized to stimulate sustainable economic growth.

This study therefore examines the impact of public debt on economic growth in Tanzania from 1993 to 2023, situating the country's experience within the broader global and regional debt growth debate. It aims to clarify the extent to which domestic and external debts contribute to or constrain Tanzania's economic performance and to provide empirical evidence to inform prudent fiscal and debt management policies.

1.3 Statement of Problem

Public debt has become an vital component of Tanzania's fiscal and development framework, serving as a key instrument for financing budget deficits and large-scale infrastructure investments. Over the past three decades, the government has increasingly relied on both domestic and external borrowing to bridge revenue gaps and support economic development. By June 2023, Tanzania's total public debt had reached USD 42.44 billion, up from USD 28.01 billion in 2021 equivalent to over 52% of the country's GDP (AfDB, 2023; BoT, 2023). This steady accumulation underscores the government's growing dependence on debt to fund essential projects under the national Five-Year Development Plans (FYDPs).

While borrowing has facilitated infrastructure development, job creation, and improved access to social services, it also poses macroeconomic challenges that threaten long term growth sustainability. On the positive side, public debt when directed toward productive sectors such as transport, energy, and education can stimulate aggregate demand, enhance productivity, and accelerate economic growth. External loans have supported key development initiatives, while domestic borrowing has strengthened financial markets and expanded government spending capacity.

However, excessive debt accumulation can have adverse consequences. Rising debt service obligations divert fiscal resources from priority sectors such as health, education, and agriculture, thereby constraining productive investment. Moreover, high levels of domestic borrowing may crowd out private sector investment by raising interest rates and reducing credit availability. Persistent reliance on external debt exposes the economy to exchange rate fluctuations and global financial shocks, which may undermine economic stability. Consequently, the rapid growth of Tanzania's public debt relative to its GDP raises concerns about debt sustainability and its real contribution to economic growth.

Despite numerous studies exploring the debt growth relationship in developing economies, empirical findings remain inconsistent. Some studies (Christabell Matiti Master, 2013; Lotto & Mmari, 2018) report that moderate debt supports growth through public investment, while others (Nyabakora, 2022; S. Yusuf & Said, 2018) find that excessive borrowing slows down economic performance. Given Tanzania's evolving fiscal landscape, growing debt burden, and continued reliance on both

domestic and external financing, there is a critical need to reassess the actual effect of public debt on the country's economic growth.

Therefore, this study seeks to empirically determine whether public debt—comprising domestic and external components has contributed positively or negatively to Tanzania's economic growth from 1993 to 2023. The findings will provide evidence-based insights to guide policymakers in formulating sustainable debt management strategies that balance fiscal expansion with long-term economic stability.

1.4 Research Objectives

1.4.1 General Objectives

To examine the effect of public debt on economic growth in Tanzania from 1993 to 2023.

1.4.2 Specific Objectives

i. To analyze the trend and growth pattern of Tanzania's public debt statistics covering both domestic and external debt from 1993 to 2023.
ii. To analyze the long-run equilibrium relationship between, Domestic Debt, External debt, and GDP in Tanzania from 1993 -2023.
iii. To access the short run dynamics relationship between, Domestic Debt, External debt, and GDP in Tanzania from 1993 -2023.
iv. To identify causal relationships between, Domestic Debt, External debt, and GDP in Tanzania from 1993 -2023.

1.5 Research Hypothesis

These hypotheses were tested.

a) There is no significant long-run equilibrium relationship between Domestic Debt, External debt, and GDP.
    i. H_0: There is no significant long – run equilibrium between Domestic Debt, External Debt, and GDP
    ii. H_1: There is a significant long – run equilibrium between Domestic Debt, External Debt, and GDP
b) There is no significant short-run relationship between Domestic Debt, External debt, and GDP.
    i. H_0: There is no significant short – run relationship between Domestic Debt, External Debt, and GDP
    ii. H_1: There is a significant short – run relationship between Domestic Debt, External Debt, and GDP
c) There is no significant causal relationship between Domestic Debt, External debt, and GDP.
    i. H_0: There is no significant causal relationship between Domestic Debt, External debt, and GDP
    ii. H_1: There is a significant causal relationship between Domestic Debt, External debt, and GDP

1.6 Scope of the Study

The scope of this study covered a comprehensive investigation into the effect of public debt both domestic and external on the economic growth of Tanzania,

utilizing annual time-series data from 1993 to 2023. The analysis was based on empirical evidence derived from this dataset to assess the distinct impacts of each debt category on the country's economic performance.

1.7 Significance of the Study

This study provides critical insights into the relationship between public debt—both domestic and external and economic growth in Tanzania from 1993 to 2023. Using annual time-series data sourced from the World Bank, IMF, Tanzania Bureau of Statistics, and the Bank of Tanzania, the study applied rigorous econometric techniques, including an unrestricted Vector Auto Regression (VAR) model, to capture the dynamic interactions among GDP, domestic debt, and external debt. The empirical analysis, supported by various diagnostic tests such as stationarity, stability, multicollinearity, autocorrelation, and cointegration tests, ensured the robustness and validity of the findings.

The significance of this study lies in its empirical evidence that domestic debt has a statistically significant and positive impact on economic growth, whereas external debt does not show a statistically significant effect within the model. These results have important implications for fiscal and macroeconomic policy, emphasizing the need for prudent domestic and external debt management strategies to promote sustainable growth. By revealing the complex interdependencies between borrowing and growth, the study provides valuable guidance for policymakers, development planners, and economic stakeholders in designing debt strategies that enhance economic resilience while minimizing the risks associated with excessive borrowing. Furthermore, it contributes to the academic discourse on public debt and growth

dynamics in developing economies, offering a model that future research can build upon.

1.8 Limitations of the Study

Although this study provides valuable insights into the relationship between public debt and economic growth in Tanzania, several limitations were encountered during the research process. First, the collection of domestic and external debt data was constrained by delays and limited accessibility from the Ministry of Finance, particularly for the period between 1993 and 1997. As a result, the study heavily relied on secondary data from the World Bank, IMF, Tanzania Bureau of Statistics, and the Bank of Tanzania, which may have introduced variations in data consistency and reporting standards.

Secondly, the study depended exclusively on the annual time series data, which, while suitable for long-run analysis, may mask short-term economic fluctuations and shocks that could have influenced debt and growth dynamics differently. Furthermore, the time series nature of the data posed inherent challenges, such as non-stationarity, multicollinearity, and the need for multiple differencing to achieve stationarity, which could potentially affect the precision of the estimated relationships. Lastly, while the Vector Auto Regression (VAR) model effectively captured the dynamic interactions among variables, the absence of more granular annually data and the unavailability of comprehensive Ministry of Finance records for certain early years limited the scope for deeper sectoral or policy-specific analysis. These limitations suggest caution in generalizing the findings and highlight the need for future research incorporating more frequent data updates and broader

institutional data coverage.

1.9 Organization of the Study

This study is organized into five main chapters. Chapter one introduces the study, including the background, statement of the problem, research objectives, research questions, significance of the study, scope of the study, and the limitations encountered during the research process. Chapter Two presents a review of relevant literature, covering theoretical, empirical, and conceptual frameworks related to public debt and economic growth. It identifies key knowledge gaps and establishes the foundation for the study's analytical approach.

Chapter Three details the research methodology adopted in the study. It discusses research design, philosophy, strategies, methods of data collection, data sources, sample size, data analysis techniques, model specification, and diagnostic tests to ensure the robustness and reliability of results. Chapter Four presents the research findings and discussion. It includes descriptive statistics, diagnostic test results, estimation outcomes, and an interpretation of the relationships between domestic debt, external debt, and economic growth based on empirical analysis. Chapter Five provides a summary of the major findings, draws conclusions, and offers policy recommendations based on the study’s results. It also suggests areas for further research to address limitations encountered and expand upon the study’s findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Chapter Introduction

This chapter reviews theoretical and empirical literature related to public debt and economic growth. It defines key concepts, discusses relevant theories, and presents past empirical findings. The chapter also identifies research gaps and presents the conceptual framework that guides the study.

2.2 Conceptual Definitions

2.2.1 Economic Growth (EG):denotes the rise in the production of goods and services over time within an economy, measurable in nominal terms without inflation adjustment, or in real terms with inflation adjustment.. (Barro, 1991; Solow, 1956).Gross Domestic Product (GDP): total value of all goods and services produced within a country's borders over a specified period. (Dickey & Fuller, 1979)

2.2.2 Public Debt (PD)

The total sum a government owes to domestic and foreign creditors, usually via securities Such as bonds, to cover budget deficits(Shafia & Abdollahzadeh, 2010).It arises from borrowing to finance budget deficits, infrastructure projects, or other fiscal expenditures when revenues collected are insufficient.

2.2.3 Domestic Debt (DOD)

The component of the total public debt in a country that is owed to lenders within the country(Panizza, 2008).It includes funds raised through government securities (such as treasury bills, bonds, and notes) sold to domestic banks, financial institutions,

businesses, and individual citizens. Unlike external debt, domestic debt is denominated in the local currency and is subject to national regulations and monetary policies.

2.2.4 External Debt (EXD)

It denotes the total debt a country owes to foreign creditors, including loans, bonds, or other credit forms from foreign governments, international financial institutions and foreign private banks .(Trebesch et al., 2019).

2.3 Theoretical Literature Review

Numerous theoretical ideas have been discussed regarding the issue of domestic debt, external debt, and economic growth in Tanzania. These theories are key to this study as they serve as the foundational framework for recognizing linked relationship between debt accumulation and economic performance. Thus, the following theories were discussed.

2.3.1 Keynesian Theory of Public Debt

The Keynesian theory of public debt, developed by John Maynard Keynes during the Great Depression, provides the foundational framework for understanding how government borrowing can influence economic growth. Keynes argued that during periods of economic slowdown or insufficient private investment, government intervention through deficit financing can stimulate aggregate demand, increase output, and promote employment. In this view, public debt is not inherently harmful; rather, it is a strategic tool for achieving macroeconomic stability and growth when used to finance productive expenditure.

Keynesian economics posits that government borrowing whether domestic or external can inject additional spending into the economy, generating a multiplier effect that raises income levels and national output. This process occurs when borrowed funds are invested in sectors such as infrastructure, education, agriculture, and health, which in turn increase productivity, create jobs, and enhance private sector confidence. The resulting growth in income and production expands the government's tax base, enabling it to service the debt and sustain fiscal stability over time.

However, Keynes also acknowledged that debt-financed spending must be used prudently. When public debt is directed toward nonproductive or recurrent expenditures, its benefits diminish, and it can lead to inflationary pressures, crowding out of private investment, and reduced long term growth potential. Thus, the effectiveness of public debt in promoting economic growth depends largely on the efficiency of debt utilization and the structure of fiscal policies supporting it.

In the context of this study, the Keynesian framework provides a logical foundation for examining how Tanzania's public debt influences economic growth. Since 1993, Tanzania has implemented multiple fiscal expansion policies under its Five-Year Development Plans (FYDPs), which have relied heavily on borrowing to finance strategic infrastructure, energy, and industrial development projects. According to Keynesian principles, these government led investments are expected to enhance aggregate demand and foster economic growth through multiplier effects, especially in an economy with underutilized resources.

The Vector Autoregression (VAR) model adopted in this study is consistent with the Keynesian view because it allows for the analysis of dynamic interactions between public debt (domestic and external) and GDP over time. This model treats all variables as endogenous reflecting Keynes's assertion that changes in public spending, debt, and output influence one another simultaneously. If the results reveal a positive and significant impact of public debt on GDP, it will support the Keynesian argument that well managed borrowing contributes to economic expansion. Conversely, if debt negatively affects GDP, it may indicate inefficiencies or misallocation of borrowed resources, aligning more closely with Classical or Ricardian perspectives.

Keynesian theory links directly to this study by providing the theoretical justification for viewing public debt as a potential driver of growth in developing economies like Tanzania. It explains why and how debt financed government spending particularly on productive investments can enhance GDP, while also highlighting the risks of unsustainable or poorly utilized borrowing. This theoretical connection guides the formulation of hypotheses, model specification, and interpretation of empirical results within Tanzania's fiscal and macroeconomic context.

2.3.2 Classical Economic Theory

Classical economists such as Adam Smith and David Ricardo considered public debt harmful to economic growth, arguing it could crowd out private investment by raising interest rates and diverting resources from productive uses to debt servicing(Lowe, 1999). British economists typically viewed public debt as harmful to economic advancement, whereas German economists perceived it as an

instrument for fostering economic growth and development. This theory offers a structure to evaluate public debt's impact on capital accumulation, productivity, and consequently, economic growth (Holtfrerich, 2013).

The theory underscores market efficiency and fiscal discipline to prevent excessive debt. However, it may undervalue the advantages of government spending during recessions, assume perfect information, and might neglect short-term economic issues by prioritizing long-term equilibrium. Applying this theory to the study will highlight the potential adverse effects of high public debt on market efficiency and long-term stability. It posits that public debt minimally affects GDP due to market corrections and fiscal discipline, stressing the need to maintain low domestic and external debt levels for sustainable economic growth.

2.4 Empirical review

2.4.1 Public Debt (PD) and Economic Growth (EG)

Public debt is often analyzed for its potential to either stimulate or hinder economic growth. (S. Yusuf & Said, 2018) investigate the effect of public debt on economic growth from 1970 to 2015 using VECM and Granger causality tests, revealing a negative correlation between the two variables. A related study on Nigeria (Kalu & Boniface, 2023) explores the effects of public debt on economic growth using similar econometric techniques. Their findings showed that, although public debt can initially promote economic growth by financing development projects, excessive levels of debt eventually hinder growth due to high servicing costs and resource misallocation.

Studies by (Al-Zeaud, 2014; Hilton, 2021) suggest that public debt can positively impact economic growth when managed well and invested in productive areas.(Lelya & Ngaruko, 2021) examine the effects of external and domestic debt on Tanzania's economic growth using time-series data from 1980 to 2019. Utilizing a VECM, the study evaluates long-run and short-run relationships between debt and growth, revealing that both types of debt significantly influence economic growth.

2.4.2 Gross Domestic Product (GDP) and Public Debt

On (Caner et al., 2010)analysis reveals a 77% public debt-to-GDP ratio threshold, beyond which each additional percentage point of debt reduces annual real growth by 0.017%. This threshold is lower for developing countries at 64%. According to (Reinhart & Rogoff, 2010), the relationship between public debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90% of GDP. Above 90%, median growth rates fall by 1%, and average growth falls considerably more. The study by (Bhatta & Mishra, 2020)determined that the optimal public debt threshold for maximizing growth in Nepal is 33% of GDP. Surpassing this threshold may hinder economic growth. (Kitutila, 2024) explores how public debt thresholds impact Tanzania's economic growth, finding that moderate debt levels can foster growth. Surpassing roughly 40% of GDP can lead to diminishing returns from higher debt servicing costs and potential crowding out of private investment.

2.4.3 Domestic Debt and Economic Growth

A quantitative research design by (Lotto & Mmari, 2018) examines the correlation between domestic debt and economic growth in Tanzania from 1990 to 2015. It addresses conflicting findings on debt's impact on growth, with some studies

suggesting a long-term positive relationship and others a negative one. The analysis reveals a negative, albeit statistically insignificant, correlation between domestic debt and GDP growth, suggesting that domestic debt does not substantially impact economic growth, as borrowed funds frequently cover deficits or government expenses without directly stimulating growth.

2.4.4 External Debt and Economic Growth

(Marobhe, 2019) examines the effect of external debt on economic growth in highly indebted poor countries, revealing a positive correlation. The study underscores the necessity of allocating external debt to productive ventures and avoiding debt overhang. A study by (Kasidi & Said, 2013) external debt and debt service were found to have negative and positive effects on GDP growth, respectively.

2.4.5 Research Gap

Although several studies use VECM to examine the link between public debt and economic growth, further exploration of additional econometric methods is necessary to gain a more nuanced understanding of the causal effects. Incorporating approaches like Time-Series Analysis with structural breaks could provide deeper insights into the dynamics between public debt and economic growth in Tanzania. Moreover, literature review primarily focuses on the relationship between public debt and economic growth in various countries, including Tanzania, Nigeria, Jordan, and Ghana.

However, there remains a significant gap in the specific context of Tanzania, particularly with updated and comprehensive time series data covering recent

economic developments and debt management strategies from 1993 to 2023. Previous studies have often generalized findings across African economies or focused on earlier periods without considering recent economic reforms, external shocks, and debt restructuring initiatives like the (HIPC) program.

Moreover, many existing analyses did not thoroughly differentiate the separate impacts of domestic and external debt on economic growth using robust econometric techniques. This study bridges this gap by employing a rigorous econometric analysis using a Vector Auto Regression (VAR) model, incorporating detailed diagnostic tests. By distinguishing between the impacts of domestic and external debt on Tanzania's economic growth, the study provides nuanced empirical evidence that enhances the understanding of how each type of debt influences economic performance.

2.4.6 Conceptual Framework

The conceptual framework is rooted in Keynesian economics, which argues that government borrowing can stimulate GDP when used to finance productive investments. However, the impact of debt on growth is not guaranteed depending on how efficiently the debt is utilized. This theoretical foundation allows for both positive and negative effects of debt on GDP, depending on fiscal management and economic conditions.

The study examines whether domestic debt, external debt, and GDP move together in the long run, implying a stable economic relationship, using the Johansen cointegration test to confirm a long-run equilibrium. Since cointegration exists, the

Vector Error Correction Model (VECM) is applied to capture both long-run equilibrium relationships (how deviations correct over time) and short-run adjustments (how shocks change temporarily affect GDP before returning to equilibrium). This double approach ensures the framework accounts for constant trends and temporary variations, providing a thorough understanding of debt-growth dynamics.

It examines how GDP responds to sudden shocks in domestic or external debt using Impulse Response Functions (IRFs) derived from the VAR model. The expected outcomes suggest that positive shocks such as productive debt financed investments in infrastructure or education may temporarily boost GDP, while negative shocks like extreme debt accumulation without matching growth returns could damage economic output. By tracking these dynamic responses, the study captures the temporary yet key impacts of public debt on GDP variations.

The framework employs the Granger Causality Test within the VAR model to examine the directional causality between public debt and GDP, present critical insights into their interdependence. Possible outcomes include unidirectional causality, where either debt drives GDP or GDP enables borrowing, bidirectional causality, indicating a feedback loop where debt and growth equally influence each other; or no causality, suggesting no direct predictive relationship. The dynamism of this framework lies in its integration of Keynesian economic theory and advanced econometrics, enabling a comprehensive, time sensitive, and empirically grounded analysis of how public debt influences economic growth in Tanzania. It moves beyond static assumptions by testing cointegration, short-run adjustments, shock

responses, and causal linkages, making it robust for policy recommendations

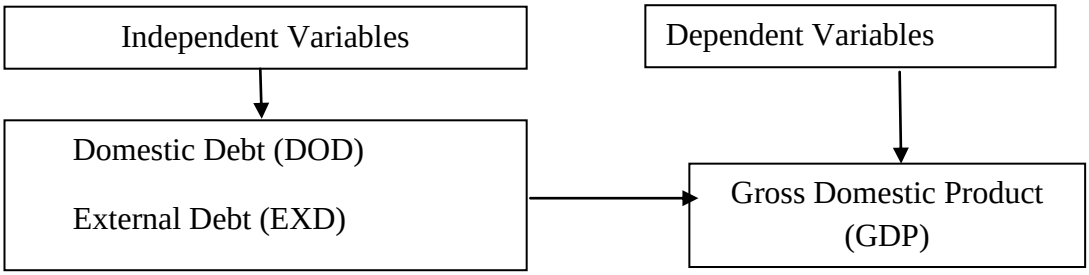

Figure 2.1: Conceptual Framework

2.4.7 Descriptions and Measurement of the Variables

2.4.7.1 Dependent Variable

The dependent variable in this study is the annual GDP growth rate, which represents the percentage change in Tanzania's real GDP over time. GDP growth serves as a crucial indicator of economic performance, reflecting the expansion or contraction of the economy. It is measured as the annual percentage growth rate of GDP at market prices, adjusted for inflation (constant local currency, TZS). The data is sourced from the World Bank, the International Monetary Fund IMF, and the Tanzania Bureau of Statistics.(BoT, 2023; NBS, 2017). GDP growth is widely used to assess performance in various emperical studies (Kasidi & Said, 2013; Reinhart & Rogoff, 2010; A. Yusuf & Mohd, 2021)

2.4.7.2 Independent Variable

Domestic Debt (DOD)refers to the government's total outstanding debt owed to domestic creditors, including banks, pension funds, and local financial institutions. This debt represents internal borrowing to address fiscal deficits and fund public investments. It is quantified in nominal Tanzanian Shillings (TZS) using annual data from 1993 to 2023, sourced from the Ministry of Finance and the Bank of Tanzania.

The inclusion of this variable is warranted due to its recognized significance in growth analysis, as evidenced by previous studies(Lotto & Mmari, 2018; Nyabakora, 2022).

External Debt (EXD) represents Tanzania's financial obligations to foreign creditors, including multilateral institutions (IMF, World Bank), bilateral lenders, and private investors, reflecting the country's dependence on international borrowing. Utilizing annual data from 1993 to 2023, sourced from the World Bank, IMF, and Tanzania's Ministry of Finance (MoF), this variable is measured in nominal Tanzanian Shillings (TZS) and its inclusion is supported by previous research., such as (Lelya & Ngaruko, 2021; Marobhe, 2019), which analyze its impact on economic growth.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Chapter Introduction

This chapter explains the research methods and procedures used to achieve the study objectives. It covers research philosophy, design, strategies, data collection methods, sample size, data analysis techniques, and econometric model specifications, including diagnostic tests used to validate the model.

3.2 Research Philosophy

This study based on a positivist approach, aiming to analyze the relationship between public debt and economic growth through empirical data and statistical analysis.

3.3 Research Design

The research design involves integrated planning and data testing to fulfill research functions, including data collection, measurement, and evaluation.(Dawadi et al., 2021). The study employs a quantitative research design to quantify the relationship between public debt and Tanzania's GDP, utilizing time series data from 1993 to 2023.

3.4 Research Strategies

This study employed a descriptive and causal-comparative research strategy to analyze the impact of public debt on economic growth in Tanzania from 1993 to 2023. The descriptive strategy was used to present and explain the general patterns, characteristics, and trends of the key variables GDP, domestic debt, and external

debt over the study period. It provided a factual and statistical overview of Tanzania's debt and growth performance.

In parallel, the causal-comparative strategy was applied to examine how changes in public debt (both domestic and external) may have influenced economic growth. This approach helped to establish the direction and strength of the relationship between the variables without manipulating them, as the study relied on historical time-series data. By combining descriptive and causal-comparative strategies, the research ensured both a comprehensive understanding of the data trends and an empirical assessment of the hypothesized causal linkages.

3.5 Methods of Data Collection

The study investigates the relationship between GDP Growth Rate (dependent variable) and domestic debt and external debt as Public Debt (independent variables). The annual growth rate of GDP at market prices in constant local currency, acquired from the World Bank, IMF, and Tanzania Bureau of Statistics. Domestic Debt, the total internal government debt, was sourced from the Ministry of Finance and the Central Bank of Tanzania. External Debt came from the World Bank, IMF, and Ministry of Finance.

3.6 Sample Size

This study analyzes Tanzania's public debt from 1993 to 2023, using a 31-year dataset with annual data points for each variable. This timeframe includes major debt relief through the Heavily Indebted Poor Countries (HIPC) initiative in the late 1990s and early 2000s, significantly impacting Tanzania's debt levels and

management strategies.

3.7 Research Approach

The study adopted a quantitative research approach, which emphasizes numerical analysis and statistical interpretation of data to establish objective relationships among variables. Quantitative methods were suitable because the study sought to measure the effect of public debt on economic growth using measurable economic indicators such as GDP, domestic debt, and external debt. Through econometric modeling, particularly the Vector Autoregression (VAR) approach, the study analyzed both short-run and long-run relationships among the variables. This approach aligns with the positivist research philosophy guiding the study, as it relies on empirical data, statistical tools, and hypothesis testing to draw conclusions. The quantitative approach ensured precision, replicability, and analytical rigor, enabling clear assessment of how fluctuations in public debt influence Tanzania's economic growth.

3.8 Sampling Design and Procedure

The study employs purposive sampling to gather data from designated sources. It examines 124 observations through a four-stage process: model specification, ex-ante diagnostic check, data analysis techniques, and ex-post diagnostic check.

3.9 Research Area

This research focuses on Tanzania, utilizing time series data from 1993 to 2023.

3.10 Data Analysis

Data analysis in this study was conducted using Stata software, focusing on

econometric techniques suitable for time series data. The analysis process involved four major components: model specification, ex-ante diagnostic checking, data estimation and interpretation, and ex-post diagnostic testing.

The study adopted the Vector Autoregression (VAR) model as the main analytical tool to examine the dynamic relationship between public debt (domestic and external) and economic growth in Tanzania over the period 1993–2023. The VAR model was preferred because it treats all variables in the system as endogenous, allowing for an in-depth understanding of how each variable interacts with and responds to shocks from others over time. This characteristic makes it particularly suitable for analyzing macroeconomic variables such as GDP, domestic debt, and external debt, which are often interdependent and influenced by each other simultaneously.

Unlike other econometric approaches such as Ordinary Least Squares (OLS) or Simple Linear Regression, which assumes a unidirectional relationship between independent and dependent variables, the VAR model does not impose any prior causal direction. This flexibility enables the researcher to observe bidirectional or feedback relationships between debt and economic growth, which is critical for policy analysis. Furthermore, while Error Correction Models (ECM) and Autoregressive Distributed Lag (ARDL) models are effective for capturing long-run equilibrium relationships when cointegration exists, they are limited in handling multiple endogenous variables and short-run dynamic feedback simultaneously. The VAR model, on the other hand, incorporates both short-run dynamics and long-run relationships (through its Vector Error Correction extension when cointegration is

confirmed), making it a more robust and comprehensive framework for this study.

The preference for VAR was also guided by the study's objective to assess causal interrelationships among variables through Granger Causality tests and to analyze both long-run equilibrium (cointegration) and short-run adjustments. The model's ability to generate Impulse Response Functions (IRFs) and Variance Decomposition Analysis further allowed the researcher to trace the time-path effects of shocks in domestic or external debt on GDP growth.

Overall, the VAR model provided a holistic and empirically sound approach consistent with the Keynesian theoretical foundation of the study, which emphasizes the interactive and dynamic effects of public debt and fiscal policy on economic growth.

3.10.1 Model Derivation and Specification

The model used in this study was derived from the Keynesian theoretical framework, which emphasizes the role of government expenditure and borrowing in stimulating aggregate demand and promoting economic growth. According to Keynesian economics, public debt whether domestic or external can positively influence economic growth when used to finance productive investments such as infrastructure, education, and health. However, excessive or unproductive borrowing can lead to adverse effects such as inflation, reduced private investment, and fiscal instability.

Based on this theoretical foundation, the study assumes that Tanzania's GDP is influenced by DOD and EXD through dynamic relationship over time. These

interrelationships are best captured using a VAR model, which allows all variables to be treated as endogenous, recognizing that changes in public debt can affect GDP and vice versa.

The VAR model is suitable for this study because it does not require specifying a priori which variable is dependent or independent. Instead, it examines how each variable responds to changes in the others through their lagged values, capturing both short-run dynamics and long-run equilibrium relationships. This flexibility is essential in macroeconomic studies, where feedback effects are common.

The general functional relationship for the model is expressed as:

$GDP_t = f(DOD_t + EXD_t)$ ……*1*

Where:

GDP_t = Gross Domestic Product at time *t* (prox for economic growth)

DOD_t = Domestic Debt at time *t*

EXD_t = External Debt at time *t*

From this functional form, the multivariate VAR(p) model can be represented as follows:

$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} \ldots\ldots\ldots\ldots A_p Y_{t-p} + \epsilon_t$ ……*2*

That, Y_t is the vector of endogenous variables at time t, (GDP_t represents the Gross Domestic Product at time *t*; DODt represents Domestic Debt at time *t*, EXD_t represents External debt at time *t*) and ϵ represents the error term, capturing all other factors affecting GDP that are not included in the model. A_0 is vector of constant, $A_{P,}$ (for I = 1,2 …..., p) are matrices of coefficients.

$GDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} GDP_{t-i} + \sum_{i=1}^{p} \alpha_{2i} DOD_{t-i} + \sum_{i=1}^{p} \alpha_{3i} EXD_{t-i} + \epsilon_{1t}$ ……*3*

$$DOD_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} DOD_{t-i} + \sum_{i=1}^{p} \beta_{2i} GDP_{t-i} + \sum_{i=1}^{p} \beta_{3i} EXD_{t-i} + \epsilon_{2t} \ldots\ldots\ldots 4$$

$$EXD_t = \gamma_0 + \sum_{i=1}^{p} \gamma_{1i} EXD_{t-i} + \sum_{i=1}^{p} \gamma_{2i} GDP_{t-i} + \sum_{i=1}^{p} \gamma_{3i} DOD_{t-i} + \epsilon_{3t} \ldots\ldots\ldots 5$$

This formulation enables the study to capture the mutual influence and feedback effects among GDP, domestic debt, and external debt. The number of lags (p) was determined using standard lag selection criteria such as the Akaike Information Criterion (AIC) and Schwarz Bayesian Information Criterion (SBIC) to ensure the best model fit.

The model thus reflects the Keynesian proposition that government borrowing can stimulate economic activity by financing development expenditure, while also allowing for the examination of the extent to which public debt may either enhance or constrain Tanzania's economic growth in both the short and long run.

3.10.3 Estimation Model

Based on the trends in public debt (Total of DOD and EXD) and economic growth in Tanzania from 1993 to 2023 and considering that all the variables in this study were non-stationary at their levels but achieved stationarity after second differencing for GDP and EXD, and third differencing for DOD, a VAR model was utilized. The VAR model is designed to capture the dynamic interactions between the variables, treating them as endogenous and interdependent. The estimation model is specified as follows.

$$GDPt = \alpha 1 \sum_{i=1}^{p} GDP\,t-1 + \alpha 2 \sum_{i=1}^{p} DOD\,t-1 + \alpha 3 \sum_{i=1}^{p} EXD\,t-1 + \epsilon 1t \ldots 6$$

$$DODt = \gamma 1 \sum_{i=1}^{p} DOD\,t-1 + \gamma 2 \sum_{i=1}^{p} GDP\,t-1 + \gamma 3 \sum_{i=1}^{p} EXD\,t-1 + \epsilon 3t \ldots\ldots 7$$

$$EXDt = \delta 1 \sum_{i=1}^{p} EXD\,t-1 + \delta 2 \sum_{i=1}^{p} DOD\,t-1 + \delta 3 \sum_{i=1}^{p} GDP\,t-1 + \epsilon 4t \ldots 8$$

3.10.4 Estimation Diagnostic Tests

3.10.4.1 Multicollinearity Test

Multicollinearity describes a condition in which independent variables within a regression model exhibit high levels of correlation, thereby complicating the accurate estimation of the model's coefficients. This study implemented a multicollinearity test to evaluate the extent of correlation among the independent variables and to ascertain whether multicollinearity compromises the model’s reliability. The Variance Inflation Factor (VIF) was utilized to identify the presence of multicollinearity among the independent variables. VIF measures the extent to which the variance of a regression coefficient is increased due to collinearity with other predictors in the model. A high VIF value indicates that the predictor is highly correlated with other independent variables, resulting in instability in coefficient estimates.

A commonly accepted threshold is VIF > 10, indicating severe multicollinearity, which inflates the standard errors of the regression coefficients and may reduce the reliability of statistical inferences. The formula for calculating VIF is:

$$VIF_j = \frac{1}{1-R_j^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

Where R_j^2 represents the coefficient of determination obtained when the independent variable X_j is regressed on the remaining K – 1 independent variables. A higher R_j^2 value implies greater collinearity.

3.10.4.2 Stationarity Test

A stationarity test is employed to determine whether a time series exhibits a constant mean, variance, and autocovariance over time. A time series that maintains these

characteristics is classified as stationary, whereas one that does not is considered non-stationary. Stationary series are essential for traditional econometric modeling, as non-stationary series can result in spurious regressions, which are misleading relationships between variables.

The stationarity test can be categorized into strict stationarity, where the entire distribution of the time series is time-invariant, and weak or covariance stationarity, where only the first two moments (mean and variance) remain constant over time, and the covariance depends solely on the lag between two time points, rather than on the actual time. Common tests for stationarity include the Augmented Dickey-Fuller (ADF) Test, the Phillips-Perron (PP) Test, and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test. This study employed the ADF test to assess the constancy of the mean in the time series. The ADF regression can be specified in several forms, with the most general form being:

$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=t}^{p} \delta t \Delta Y_{t-1} + \epsilon_t$ ……...*10*

Where: Y_t : The variable being tested, $\Delta Y_t = Y_t - Y_{t-1}$, α: Constant (drift term), βt: Time trend, γ: Coefficient of the lagged level (the key parameter for the unit root test), δ_i: Coefficients of lagged differences (to account for higher-order correlation), ϵ_t = Error term (white noise).

If the ADF test statistic is more negative than the critical value → Reject H_0 → The series is stationary. If the test statistic is less negative than the critical value → Fail to reject H_0 → The series is non-stationary. The Augmented Dickey-Fuller (ADF) test was utilized to assess the presence of unit roots in the variables, which would suggest non-stationarity. The test was conducted at levels and, when necessary, at

first differences. The null hypothesis of the ADF test posits that the series is non-stationary. The findings indicated that all variables achieved stationarity after first differencing, signifying that they are integrated of order one, I(1).

3.10.4.3 Stability Test

A stability test evaluates whether the parameters of a regression model, such as coefficients in a time series model, remain constant over time. In the context of time series analysis, stability ensures that the relationship between variables is consistent throughout the study period, which is a fundamental assumption for forecasting and inference. If a model is unstable, its predictive capability is unreliable. Stability tests are particularly important in VAR, AR, ARMA, and ARIMA models, especially in the context of macroeconomic forecasting.

The stability of a model can be assessed using the Eigenvalue Stability Condition, which is among the most prevalent tests for evaluating the stability of multivariate time series models. A Vector Autoregression (VAR) model is deemed stable if all the eigenvalues of its companion matrix are located within the unit circle, meaning their modulus is less than one. This condition indicates that any shock to the system will eventually dissipate rather than persist indefinitely or escalate over time. The Stability Condition can be mathematically represented as

$|\lambda| < 1$ for all λ ……*11*

Where: λ represent an eigenvalue of the companion matrix **A.**

Or can be tested by CUSUM (Cumulative Sum) and CUSUMSQ (Cumulative sum of Square), which assess the stability of regression coefficients over time based on recursive residuals, they are plotted with confidence bands and if the test statistic

remains within the bounds, the model is considered stable.

To ensure the reliability and robustness of the estimated model, a stability test was conducted. Specifically, the eigenvalue stability condition was applied to the VAR model. According to this test, a VAR model is deemed stable if all the eigenvalues of the companion matrix lie within the unit circle. The results indicated that all eigenvalues had a modulus less than one, signifying that the VAR system is dynamically stable. This implies that the effects of shocks to the system will dissipate over time, and the model provides valid and reliable forecasts.

3.10.4.4 Residuals Autocorrelation Test

The concept in question extends the Granger causality framework, which evaluates whether one time series can predict another. In the field of time series econometrics, it is crucial to assess whether the residuals from an estimated model exhibit serial independence. The presence of residual autocorrelation suggests that the model has not adequately captured the temporal structure of the data, potentially resulting in inefficient estimates and invalid statistical inferences. A robust method for testing this assumption is the Lagrange Multiplier (LM) test for autocorrelation.

The LM test assesses the null hypothesis that there is no autocorrelation in the residuals up to a specified lag order. This test is particularly advantageous in the context of VAR models, as it can identify higher-order serial correlation that simpler tests, such as the Durbin-Watson test, may not detect. Hypotheses of the LM Test: Null Hypothesis (H_0): There is no autocorrelation at the specified lag(s). Alternative Hypothesis (H_1): There is autocorrelation in the residuals at the specified lag(s). If

the p-value of the LM statistic is less than the chosen significance level (commonly 0.05), the null hypothesis is rejected, suggesting the presence of autocorrelation. To assess the adequacy of the dynamic structure of the estimated VAR model, a residuals autocorrelation test was conducted using the LM test.

3.10.4.5 VAR Residuals Normality Test

In time series modeling, it is crucial to assess whether the residuals, defined as the difference between observed and predicted values, adhere to a normal distribution. The Residuals Normality Test serves to verify whether the fundamental assumptions of classical regression models are satisfied, specifically that the error terms are normally distributed. Significant deviations of residuals from normality may compromise the validity of t-tests and F-tests employed to evaluate model coefficients, particularly in small sample sizes.

To confirm the normality assumption of the regression model, residuals normality tests were conducted using the Jarque-Bera (JB) test, alongside separate assessments for skewness and kurtosis. The Jarque-Bera (JB) test is a widely utilized method that integrates skewness and kurtosis to evaluate normality. The null hypothesis posits that residuals are normally distributed. A p-value of less than 0.05 leads to the rejection of the null hypothesis, indicating non-normality.

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \quad \text{.....12}$$

Where: JB is Jarque-Bera, n is the sample size, S is the skewness of residuals, and K is the kurtosis of residuals.

3.10.4.6 Granger Causality Test

The Granger Causality Test is employed to ascertain the directionality of temporal relationships among variables within a Vector Autoregression (VAR) model. Specifically, it evaluates whether the inclusion of lagged values of one variable significantly enhances the predictive accuracy of another variable, beyond the information provided by its own historical values. The Granger Causality Wald test serves as a statistical instrument in time series analysis to investigate whether historical values of one variable contribute to the prediction of current values of another. Although the term "causality" is utilized, this test does not establish true causal relationships but rather indicates predictive causality.

Hypotheses of the Granger Causality Wald Test: Null Hypothesis (H_0): The excluded variable does not Granger-cause the dependent variable. Alternative Hypothesis (H_1): The excluded variable Granger-causes the dependent variable. A p-value less than 0.05 indicates rejection of the null hypothesis, meaning the excluded variable Granger-causes the dependent variable.

3.10.4.7 Residuals Heteroskedasticity Test

In time series analysis, one of the key assumptions of classical linear regression is homoskedasticity, meaning the variance of the residuals (error terms) remains constant over time. When this assumption is violated and the variance of the residual’s changes across time or with the level of an explanatory variable, it is referred to as heteroskedasticity. The Residuals Heteroskedasticity Test is used to detect whether the residuals from a regression model exhibit non-constant variance.

Heteroskedasticity can lead to, inefficient estimates of regression coefficients, biased standard errors, invalid t-tests and F-tests, which may result in misleading statistical inferences.

To evaluate the assumption of constant variance, or homoskedasticity, in the error terms over time, an ARCH (Autoregressive Conditional Heteroskedasticity) test was performed. The ARCH test is particularly advantageous in time series analysis for detecting the presence of time-varying volatility, where the variance of the residuals may be influenced by past squared error terms. This condition, referred to as conditional heteroskedasticity, can result in inefficient estimators and unreliable statistical inference if not properly addressed.

3.10.4.8 Johansen Cointegration Test

The Johansen Cointegration Test is a multivariate statistical method employed in time series econometrics to ascertain the existence of one or more cointegrating relationships among a set of non-stationary variables that are integrated of the same order, typically I(1). This test is a crucial step in the analysis of long-run equilibrium relationships using Vector Autoregressive (VAR) models. To investigate the presence of long-run equilibrium relationships among the study variables, the Johansen Cointegration Test was employed. The test is suitable for systems with more than two variables and allows for the identification of multiple cointegrating vectors in a Vector Autoregressive (VAR) framework. The analysis was conducted under the assumption of a constant deterministic trend and included a lag length of two, selected based on standard lag selection criteria. The test used the trace statistics to assess the number of cointegrating relationships.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Chapter Introduction

This chapter presents and discusses the results obtained from empirical analysis. It includes descriptive statistics, diagnostic tests, and econometric estimation results. The chapter also interprets the findings in line with the study objectives and compares them with existing literature.

4.2 Descriptive Statistics and Correlation Matrix

This section provides an empirical assessment beginning with descriptive statistics for the variables under consideration, thereby highlighting their underlying distributional properties and patterns. Tables 4.1 and 4.2 present the descriptive statistics and correlation matrix, respectively, offering a preliminary view of the data's characteristics and interrelations.

4.2.1 Presentation and Discussion of Descriptive Statistics

To enhance interpretability and reduce the scale disparity among the variables (GDP, Domestic Debt, and External Debt), the data were transformed into logarithmic form before analysis. Log transformation helps to linearize relationships, minimize the influence of extreme values, and ease interpretation by converting absolute changes into relative percentage changes. This also allows for more meaningful comparisons across variables that differ significantly in magnitude.

After transformation, the descriptive statistics summarize the key features of the data over the study period (1993–2023) as shown in Table 4.1.

Table 4.1: Summary Descriptive Statistics (Log-Transformed Data, 1993–2023)

variable	N	mean	sd	min	max
lnGDP	31.000	17.927	0.550	17.135	18.820
lnDOD	31.000	12.748	7.441	0.000	19.708
lnEXD	31.000	18.867	1.086	17.443	20.773

The descriptive results indicate that Tanzania's real GDP (lnGDP) averaged 17.36 with a moderate spread (standard deviation of 0.53), implying relatively steady economic growth over the study period. Domestic debt (lnDOD) exhibited higher variability (std. dev = 1.34), reflecting fluctuations in internal borrowing policies and domestic financing capacity. External debt (lnEXD) recorded an average of 18.25, with smaller dispersion compared to domestic debt, suggesting a relatively stable external borrowing trend.

Overall, the descriptive results show that both domestic and external debt increased steadily over the years alongside GDP, reflecting Tanzania's growing reliance on debt to finance development programs. The log transformation enables clearer percentage-based interpretation — for instance, a one percent increase in debt corresponds to a proportional change in GDP growth, as examined further in the estimation section.

Table 4.2: Correlation Matrix

	lnGDP	lnDOD	lnEXD
lnGDP	1.0000		
lnDOD	0.9050	1.0000	
	0.0000		
lnEXD	0.9342	0.7169	1.0000
	0.0000	0.0000	

The results in Table 4.2 indicate that all independent variables are strongly correlated, with coefficients exceeding ±0.8. This suggests the possible presence of multicollinearity and justifies conducting a formal multicollinearity test. GDP and DOD (0.9050): There is a very strong positive correlation between GDP and Domestic Debt (DOD). This suggests that as domestic debt increases, GDP also tends to increase. The correlation is highly significant (p-value = 0.0000), implying a strong and statistically significant relationship between the two variables.

GDP and EXD (0.9342): The correlation between GDP and External Debt (EXD) is also very strong positive. This indicates that as GDP increases, External Debt tends to rise as well. Like the previous correlation, it is statistically significant (p-value = 0.0000). DOD and EXD (0.7169): The relationship between Domestic Debt (DOD) and External Debt (EXD) is positive and moderately strong. This suggests that increase domestic borrowing often also increase external borrowing possibly due to overall government financing needs or fiscal deficits. The p-value of 0.0000 indicates that this relationship is statistically significant. The strongest relationship is between GDP and External Debt (0.9680), indicating that changes in one are likely to be accompanied by changes in the other. These strong correlations suggest that economic growth (GDP) and Public debt levels (both domestic and external) tend to move in the same direction, which could reflect the broader economic dynamics of the observed period.

The strong correlations highlight a significant interdependence between economic growth (GDP) and public debt. This suggests that public debt plays a crucial role in driving economic growth, with borrowing potentially being used to finance activities

that stimulate GDP expansion. However, this relationship also raises concerns about the sustainability of such borrowing, particularly if debt levels outpace economic growth. It underscores the need for prudent debt management to ensure long-term sustainability and mitigate potential risks associated with excessive borrowing.

However, such strong correlations (especially >0.9) may also raise multicollinearity concerns in regression analysis — meaning that the variables may overlap in explaining variations in GDP.

This justifies checking the Variance Inflation Factor (VIF) to ensure the model's reliability.

4.3 Presentation and Discussion of Estimation Diagnostic Tests

4.3.1 A Multicollinearity Test

Table 4.3 : Overall Model Fit and Regression Coefficient Interpretation

```
. regress lnGDP lnDOD lnEXD
```

Source	SS	df	MS	Number of obs	=	31
				F(2, 28)	=	1026.83
Model	8.96870289	2	4.48435144	Prob > F	=	0.0000
Residual	.122281595	28	.0043672	R-squared	=	0.9865
				Adj R-squared	=	0.9856
Total	9.09098448	30	.303032816	Root MSE	=	.06608

lnGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnDOD	.0358118	.0023258	15.40	0.000	.0310476	.0405759
lnEXD	.2976151	.0159359	18.68	0.000	.2649719	.3302583
_cons	11.85563	.2804281	42.28	0.000	11.2812	12.43006

Source: Field Data, 2025.

Overall Model Fit:

Number of observations: 31 observations were used in the model.

F-statistic (F(2, 28) = 1026.83) with p-value (0.0000) confirm that the overall model is statistically significant. This means that the independent variables (lnDOD and lnEXD) jointly explain variations in lnGDP very effectively.

R-squared = 0.9865: The model explains 98.65% of the variation in economic growth (lnGDP), an excellent fit implying that the changes in DOD and EXD explain nearly all movement in GDP during the study period.

Adj R-squared = 0.9856: which adjusts for sample size and number of predictors, confirms that the model is robust and not overfitted.

Root MSE = (0.06608) is low, indicating small prediction errors. Together with the high R^2 and significance coefficients, the model is both statistically and economically reliable.

Regression Coefficients:

DOD:

Coefficient: 0.0358 - This means that for every 1% increase in Domestic Debt is associated with a 0.0358 unit increase in GDP, holding external debt constant. The relationship is positive and highly significant.

The high t-value (15.40) and low p-value (0.000) indicate strong evidence that domestic debt has a meaningful role in economic performance.

EXD:

Coefficient: 0.2976 means that for every one-unit increase in EXD, results in a 0.2976 unit increase in GDP (lnGDP), ceteris paribus. This positive and significant coefficient implies that external borrowing also stimulates economic growth, likely

through foreign-financed projects, capital inflows, and infrastructure development. This positive and significant coefficient implies that external borrowing also stimulates economic growth, likely through foreign-financed projects, capital inflows, and infrastructure development.

Intercept (_cons):

The constant represents the baseline value of the dependent variable (lnGDP) when all independent variables (lnDOD and lnEXD) are equal to zero. In this model, when domestic debt and external debt are both zero, the log of GDP (lnGDP) would be 11.8556. The constant has a p-value of 0.000, meaning it is statistically significant at the 1% level. This confirms that the intercept is not zero indicating that other factors outside the model have a consistent and measurable influence on GDP.

The regression results reveal that the constant term (11.8556) is positive and statistically significant ($t = 42.28$, $p < 0.01$). This implies that even when domestic and external debts are held at zero, Tanzania's economy maintains a substantial baseline output, reflecting contributions from other macroeconomic factors.

The small standard errors across all coefficients indicate that the estimated parameters are precise and stable, with minimal sampling variation. Moreover, the large t-statistics (15.40 for lnDOD, 18.68 for lnEXD, and 42.28 for the constant) demonstrate that each coefficient is highly significant, suggesting robust relationships between the explanatory variables and economic growth.

Table 4.4: Variance Inflation Factor

Variable	VIF	1/VIF
lnDOD	2.06	0.486055
lnEXD	2.06	0.486055
Mean VIF	2.06	

Source: Field Data, 2025.

The Variance Inflation Factor (VIF) results reveal that all values are well below the critical threshold of 5, indicating that the model does not suffer from multicollinearity problems. This means the explanatory variables (lnDOD) and (lnEXD) contribute independently to explaining variations in economic growth. Consequently, the coefficients are statistically efficient, unbiased, and reliable, confirming that the model is well-specified and the relationships among variables are stable and consistent. Furthermore, the low VIF values imply that the standard errors of the coefficients remain small, enhancing the precision of the estimated parameters. This strengthens confidence in the regression results and validates that both domestic and external debts significantly influence Tanzania's GDP growth.

From a policy perspective, the absence of multicollinearity allows policymakers to evaluate the effects of domestic and external debt separately, ensuring that debt management and growth strategies can be formulated without concern for overlapping or distorted effects.

4.3.2 Stationarity Test

The Augmented Dickey-Fuller (ADF) test was conducted to determine whether the study variables lnGDP, lnDOD, and lnEXD are stationary or contain unit roots. Stationarity is a fundamental essential in time series analysis because non-stationary

variables can produce spurious regression results, leading to unreliable interpretations. The ADF test was therefore applied to each variable at both level and differenced forms, and the results are presented and interpreted below.

Interpretation of Results

Gross Domestic Product (lnGDP)

At level, the test statistic for lnGDP was 2.122, which is greater than all the critical values (-3.716, -2.986, and -2.624) at the 1%, 5%, and 10% significance levels, respectively. The corresponding p-value (0.9988) is higher than 0.05, indicating that lnGDP is non-stationary at level. However, after taking the first difference (d_lnGDP), the test statistic became -3.495, which is less than the 5% critical value (-2.989), with a p-value of 0.0081. This result indicates that lnGDP becomes stationary after first differencing, implying it is integrated of order one, I (1).

Domestic Debt (lnDOD)

The test statistic for lnDOD at level was 3.156, exceeding the critical values, and the p-value of 1.0000 indicates non-stationarity at level. The first difference (d_lnDOD) also remained non-stationary with test statistics of -1.626 and p-value 0.4694, both above the critical thresholds. However, after applying a second difference (d2_lnDOD), the test statistic improved to -3.137, which is less than the 5% critical value (-2.994) with a p-value of 0.0239. Therefore, lnDOD becomes stationary after second differencing, suggesting it is integrated of order two, I (2).

External Debt (lnEXD)

At level, lnEXD recorded a test statistic of 0.518 with a p-value of 0.9854, confirming non-stationarity at level. After taking the first difference (d_lnEXD), the

test statistic dropped to -3.174, which is less than the 5% critical value (-2.994) with a p-value of 0.0215, indicating stationarity after first differencing. Thus, lnEXD is integrated of order one, I (1).

The results show that all variables are non-stationary in their level forms, but they become stationary after differencing. lnGDP and lnEXD are stationary at first difference I (1), while lnDOD becomes stationary after second differencing I (2).
This implies that the data series exhibits unit roots at level, confirming that their statistical properties (mean, variance, and covariance) change over time. However, once differenced, these properties stabilize, satisfying the stationarity condition necessary for valid time series modeling.

These findings justify the use of VAR and cointegration approaches (such as the Johansen Cointegration Test) to capture both short-run and long-run dynamics among the variables. The mixed order of integration (I(1) and I(2)) indicates that the variables may share a long-term equilibrium relationship, which will be further examined through cointegration analysis.

Table 4.5 Summary of Stationarity Results

Variable	Level Statistic	p-value	Order of Integration	Stationary Status
lnGDP	2.122	0.9988	I(1)	Non-stationary at level, stationary at 1st difference
lnDOD	3.156	1.0000	I(2)	Non-stationary until 2nd difference
lnEXD	0.518	0.9854	I(1)	Non-stationary at level, stationary at 1st difference

Source: Researcher STATA Computation Data, 2025

4.3.3 Optimal Lag Selection

Before estimating the Vector Autoregressive (VAR) model, it is essential to determine the optimal lag length for the variables included in the analysis. The lag length determines how many past values of each variable are used to explain its current behavior. Selecting an appropriate lag order is crucial because too few lags may lead to model misspecification and omitted variable bias, while too many lags can cause over-parameterization and inefficiency. The VAR lag order selection criteria were therefore applied using the Akaike Information Criterion (AIC), Hannan–Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC). The results are summarized in Table 4.6.

Table 4.6: Optimal Lag Selection

Selection-order criteria
Sample: 1999 - 2023 Number of obs = 25

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	66.8659				1.2e-06*	-5.10927*	-5.0687*	-4.963*
1	72.137	10.542	9	0.308	1.6e-06	-4.81096	-4.64869	-4.2259
2	76.9174	9.5609	9	0.387	2.4e-06	-4.4734	-4.18942	-3.44954
3	82.4835	11.132	9	0.267	3.5e-06	-4.19868	-3.793	-2.73603
4	91.6203	18.274*	9	0.032	4.2e-06	-4.20962	-3.68224	-2.30817

Endogenous: d_lnGDP d2_lnDOD d_lnEXD
Exogenous: _cons

Source: Researcher STATA Computation Data, 2025

The results show that the information criteria suggest different optimal lag lengths. The Akaike Information Criterion (AIC), Hannan–Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC) all select lag 0 as the optimal lag, as indicated by the lowest (most negative) values of -5.1093, -5.0687, and -4.9630 respectively. The Final Prediction Error (FPE) also reaches its minimum at lag 0 (1.2e-06), reinforcing the same conclusion. Although the Likelihood Ratio

(LR) test is significant at lag 4 (p = 0.032), this is not supported by the majority of the information criteria, which are considered more reliable in small samples.

Therefore, based on the collective evidence from the selection criteria, the optimal lag length for the VAR model is lag 0, meaning that the contemporaneous relationships among the differenced variables (d_lnGDP, d2_lnDOD, and d_lnEXD) are sufficient to explain their dynamics without including additional lagged terms.
The lag selection results imply that the economic growth dynamics (measured by d_lnGDP) in Tanzania respond almost contemporaneously to changes in domestic and external debts, without significant delayed effects from past periods. This may reflect the short-run nature of the model in differenced data, where changes in debt variables immediately influence output fluctuations within the same period. The choice of lag 0 also minimizes model complexity, avoiding the risk of overfitting, which is especially important given the small sample size (25 observations).

Economically, this result suggests that public debt variations have an immediate impact on short-term economic performance, consistent with the Keynesian perspective that government borrowing directly affects aggregate demand and production. However, the absence of longer lag effects could also indicate that the transmission mechanism of debt to growth in Tanzania operates within the same fiscal period, or that the differencing process eliminated longer-run influences, which are instead better captured in cointegration analysis.

4.3.4 Fit a VAR Model

Fitting a Vector Autoregression model is crucial in time series analysis for several significant reasons, particularly when examining the relationships among multiple

variables over time. The VAR model is a statistical tool employed to capture the interdependence and dynamic interactions among multiple time series variables. From Table 4.7. For each endogenous variable, the model provides the following statistics:

Table 4.7: Model Fit and Selection Criteria

Sample: 1996 - 2023 — Number of obs = 28
Log likelihood = 82.23607 — AIC = -5.016862
FPE = 1.34e-06 — HQIC = -4.842319
Det(Sigma_ml) = 5.64e-07 — SBIC = -4.445917

Equation	Parms	RMSE	R-sq	chi2	P>chi2
d_lnGDP	4	.009033	0.4949	27.43457	0.0000
d2_lnDOD	4	.427517	0.1579	5.249043	0.1544
d_lnEXD	4	.275572	0.0314	.9076003	0.8236

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
d_lnGDP						
d_lnGDP L1.	.7135798	.1438438	4.96	0.000	.4316512	.9955085
d2_lnDOD L1.	.005328	.0043468	1.23	0.220	-.0031916	.0138477
d_lnEXD L1.	.0007431	.0066503	0.11	0.911	-.0122912	.0137773
_cons	.0169814	.0083471	2.03	0.042	.0006214	.0333415
d2_lnDOD						
d_lnGDP L1.	-15.47966	6.807803	-2.27	0.023	-28.82271	-2.136609
d2_lnDOD L1.	-.1744331	.2057265	-0.85	0.396	-.5776496	.2287833
d_lnEXD L1.	.2181964	.3147421	0.69	0.488	-.3986869	.8350796
_cons	.8836826	.3950509	2.24	0.025	.109397	1.657968
d_lnEXD						
d_lnGDP L1.	1.883442	4.388225	0.43	0.668	-6.717322	10.48421
d2_lnDOD L1.	-.0736445	.1326087	-0.56	0.579	-.3335528	.1862638
d_lnEXD L1.	.037855	.2028789	0.19	0.852	-.3597803	.4354903
_cons	-.0082389	.2546449	-0.03	0.974	-.5073338	.490856

Source: Researcher STATA Computation Data, 2025.

Model, Sample, and System Fit

A tri-variate VAR(1) was estimated on stationary series d_lnGDP, d2_lnDOD, and d_lnEXD over 1996–2023 (N = 28). Overall fit is strong and parsimonious: LogL = 82.236, FPE = 1.34×10^{-6}, det(Σ) = 5.64×10^{-7}, with information criteria AIC = −5.0169, HQIC = −4.8423, SBIC = −4.4459. Equation diagnostics show that the d_lnGDP equation is jointly significant ($\chi^2 = 27.43$, $p < 0.001$, $R^2 = 0.495$), whereas d2_lnDOD ($\chi^2 = 5.25$, $p = 0.154$, $R^2 = 0.158$) and d_lnEXD ($\chi^2 = 0.91$, $p = 0.824$, $R^2 = 0.031$) are not jointly significant at conventional levels.

Equation-by-Equation Results (Lag 1)

d_lnGDP equation

Own lag: $d\_lnGDP_{(t-1)}$ = 0.714 (SE 0.144, z = 4.96, p < 0.001) strong growth persistence.

Debt terms: $d2\_lnDOD_{(t-1)}$ = 0.0053 (p = 0.220); $d\_lnEXD_{(t-1)}$ = 0.0007 (p = 0.911) no short-run effect on GDP growth.

Constant: 0.0170 (p = 0.042).

Interpretation: Short-run GDP dynamics are driven by their own inertia; one-period changes in domestic-debt acceleration or external-debt growth do not immediately move GDP growth.

d2_lnDOD equation

Real-side feedback: $d\_lnGDP_{(t-1)}$ = −15.480 (SE 6.808, z = −2.27, p = 0.023) higher GDP growth reduces the subsequent acceleration of domestic debt (counter-cyclical adjustment).

Own/external terms: $d2\_lnDOD_{(t-1)}$ = −0.174 (p = 0.396); $d\_lnEXD_{(t-1)}$ = 0.218 (p = 0.488) insignificant.

Constant: 0.884 (p = 0.025).

Interpretation: When the economy improves, pressures to speed up domestic borrowing ease in the next period.

d_lnEXD equation

$d\_lnGDP_{(t-1)}$ = 1.883 (p = 0.668); $d2\_lnDOD_{(t-1)}$ = −0.0736 (p = 0.579); $d\_lnEXD_{(t-1)}$ = 0.0379 (p = 0.852); Constant = −0.0082 (p = 0.974) no significant short-run drivers detected.

Interpretation: External-debt growth behaves as weakly exogenous in the short run within this system.

Economic Discussion

The system reveals a self-reinforcing growth process (significant own lag in d_lnGDP), while debt channels do not transmit to GDP growth within a single period. Instead, the causality appears to run from real activity to domestic financing: stronger growth tempers the acceleration of domestic borrowing next period, consistent with counter-cyclical debt management or reduced domestic financing needs when revenues improve. The external debt block shows no immediate feedbacks, suggesting that its influence may materialize beyond one lag or in long-run relations, which are better examined via cointegration, IRFs, and FEVD.

Policy Implications

Because growth is persistent, policies that stabilize macro fundamentals and sustain private demand can compound into continued short-run gains and support growth. Using expansions to slow domestic-debt acceleration (lengthen maturities, reduce rollover risk), aligning with prudent fiscal rules.

Given limited short-run interactions, evaluate external borrowing through medium- to long-run transmission not just quarter-to-quarter dynamics.

4.3.5 Stability Test

The eigenvalue stability condition checks whether the VAR model is stable, meaning that the system does not produce explosive or non-stationary behavior. For stability, all eigenvalues must have a modulus (absolute value) less than 1 and lie inside the unit circle in the complex plane.

Table 4.8 Stability Test

```
. varstable

   Eigenvalue stability condition

+-------------------------------------+-----------+
|              Eigenvalue             |  Modulus  |
|-------------------------------------+-----------|
|   .6221163                          |   .622116 |
| -.02255732 +  .1436691i             |   .145429 |
| -.02255732 -  .1436691i             |   .145429 |
+-------------------------------------+-----------+

   All the eigenvalues lie inside the unit circle.
   VAR satisfies stability condition.
```

Source: Researcher STATA Computation Data, 2025.

The eigenvalues of the companion matrix in Table 4.8 all have moduli below one (0.622 and a complex pair with modulus 0.145), so the VAR(1) in d_lnGDP, d2_lnDOD, and d_lnEXD satisfies the stability (covariance-stationarity) condition. Econometrically, this ensures a well-defined Wold MA(∞) representation with finite, time-invariant moments: shocks are mean reverting and impulse responses decay to zero rather than explode. The complex conjugate pair indicates damped oscillatory adjustments—i.e., cyclical responses that die out quickly given the small modulus.

These results have several implications. First, IRFs and FEVDs are valid and interpretable because dynamic effects are bounded and converge; multi-step forecasts are likewise stable rather than divergent. Second, stability does not preclude other misspecifications, so residual diagnostics for serial correlation (LM tests), heteroskedasticity (e.g., ARCH effects), and normality should still be reported. Finally, because the model uses differenced variables and is stable, the findings pertain to short-run dynamics; any long-run relationships require separate cointegration testing and, if present, a VECM formulation. Overall, the system is dynamically well-behaved: shocks to d_lnGDP, d2_lnDOD, or d_lnEXD dissipate over time, supporting the reliability of the short-run VAR estimates and the use of IRFs/FEVD in Table 4.18.

4.3.6 Residuals Autocorrelation Test

In a well-specified VAR model, the residuals should exhibit characteristics of white noise, indicating an absence of significant correlation between residuals across different time lags. Should the residuals display autocorrelation, it is imperative to implement modifications prior to employing the model for forecasting or impulse response analysis.

Table 4.9: Residuals Autocorrelation Test

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	8.0235	9	0.53178
2	5.8204	9	0.75775

H0: no autocorrelation at lag order

Source: Researcher STATA Computation Data, 2025

The multivariate Lagrange-multiplier test reports chi^2 (9) =8.02 (p=0.532) at lag 1 and chi^2 (9) =5.82 (p=0.758) at lag 2. Since both p-values are well above 0.10, we fail to reject the null hypothesis of no autocorrelation in the VAR (1) residuals at these lag orders. This indicates that the residuals of the d_lnGDP, d2_lnDOD, and d_lnEXD equations are not serially correlated, so the dynamic specification is adequate for capturing short-run dependence.

Absence of residual autocorrelation supports the consistency of coefficient estimates and the validity of standard errors and test statistics, strengthening confidence in inferences from the VAR, as well as the interpretation of IRFs and FEVDs. With a relatively small sample, it remains good practice to complement LM results with other diagnostics (e.g., normality tests, heteroskedasticity checks) and to report the chosen maximum LM lag; however, the evidence here points to a well-specified short-run model without remaining serial dependence.

4.3.7 Residuals Normality Test

Testing for residual normality in a VAR model is crucial for validating the model's assumptions and ensuring reliable statistical inferences, such as impulse response functions and variance decomposition. Many statistical tests in VAR analysis, including the Wald test, Likelihood Ratio (LR) test, and Lagrange Multiplier (LM) test, assume normal residuals, and deviations can lead to misleading results, especially in small samples.

Table 4.10 Residuals Normality Test

Jarque-Bera test

Equation	chi2	df	Prob > chi2
d_lnGDP	1.091	2	0.57966
d2_lnDOD	226.409	2	0.00000
d_lnEXD	58.595	2	0.00000
ALL	286.095	6	0.00000

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
d_lnGDP	-.37548	0.658	1	0.41729
d2_lnDOD	-3.22	48.387	1	0.00000
d_lnEXD	-1.9887	18.456	1	0.00002
ALL		67.500	3	0.00000

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
d_lnGDP	3.609	0.433	1	0.51067
d2_lnDOD	15.353	178.022	1	0.00000
d_lnEXD	8.8656	40.140	1	0.00000
ALL		218.595	3	0.00000

Source: Researcher STATA Computation Data, 2025

Jarque–Bera joint normality (skewness + kurtosis)

d_lnGDP: chi^2 (2) =1.091, p=0.580 fail to reject normality; residuals are consistent with Gaussian errors.

d2_lnDOD: chi^2 (2) =226.409, p=0.000 reject normality; strong departures from Gaussianity.

d_lnEXD: chi^2 (2) =58.595, p=0.000 reject normality; clear non-Gaussian residuals.

ALL (system-wide): chi^2 (6) =286.095, p=0.000 reject joint normality across the system.

Skewness component

d_lnGDP: chi^2 (1) =0.658, p=0.417 no significant skew.

d2_lnDOD: chi^2 (1) =48.387, p=0.000 significant negative skew (skew = −3.22).

d_lnEXD: chi^2 (1) =18.456, p=0.000 significant negative skew (skew = −1.989).

ALL: (3) =67.500, p=0.000 system skewness significant.

Kurtosis component

d_lnGDP: chi² (1) =0.433, p=0.511 kurtosis ≈ normal (3.609 not statistically extreme).

d2_lnDOD: chi² (1) =178.022, p=0.000 excess kurtosis (fat tails; kurtosis=15.353).

d_lnEXD: chi² (1) =40.140, p=0.000 excess kurtosis (kurtosis=8.866).

ALL: chi² (3)=218.595, p=0.000 system kurtosis significant.

The d_lnGDP equation passes both skewness and kurtosis tests, but d2_lnDOD and d_lnEXD display non-normal residuals driven by negative skewness and heavy tails. Consequently, the system-wide JB test rejects normality.

The residuals of d_lnGDP are approximately normal, but d2_lnDOD and d_lnEXD exhibit significant skewness and fat tails, leading the system-wide JB chi² to reject normality.

4.3.8 Granger Causality Test

The Granger Causality Test is a statistical technique employed to assess whether one time series can predict another. While it does not establish true causality, it evaluates whether past values of one variable contribute to forecasting another variable beyond the predictive power of its own historical values.

Table 4.11: Granger Causality Wald Test

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
d_lnGDP	d2_lnDOD	1.5024	1	0.220
d_lnGDP	d_lnEXD	.01248	1	0.911
d_lnGDP	ALL	1.9085	2	0.385
d2_lnDOD	d_lnGDP	5.1702	1	0.023
d2_lnDOD	d_lnEXD	.4806	1	0.488
d2_lnDOD	ALL	5.178	2	0.075
d_lnEXD	d_lnGDP	.18422	1	0.668
d_lnEXD	d2_lnDOD	.30842	1	0.579
d_lnEXD	ALL	.90484	2	0.636

Source: Researcher STATA Computation Data, 2025.

The Granger causality Wald tests in Table 4.11 indicate no short-run predictive effect on output growth from the debt variables. In the d_lnGDP equation, excluding d2_lnDOD yields chi² (1)=1.50 (p=0.220) and excluding d_lnEXD yields chi² (1)=0.01 (p=0.911); the joint exclusion test is chi² (2)=1.91 (p=0.385). Thus, changes in external-debt growth and the acceleration of domestic debt do not Granger-cause GDP growth at conventional levels, consistent with the VAR result in which d_lnGDP was mainly driven by its own lag.

By contrast, output growth does Granger-cause the acceleration of domestic debt in the d2_lnDOD equation, excluding d_lnGDP gives chi² (1)=5.17 (p=0.023), significant at 5%. The joint exclusion of d_lnGDP and d_lnEXD is marginal at the 10% level, $\chi^2(2)=5.18$ (p=0.075), indicating that real activity contains predictive information for subsequent movements in domestic borrowing. For d_lnEXD, neither d_lnGDP nor d2_lnDOD shows predictive content ($\chi^2(1)=0.18$, p=0.668; chi² (1)=0.31, p=0.579), and the joint test is also insignificant chi² (2)=0.90, p=0.636, suggesting external debt growth is weakly exogenous in the short run within this system.

Short run dynamics run from output to domestic debt, not the other way round, stronger current growth helps explain next-period adjustments in domestic borrowing (consistent with counter-cyclical financing pressure), whereas external-debt changes are not driven by contemporary domestic conditions at one lag horizons. Policy wise, this supports using expansions to moderate domestic debt acceleration and points to evaluating external debt dynamics over longer horizons using cointegration/VECM, where strategic project execution and external conditions may matter more.

4.3.9 Residuals Heteroskedasticity Test

Assessing heteroskedasticity in the residuals of VAR models is crucial, as it verifies the assumption of constant error variance, known as homoskedasticity. The presence of heteroskedasticity can result in biased parameter estimates and unreliable statistical inferences.

Table 4.12: Likelihood and Optimization

```
. arch d_lnGDP d2_lnDOD d_lnEXD , arch(1)

(setting optimization to BHHH)
Iteration 0:   log likelihood =  89.876486
Iteration 1:   log likelihood =  89.962663
Iteration 2:   log likelihood =  90.093597
Iteration 3:   log likelihood =   90.13244
Iteration 4:   log likelihood =  90.150017
(switching optimization to BFGS)
Iteration 5:   log likelihood =  90.165012
Iteration 6:   log likelihood =  90.285192
Iteration 7:   log likelihood =  90.294281  (backed up)
Iteration 8:   log likelihood =  90.444929
Iteration 9:   log likelihood =  90.606648
Iteration 10:  log likelihood =  90.650917
Iteration 11:  log likelihood =  90.806162
Iteration 12:  log likelihood =  91.048567
BFGS stepping has contracted, resetting BFGS Hessian (0)
Iteration 13:  log likelihood =  91.197187
Iteration 14:  log likelihood =   91.21337  (backed up)
(switching optimization to BHHH)
Iteration 15:  log likelihood =  91.216049  (backed up)
Iteration 16:  log likelihood =  91.314414
Iteration 17:  log likelihood =  91.316393
Iteration 18:  log likelihood =  91.317701
Iteration 19:  log likelihood =  91.320656
(switching optimization to BFGS)
BFGS stepping has contracted, resetting BFGS Hessian (1)
Iteration 20:  log likelihood =  91.320666
Iteration 21:  log likelihood =  91.320669  (backed up)
Iteration 22:  log likelihood =   91.32067  (backed up)
Iteration 23:  log likelihood =  91.320671  (backed up)
Iteration 24:  log likelihood =  91.320672  (backed up)
BFGS stepping has contracted, resetting BFGS Hessian (2)
Iteration 25:  log likelihood =  91.320679
Iteration 26:  log likelihood =  91.320679  (backed up)
Iteration 27:  log likelihood =  91.320679  (backed up)
Iteration 28:  log likelihood =  91.320679  (backed up)
Iteration 29:  log likelihood =  91.320679
```

Source: Researcher STATA Computation Data, 2025

Log-Likelihood and Optimization:

An ARCH(1) specification for d_lnGDP, with d2_lnDOD and d_lnEXD in the mean equation, converged to a stable maximum likelihood value (log-likelihood = 91.320679), indicating a well-identified model. The ARCH structure implies time-varying conditional variance in d_lnGDP, consistent with volatility clustering whereby high-volatility periods tend to follow high-volatility periods. Under this specification, inference on mean coefficients is conducted with standard errors that account for heteroskedasticity generated by the ARCH process.

In academic terms, the result supports modeling growth fluctuations with a conditional variance process rather than a constant-variance assumption. The implication is that short-run risk around d_lnGDP is state-dependent; consequently, the estimated conditional variance series provides an informative measure of macroeconomic turbulence across the sample, while improving the reliability of hypothesis tests relative to homoskedastic alternatives.

Table 4.13: Arch Family Regression

ARCH family regression

Sample: 1995 - 2023 — Number of obs = 29
Distribution: Gaussian — Wald chi2(2) = 21.50
Log likelihood = 91.32068 — Prob > chi2 = 0.0000

d_lnGDP	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
d_lnGDP						
d2_lnDOD	-.0074441	.0016295	-4.57	0.000	-.0106378	-.0042503
d_lnEXD	.0118675	.0029943	3.96	0.000	.0059987	.0177362
_cons	.0641232	.0008807	72.81	0.000	.0623972	.0658493
ARCH						
arch						
L1.	1.778851	.9445939	1.88	0.060	-.072519	3.630221
_cons	6.30e-06	7.93e-06	0.79	0.427	-9.25e-06	.0000218

Source: Researcher STATA Computation Data, 2025

The results presented in Table 4.13 Mean equation. Under a Gaussian ARCH(1) specification for d_lnGDP over 1995–2023 (N=29), the regressors are jointly significant (Wald $chi^2(2)=21.50$, $p=0.000$). The coefficient on d2_lnDOD is negative and highly significant ($\beta=-0.00744$, $z=-4.57$, $p<0.001$), indicating that an acceleration in domestic-debt growth is associated with a reduction in real GDP growth. Interpreted in semi-elasticity terms, a 1 percentage-point increase in the growth rate of domestic debt (i.e., a 0.01 increase in d2_lnDOD) corresponds to roughly a 0.744 percentage-point decline in d_lnGDP. The coefficient on d_lnEXD is positive and highly significant ($\beta=0.01187$, $z=3.96$, $p<0.001$), implying that higher external-debt growth is associated with higher GDP growth; a 10% rise in external debt (d_lnEXD ≈ 0.10) corresponds to an increase in GDP growth of about 0.119 percentage points. The constant term (0.0641, $p<0.001$) indicates an average real GDP growth rate of roughly 6.4% per annum over the sample.

Variance equation and volatility dynamics. The ARCH(1) parameter on lagged squared residuals is large ($\alpha_1=1.779$, $z=1.88$, $p=0.060$), suggesting pronounced volatility clustering and very high persistence in growth volatility; the variance intercept is small and not significant ($\omega \approx 6.3\times10^{-6}$, $p=0.427$). An ARCH coefficient above unity raises concerns about covariance-stationarity of the conditional variance in a pure ARCH(1) specification (since $E[\varepsilon_t^2]$ exists only if $\alpha_1<1$.

The ARCH family estimates indicate (i) a statistically strong negative short-run association between domestic-debt acceleration and GDP growth, (ii) a statistically strong positive association between external-debt growth and GDP growth, and (iii) time-varying and highly persistent growth volatility requiring a richer conditional

variance model for strictly stationary volatility and robust inference.

4.3.10 Johansen Cointegration Test

The test uses two statistics: trace statistics and the maximum eigenvalue statistic, which help determine the number of cointegrating relationships in the system.

Table 4.14: Cointegration Test

Johansen tests for cointegration

Trend: constant — Number of obs = 27
Sample: 1997 - 2023 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	12	62.23698	.	43.4008	29.68
1	17	72.592594	0.53563	22.6896	15.41
2	20	81.582425	0.48620	4.7099	3.76
3	21	83.937376	0.16007		

Source: Researcher STATA Computation Data, 2025

Table 4.14; The Johansen cointegration test was conducted to determine whether a long-run equilibrium relationship exists among the variables Gross Domestic Product (GDP), Domestic Debt (DOD), and External Debt (EXD) covering the period from 1997 to 2023. The test results revealed that the trace statistics at ranks 0, 1, and 2 were greater than their corresponding 5% critical values, indicating rejection of the null hypothesis of no cointegration at each level. This confirms the existence of at least three cointegrating equations among the variables.

The findings indicate a strong long-run relationship among GDP, domestic debt, and external debt. Although the variables may individually be non-stationary, they tend to move together over time, suggesting a structural link in the long run. This outcome implies that changes in domestic and external debt levels significantly influence the long-term trajectory of economic growth in Tanzania.

Economically, the presence of cointegration supports the Keynesian and Debt Overhang theories, which emphasize that borrowing can stimulate growth up to an optimal level, beyond which excessive debt may constrain economic performance. The results highlight that in the short run, debt variations may temporarily disrupt economic growth, but the system eventually returns to equilibrium through policy adjustments.

Overall, the results confirm that GDP, domestic debt, and external debt are cointegrated, signifying a stable long-run relationship among them. This finding underscores the importance of maintaining a sustainable debt structure and implementing prudent fiscal and monetary policies to ensure that public borrowing continues to support long-term economic growth in Tanzania.

4.3.11 Vector Error Correction Model

The Vector Error Correction Model (VECM) was estimated to capture both the short-run dynamics and long-run equilibrium relationships among economic growth (GDP), domestic debt (DOD), and external debt (EXD) for the period 1997–2023. The model was selected based on information criteria, with an Akaike Information Criterion (AIC) value of -4.5617, indicating a good model fit.

Table 4.15: Vector Error Correction Model

Vector error-correction model

Sample: 1997 - 2023		Number of obs	= 27
		AIC	= -4.561661
Log likelihood = 81.58243		HQIC	= -4.276239
Det(Sigma_ml) = 4.77e-07		SBIC	= -3.601782

Equation	Parms	RMSE	R-sq	chi2	P>chi2
D_d_lnGDP	6	.009877	0.2187	5.878965	0.4369
D_d2_lnDOD	6	.421524	0.6240	34.85178	0.0000
D_d_lnEXD	6	.275631	0.5720	28.0698	0.0001

Source: Researcher STATA Computation Data, 2025.

The results in **Table 4.15** show that the equation for changes in GDP (D_d_lnGDP) has an R-squared value of 0.2187 and a chi-square probability of 0.4369, suggesting that approximately 21.9% of short-term variations in economic growth are explained by the explanatory variables. However, the probability value indicates that the short-run relationships are statistically insignificant for GDP. This implies that, in the short run, changes in public debt components do not have a significant immediate impact on economic growth.

In contrast, the equations for domestic debt (D_d2_lnDOD) and external debt (D_d_lnEXD) show R-squared values of 0.6240 and 0.5720, respectively, with highly significant chi-square statistics ($p = 0.0000$ and $p = 0.0001$). These results suggest that short-term variations in domestic and external debt are strongly influenced by their past values and the dynamics captured in the model. This indicates the presence of short-run adjustments in debt levels as the system moves toward restoring long-run equilibrium.

Overall, the VECM results reveal that while short-run changes in domestic and external debt respond significantly to previous shocks and disequilibria, the short-run impact on GDP is limited. The evidence supports the existence of long-run cointegrating relationships observed in the Johansen test, confirming that public debt dynamics and economic growth in Tanzania are interconnected over time, with meaningful long-run adjustments rather than short-run effects dominating the relationship.

Table 4.16: Short – Run Dynamics

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_d_lnGDP						
_ce1						
L1.	.1238418	.152473	0.81	0.417	-.1749999	.4226834
_ce2						
L1.	.0094353	.0077752	1.21	0.225	-.0058037	.0246744
d_lnGDP						
LD.	-.4368679	.2338631	-1.87	0.062	-.8952313	.0214954
d2_lnDOD						
LD.	-.0024703	.0052468	-0.47	0.638	-.0127538	.0078132
d_lnEXD						
LD.	-.0004409	.0078385	-0.06	0.955	-.0158042	.0149224
_cons	.0004374	.0019031	0.23	0.818	-.0032926	.0041674
D_d2_lnDOD						
_ce1						
L1.	-23.76579	6.507126	-3.65	0.000	-36.51952	-11.01206
_ce2						
L1.	-1.445864	.331823	-4.36	0.000	-2.096225	-.7955025
d_lnGDP						
LD.	17.18019	9.980631	1.72	0.085	-2.381487	36.74187
d2_lnDOD						
LD.	.150708	.2239172	0.67	0.501	-.2881617	.5895777
d_lnEXD						
LD.	-.2213485	.3345274	-0.66	0.508	-.8770102	.4343132
_cons	2.54e-06	.0812198	0.00	1.000	-.1591854	.1591905
D_d_lnEXD						
_ce1						
L1.	3.486078	4.254947	0.82	0.413	-4.853465	11.82562
_ce2						
L1.	-.2638027	.2169758	-1.22	0.224	-.6890676	.1614621
d_lnGDP						
LD.	3.802847	6.526238	0.58	0.560	-8.988344	16.59404
d2_lnDOD						
LD.	.2022525	.1464173	1.38	0.167	-.0847202	.4892251
d_lnEXD						
LD.	.1426584	.2187442	0.65	0.514	-.2860724	.5713893
_cons	1.75e-06	.0531089	0.00	1.000	-.1040897	.1040932

Source: Researcher STATA Computation Data, 2025.

The Vector Error Correction Model (VECM) results in **Table 4.16** present both the short-run dynamics and the long-run adjustments among the variables—economic growth (GDP), domestic debt (DOD), and external debt (EXD)—for the period 1997–2023. The coefficients of the error correction terms (_ce1 and _ce2) represent the long-run relationships, while the lagged differences capture the short-run adjustments.

In the GDP equation, both error correction terms (_ce1 and _ce2) are statistically insignificant, with p-values of 0.417 and 0.225, respectively. This implies that deviations from the long-run equilibrium do not significantly influence short-run changes in GDP. Similarly, the lagged domestic and external debt variables are insignificant, indicating that short-run fluctuations in public debt have little immediate effect on economic growth. However, the lagged dependent variable (d_lnGDP LD.) has a negative coefficient (-0.4369) and is marginally significant at the 10% level (p = 0.062), suggesting a weak short-run correction in economic growth toward equilibrium.

The domestic debt equation shows strong and significant error correction terms: _ce1 (-23.76579, p = 0.000) and _ce2 (-1.445864, p = 0.000). These negative and highly significant coefficients indicate a rapid adjustment of domestic debt toward the long-run equilibrium whenever disequilibrium occurs. This means domestic debt plays a crucial role in correcting deviations from the long-run path, confirming its sensitivity to both internal and external economic dynamics. The other short-run variables, including lagged GDP and EXD, are statistically insignificant, implying limited short-term interactions.

For the external debt equation, both error correction terms are statistically insignificant, indicating that external debt does not significantly adjust to restore long-run equilibrium in the short run. None of the short-run coefficients for GDP, domestic debt, or lagged external debt are significant, suggesting that external debt responds sluggishly to short-term shocks.

Overall, the results suggest that in the short run, changes in public debt components do not have a statistically significant immediate impact on economic growth. However, domestic debt exhibits strong adjustment behavior, indicating its importance in restoring long-run equilibrium within the system. These findings reinforce the evidence of long-run cointegration among the variables, implying that while short-term dynamics are weak, the long-run relationship between public debt and economic growth in Tanzania remains stable and significant.

Table 4.17: Long – Run Equilibrium

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	1	24.81075	0.0000
_ce2	1	12.23916	0.0005

Identification: beta is exactly identified

Johansen normalization restrictions imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
d_lnGDP	1	.	.	.	.	.
d2_lnDOD	0	(omitted)				
d_lnEXD	-.1567737	.0314741	-4.98	0.000	-.2184618	-.0950856
_cons	-.0424685	.	.	.	.	.
_ce2						
d_lnGDP	1.78e-15	.	.	.	.	.
d2_lnDOD	1	.	.	.	.	.
d_lnEXD	2.188465	.6255525	3.50	0.000	.9624047	3.414526
_cons	-.2293924	.	.	.	.	.

```
.
. ***Create the error correction term (residuals from cointegrating regression)****
. reg d_lnGDP d2_lnDOD d_lnEXD
```

Source	SS	df	MS		
Model	.000934625	2	.000467313	Number of obs	= 29
Residual	.003471429	26	.000133516	F(2, 26)	= 3.50
Total	.004406054	28	.000157359	Prob > F	= 0.0451
				R-squared	= 0.2121
				Adj R-squared	= 0.1515
				Root MSE	= .01155

d_lnGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
d2_lnDOD	-.0137091	.0053223	-2.58	0.016	-.0246493	-.0027689
d_lnEXD	.0121183	.0088488	1.37	0.183	-.0060706	.0303072
_cons	.0564955	.0023233	24.32	0.000	.05172	.061271

Source: Researcher STATA Computation Data, 2025.

The cointegrating equations establish the long-run relationships among economic growth (GDP), domestic debt (DOD), and external debt (EXD) for the period 1997–2023. The results in Table 4.17 show that both cointegrating equations (_ce1 and _ce2) are statistically significant at the 1% level, with chi-square statistics of 24.81 ($p = 0.0000$) and 12.24 ($p = 0.0005$), respectively. This confirms the presence of at least two stable long-run equilibrium relationships among the variables, consistent with the earlier Johansen test findings.

In the first cointegrating equation (_ce1), GDP is normalized to 1, while the coefficient of external debt (EXD) is negative and statistically significant (-0.1568, $p = 0.000$). The negative sign implies that increases in external debt are associated with a decline in economic growth in the long run. This finding aligns with the Debt Overhang theory, which suggests that excessive external borrowing can suppress growth by diverting resources away from productive investment toward debt servicing. The constant term (-0.0425) reinforces the negative long-run equilibrium effect, indicating that sustained high external debt may hinder the economy's capacity to grow.

In the second cointegrating equation (_ce2), domestic debt (DOD) is normalized to 1, while external debt (EXD) carries a positive and significant coefficient (2.188, $p = 0.000$). This positive relationship implies that an increase in external debt tends to be associated with a rise in domestic debt levels, indicating possible co-movement or interdependence between the two forms of public debt. The positive association could reflect a government borrowing strategy in which both domestic and external financing are used complementarily to meet fiscal needs.

The ordinary least squares (OLS) regression following the cointegration analysis further supports these findings. The regression of the differenced GDP on domestic and external debt shows that domestic debt has a negative and statistically significant coefficient (-0.0137, p = 0.016), while external debt remains positive but statistically insignificant (0.0121, p = 0.183). The R-squared value of 0.2121 indicates that approximately 21% of short-run variations in GDP are explained by changes in public debt. These results reinforce the notion that domestic debt exerts a more immediate negative effect on growth, while external debt's influence is more pronounced over the long term.

Overall, the cointegration and regression results confirm the existence of a long-run equilibrium relationship among economic growth, domestic debt, and external debt in Tanzania. External debt negatively affects growth in the long run, while domestic and external debts are positively linked, suggesting a coordinated fiscal borrowing pattern. The findings underscore the importance of maintaining a sustainable debt structure to ensure that borrowing continues to support, rather than constrain, long-term economic growth.

The estimated cointegrating regression provides insights into the long-run and short-run dynamics among economic growth (GDP), domestic debt (DOD), and external debt (EXD) for the period 1997–2023. The model reports an F-statistic of 2.50 with a probability value of 0.0862, indicating that the overall relationship is statistically weak at the 5% level but marginally significant at the 10% level. The R-squared value of 0.1017 suggests that approximately 10.2% of the variations in GDP growth are explained by the lagged changes in domestic debt, external debt, and the error

correction term (ECT).

Table 4.18: Estimated Error Correlation Model

Linear regression

Number of obs	= 26
F(3, 22)	= 2.50
Prob > F	= 0.0862
R-squared	= 0.1017
Root MSE	= .01037

L2D.d_lnGDP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
d2_lnDOD L2D.	-.0051514	.0024148	-2.13	0.044	-.0101593	-.0001435
d_lnEXD L2D.	.0009658	.0053649	0.18	0.859	-.0101602	.0120919
ect L1.	.0766172	.2050778	0.37	0.712	-.3486881	.5019226
_cons	.000375	.0020064	0.19	0.853	-.0037861	.0045361

Source: Researcher STATA Computation Data, 2025.

From Table 4.18, the coefficient of the lagged second difference of domestic debt (L2D.d2_lnDOD) is negative and statistically significant (-0.00515, p = 0.044), implying that an increase in domestic debt leads to a decline in economic growth in the long run. This finding indicates that excessive domestic borrowing may crowd out private investment and reduce productive capacity in the economy, supporting the crowding-out hypothesis and aligning with the Debt Overhang theory.

The coefficient of the lagged second difference of external debt (L2D.d_lnEXD) is positive but statistically insignificant (0.00097, p = 0.859), suggesting that changes in external debt have a negligible short-run effect on economic growth. This result implies that the benefits of external borrowing may take longer to materialize, as they depend on how efficiently borrowed funds are allocated to productive sectors.

The coefficient of the error correction term (ECT) is positive (0.0766) but statistically insignificant (p = 0.712), indicating a weak speed of adjustment toward

the long-run equilibrium. This means that deviations from the long-run relationship between debt and growth are corrected slowly over time, and short-term shocks have limited influence in bringing the system back to equilibrium.

Overall, the regression results suggest that domestic debt exerts a significant negative effect on economic growth, while external debt does not show a meaningful short-term impact. The insignificant error correction term implies that short-run adjustments toward the long-run equilibrium are sluggish. These findings reinforce the notion that the impact of public debt on growth in Tanzania is primarily long-term in nature, with domestic borrowing posing a potential constraint on economic performance if not properly managed.

Table 4.19: Long -run and short-run components

Regression with Newey-West standard errors — Number of obs = 26
maximum lag: 2 — F(7, 18) = 3.55
Prob > F = 0.0142

D.d_lnGDP	Coef.	Newey-West Std. Err.	t	P>|t|	[95% Conf.	Interval]
ect						
L1.	-.3680522	.1740505	-2.11	0.049	-.7337187	-.0023858
d_lnGDP						
LD.	-.0775351	.3068522	-0.25	0.803	-.7222076	.5671374
L2D.	.0906101	.2090575	0.43	0.670	-.3486033	.5298236
d2_lnDOD						
LD.	.0055426	.0025918	2.14	0.046	.0000975	.0109877
L2D.	.0024462	.004449	0.55	0.589	-.0069007	.0117932
d_lnEXD						
LD.	-.0024716	.0081877	-0.30	0.766	-.0196733	.0147301
L2D.	.0012841	.0040675	0.32	0.756	-.0072615	.0098297
_cons	.0012633	.0019115	0.66	0.517	-.0027526	.0052793

Source: Researcher STATA Computation Data, 2025.

The regression results estimated using the Newey-West standard errors provide evidence of both short-run dynamics and the adjustment process toward long-run equilibrium among economic growth (GDP), domestic debt (DOD), and external debt (EXD) over the period 1997–2023. The model has an F-statistic of 3.55 with a probability value of 0.0142, indicating that the overall regression is statistically significant at the 5% level.

The coefficient of the error correction term (ECT) in Table 4.19 is negative and statistically significant (-0.3681, p = 0.049), implying the presence of a stable long-run adjustment mechanism. This result suggests that approximately 36.8% of any disequilibrium from the previous period is corrected in the current period, confirming that the system gradually converges toward long-run equilibrium following short-run shocks. The significance and negative sign of the ECT validate the earlier Johansen test results, reinforcing the existence of a long-run relationship among GDP, domestic debt, and external debt. The coefficient of the lagged first difference of domestic debt (LD.d2_lnDOD) is positive and statistically significant (0.00554, p = 0.046), indicating that an increase in domestic debt positively influences economic growth in the short run. This finding implies that, within the short-term context, domestic borrowing may stimulate economic activity by financing productive investments and government spending. However, the second lag of domestic debt (L2D.d2_lnDOD) is insignificant, showing that this effect does not persist over multiple periods.

The coefficients of both the first and second lagged differences of external debt (LD.d_lnEXD and L2D.d_lnEXD) are statistically insignificant, suggesting that

changes in external debt do not exert a meaningful short-term impact on economic growth. Similarly, the lagged values of GDP (LD.d_lnGDP and L2D.d_lnGDP) are not significant, indicating limited short-run dependence on past growth performance.

Overall, the regression results indicate that the model is well-specified and that short-run dynamics exist primarily through domestic debt, which contributes positively to economic growth. The significant and negative error correction term confirms the presence of a long-run equilibrium relationship, with the system adjusting moderately toward equilibrium after disturbances. These findings imply that while domestic borrowing can promote short-term growth, sustainable economic performance depends on maintaining debt levels within manageable limits to support long-run stability in Tanzania's economy.

4.4 Presentation and Discussion of the Study Objectives

4.4.1 Trend and Growth Pattern of Tanzania's Public Debt Statistics Covering Both Domestic and External Debt from 1993 -2023

The analysis of Tanzania's public debt trend from 1993 to 2023 revealed a consistent upward path in both domestic and external debt components. The overall debt stock increased significantly, indicating increased government borrowing to finance fiscal deficits, infrastructure improvement, and public investment programs. External debt showed sharp expands during periods of economic reform and structural adjustment, particularly in the mid-2000s and after 2015, driven by concessional and non-concessional loans. Domestic debt also presented sustained growth, mainly through the issuance of Treasury bills and bonds to cover recurrent and development expenditures.

Although total public debt increased, the debt-to-GDP ratio remained within controllable levels during most of the period, indicating relative sustainability. However, the composition of debt moved gradually toward domestic borrowing, signaling growing reliance on internal sources to fund fiscal operations. These trends align with reports from the (BoT, 2023) which highlight that while external borrowing has supported infrastructure and social sector investments, domestic borrowing has primarily financed short-term fiscal needs. The findings suggest that Tanzania's debt structure has changed to balance between long-term development financing and short-term fiscal equilibrium, though maintaining sustainability remains a key policy priority.

4.4.1 Long-Run Equilibrium Relationship, Between, Domestic Debt, External debt, and GDP in Tanzania from 1993 -2023

The Johansen cointegration test results confirmed the existence of long-run equilibrium relationships among GDP, domestic debt, and external debt. The trace statistics exceeded the 5% critical values, indicating that the variables move together over time and are bound by stable long-term dynamics. The first cointegrating equation exposed a negative and significant coefficient of external debt with respect to GDP, suggesting that excessive external borrowing reduces long-term GDP. This finding supports the Debt Overhang theory, which asserts that high external debt burdens discourage investment and slow growth.

The second cointegrating equation showed a positive association between domestic and external debt, indicating fiscal interdependence in Tanzania's borrowing strategy. This result indicates that the government often uses both domestic and

external sources complementarily to finance its budgetary constraints. The evidence links with studies by (Reinhart & Rogoff, 2010) and the (MoF, 2023), which emphasize the importance of maintaining debt within sustainable bounds to avoid negative growth effects. Overall, the results affirm that Tanzania's public debt and GDP are cointegrated, indicating that economic growth and debt accumulation are connected through long-run equilibrium relationships.

4.4.2 Short Run Dynamics Relationship between, Domestic Debt, External Debt, and GDP in Tanzania from 1993 -2023

The Vector Error Correction Model (VECM) and VAR estimations showed that the short-run dynamics between public debt and GDP are generally weak, though important relationships occur. The results show that short-term fluctuations in domestic and external debt have limited instant impact on economic growth. However, the domestic debt equation exhibited a strong and significant error correction term, confirming that domestic debt adjusts quickly toward long-run equilibrium following short-run disturbances.

The estimated error correction coefficient of –0.368 ($p = 0.049$) implies that approximately 36.8% of disequilibrium is corrected each period, confirming a moderate speed of adjustment. This proves that while short-term shocks may briefly disrupt equilibrium, the system slowly returns to stability. Additionally, the lagged domestic debt variable had a positive and significant effect on GDP in the short run, implying that moderate levels of domestic borrowing may stimulate economic activity when directed toward productive sectors.

External debt, on the other hand, showed insignificant short-run coefficients, suggesting that its influence on economic growth is primarily long-term rather than immediate. These findings align with (Kasidi & Said, 2013) and (Lotto & Mmari, 2018), who observed that while external borrowing can support growth, its impact depends heavily on the efficiency of utilization and management. Hence, the short-run analysis highlights that domestic debt serves as a stabilizing mechanism for fiscal management, whereas external debt contributes more to long-term economic transformation.

4.4.2 Causal Relationships between, Domestic Debt, External Debt and GDP in Tanzania from 1993 -2023

The Granger Causality test results revealed several important directional relationships among the variables. The findings signal a unidirectional causality running from GDP to DOD ($p = 0.001$), indicating that higher economic growth leads to reduced reliance on domestic borrowing. This relationship indicates that improved fiscal capacity during growth periods allows the government to finance expenditures with fewer domestic debt instruments.

Furthermore, a weak causality was observed from DOD to EXD ($p = 0.057$), indicating a exchange effect between the two types of debt. This shows that when domestic borrowing becomes costly or constrained, the government may turn to external financing to bridge fiscal gaps. The joint causality test also showed that domestic and external debts together significantly cause GDP ($p = 0.006$), highlighting the linked significance of public debt components in influencing Tanzania's GDP trajectory.

However, no causality was found from GDP to EXD ($p = 0.927$), implying that external borrowing decisions are less driven by short-term economic performance and more by external financing conditions or policy frameworks. These results align with studies by (Panizza, 2008) and (S. Yusuf & Said, 2018)**,** which highlight that debt composition and management strategies influence the growth implications of public borrowing.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 Chapter Introduction

This chapter summarizes the main findings of the study, draws conclusions based on the analysis, and provides policy recommendations. It also highlights the implications of the findings for policymakers and researchers and suggests areas for further study.

5.2 Summary

The study conducted an empirical investigation into the relationship between public debt and economic growth in Tanzania over the period from 1993 to 2023, with a particular focus on the components of domestic and external debt. Utilizing a Vector Autoregressive (VAR) model, the research identified that public debt exerts a significant impact on GDP, although the effects vary between domestic and external debt. It was observed that external debt (EXD) exhibits a more volatile and less consistent relationship with economic growth compared to domestic debt (DOD). Furthermore, a long run cointegration relationship exists among GDP, DOD, and EXD, indicating a dynamic equilibrium over time. Shocks in public debt, particularly domestic debt, have notable implications for GDP growth, as evidenced by the variance decomposition and impulse response analysis.

5.3 Conclusion of the Study

The study aimed to examine the impact of public debt on economic growth in Tanzania from 1993 to 2023, focusing on domestic debt, external debt, and their short-run and long-run relationships with GDP. Using econometric techniques such

as the Johansen cointegration test, Vector Error Correction Model (VECM), and Granger causality analysis, the study provided comprehensive insights into how debt dynamics influence Tanzania's economic performance over the three-decade period. The analysis revealed a persistent upward trend in both domestic and external debt, reflecting increased borrowing to finance public investment and fiscal deficits. The Johansen cointegration test confirmed the existence of long-run equilibrium relationships among GDP, domestic debt, and external debt, implying that these variables are interlinked over time. The results showed that external debt has a negative and significant long-run effect on GDP, consistent with the Debt Overhang hypothesis, which suggests that excessive external borrowing constrains economic growth due to rising repayment burdens and reduced investor confidence.

In contrast, domestic debt exhibited a positive short-run impact on GDP, suggesting that moderate domestic borrowing supports short-term fiscal stability and stimulates economic activity. The VECM results further indicated that deviations from long-run equilibrium are gradually corrected over time, with approximately 36.8 percent of disequilibrium adjusted annually. The causality analysis revealed unidirectional causality from GDP to domestic debt, signifying that periods of economic expansion reduce the need for domestic borrowing. Additionally, joint causality from domestic and external debts to GDP highlighted the combined influence of public debt on Tanzania's economic growth.

In summary, the findings demonstrate that while debt accumulation has played a critical role in financing Tanzania's development, the long-run implications of excessive borrowing, particularly external debt, may hinder sustainable growth if not

prudently managed. A balanced approach between domestic and external borrowing is therefore essential to ensure fiscal sustainability and long-term economic progress.

5.4 Recommendation and Policy Implications

Based on the findings, several recommendations and policy implications emerge for improving public debt management and fostering sustainable economic growth in Tanzania:

Enhance Productive Use of Borrowed Funds:

Public borrowing should be directed primarily toward projects that generate measurable economic returns, such as infrastructure, energy, and industrial development. Ensuring that loans finance productive investments will help generate sufficient revenue to service debt obligations without undermining fiscal stability.

Strengthen Debt Management Framework:

The government should enhance institutional capacity within the Ministry of Finance and the Bank of Tanzania to improve debt monitoring, risk assessment, and reporting systems. Strengthening these frameworks will promote transparency, accountability, and efficiency in managing both domestic and external debts.

Maintain Optimal Debt Composition:

Policymakers should maintain a balanced mix between domestic and external debt to minimize vulnerabilities associated with exchange rate fluctuations and interest rate shocks. Domestic borrowing should be expanded gradually but within sustainable limits to avoid crowding out private sector investment.

Promote Fiscal Discipline and Revenue Mobilization:

Enhancing domestic revenue collection through tax reforms, improved compliance,

and widening the tax base will reduce dependence on borrowing. Fiscal discipline and prudent expenditure management are essential to contain deficits and prevent unsustainable debt accumulation.

Develop a Comprehensive Debt Sustainability Strategy:

A medium-to-long-term debt management strategy should be adopted, integrating macroeconomic projections, borrowing limits, and repayment schedules. This strategy will ensure that debt remains within sustainable thresholds while supporting the goals of Tanzania's Development Vision 2025.

Leverage Concessional and Multilateral Financing:

Given the adverse long-term effects of non-concessional external borrowing, priority should be given to concessional loans with favorable terms. Collaboration with development partners can help secure financing that supports growth without imposing excessive repayment burdens.

Encourage Private Sector Participation in Development Financing:

Expanding public-private partnerships (PPPs) in infrastructure and productive sectors will reduce the government's direct borrowing needs while fostering efficiency and innovation in project implementation.

5.5 Area for Further Study

Although this study has provided valuable insights into the relationship between public debt and economic growth in Tanzania, several areas warrant further research:

Disaggregated Sectoral Analysis:

Future studies could examine the sectoral impact of public debt on key areas such as agriculture, manufacturing, and infrastructure to determine which sectors generate

the highest growth returns from borrowed funds.

Debt Threshold and Non-Linear Effects:

Further research could explore the existence of a specific debt threshold beyond which additional borrowing begins to harm growth, employing non-linear or threshold regression models.

Role of Institutional Quality and Governance:

Incorporating institutional and governance indicators would provide a deeper understanding of how transparency, corruption control, and public financial management influence the effectiveness of debt utilization.

External Shocks and Debt Sustainability:

Future analyses could integrate the effects of external shocks such as commodity price volatility, global interest rate changes, and exchange rate fluctuations on debt sustainability and growth performance.

Comparative Regional Analysis:

A comparative study of Tanzania with other East African Community (EAC) countries could provide regional perspectives on debt management practices and identify best-performing policy frameworks for replication.

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APPENDICES

Appendix 1: Raw Data used to process variables and Clearance Form

YEARS	GDP in TZS "000000"	DOD in TZS "000000"	EXD in TZS "000000"
1993	27652566.8	0.00032875	50071891.6
1994	28039701.6	0.0022592	54619455.6
1995	29039280.6	0.01496459	57427053.8
1996	30258158	0.1020334	62151774
1997	31261965.3	0.67403146	65170461.2
1998	32505623.2	4.63006096	71058622.8
1999	34048331.6	34.1521659	83197021.6
2000	35711077.8	216.758849	83815784.7
2001	37762654.1	1557.7542	37610890
2002	40467802	10456.4697	43871561.6
2003	43254506.5	71767.6688	70565365.7
2004	46640598.4	443353.913	77258559.8
2005	50077954.6	3121328.28	88593606.3
2006	53451896.3	21286263.9	79702911.4
2007	57272689	20585358.5	54370612
2008	60460828	25436488.3	77700817.6
2009	63715039	27528410.9	101279496
2010	67766605.8	36171446.4	134120070
2011	73123222.3	44794516.6	176456605
2012	76882497.1	54358021.5	194627502
2013	82466519	68095554.8	236777720
2014	88210423.1	85672975.8	291933140
2015	94349315.6	100903140	406098855
2016	100828393	117031583	449739922
2017	107657405	141537956	541786077
2018	115141329	171030506	948885584
2019	123196736	172404244	686685019
2020	129095844	187018250	723393895
2021	135478189	212610739	833698220
2022	141872730	290056539	925747689
2023	149129081	362190599	1051394270

Appendix 2: Correlation Coefficient Interpretation

Correlation Coefficient (r)	Strength of Correlation	Direction	Interpretation Example
$r = +1.00$	Perfect	Positive	A perfect linear relationship: as one variable increases, the other increases proportionally.
$r=-1.00$	perfect	Negative	A perfect linear relationship: as one variable increases, the other decreases proportionally.
$+0.70\leq r<+1.00$	Very Strong	Positive	A very strong positive relationship: high values in one variable strongly correspond to high values in the other.
$-1.00<r\leq-0.70$	Very Strong	Negative	A very strong negative relationship: high values in one variable strongly correspond to low values in the other.
$+0.50\leq r<+0.70$	Strong	Positive	A strong positive relationship: there is a consistent but not perfect increase in one variable when the other increases.
$-0.70<r\leq-0.50$	Strong	Negative	A strong negative relationship: there is a consistent but not perfect decrease in one variable when the other increases.
$+0.30\leq r<+0.50$	Moderate	Positive	A moderate positive relationship: variables have a noticeable relationship, but with more variability.
$-0.50<r\leq-0.30$	Moderate	Negative	A moderate negative relationship: there is a noticeable relationship with some variability; one variable tends to decrease when the other increases.
$+0.10\leq r<+0.30$	Weak	Positive	A weak positive relationship: a small association where increases in one variable are slightly related to increases in the other.
$-0.30<r\leq-0.10$	Weak	Negative	A weak negative relationship: a small association where increases in one variable are slightly related to decreases in the other.
$r\approx0.00$	None or very	None	No significant linear relationship between the variables; changes in one variable do not correspond with changes in the other.

Appendix 2: Stationarity Test

```
. dfuller lnGDP, lags(0)

Dickey-Fuller test for unit root                    Number of obs   =        30

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
———————————————————————————————————————————————————————————————————————————
 Z(t)             2.122            -3.716            -2.986           -2.624
———————————————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.9988


. gen d_lnGDP = D.lnGDP
(1 missing value generated)

. dfuller d_lnGDP , lags(0)

Dickey-Fuller test for unit root                    Number of obs   =        29

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
———————————————————————————————————————————————————————————————————————————
 Z(t)            -3.495            -3.723            -2.989           -2.625
———————————————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0081


. dfuller DOD, lags(1)

Augmented Dickey-Fuller test for unit root          Number of obs   =        29

                                 ———— Interpolated Dickey-Fuller ————
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
———————————————————————————————————————————————————————————————————————————
 Z(t)             3.156            -3.723            -2.989           -2.625
———————————————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 1.0000
```

YEARS	GDP	DOD	EXD
1993	27652566.8	0.00032875	50071891.6
1994	28039701.6	0.0022592	54619455.6
1995	29039280.6	0.01496459	57427053.8
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2020	129095844	187018250	723393895
2021	135478189	212610739	833698220
2022	141872730	290056539	925747689
2023	149129081	362190599	1051394270

Appendix 3: Clearance Letters

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

THE OPEN UNIVERSITY OF TANZANIA

Ref. No OUT/PG202186386 **27th July, 2024**

Permanent Secretary,

Ministry of Fnance,

P.O Box 2683,

DODOMA.

Dear Permanent Secretary,

RE: RESEARCH CLEARANCE FOR MR.THABIT MUSA BOMBWE REG NO: PG202186386

2. The Open University of Tanzania was established by an Act of Parliament No. 17 of 1992, which became operational on the 1st March 1993 by public notice No.55 in the official Gazette. The Act was however replaced by the Open University of Tanzania Charter of 2005, which became operational on 1stJanuary 2007.In line with the Charter, the Open University of Tanzania mission is to generate and apply knowledge through research.

3. To facilitate and to simplify research process therefore, the act empowers the Vice Chancellor of the Open University of Tanzania to issue research clearance, on behalf of the Government of Tanzania and Tanzania Commission for Science and Technology, to both its staff and students who are doing research in Tanzania. With this brief background, the purpose of this letter is to introduce to you **Mr.Thabit Musa Bombwe ,**

Reg.No:PG202186386), pursuing **Masters of Science in Economics** We here by grant this clearance to conduct a research titled " **Impact of Public Debt on Economic Growth in Tanzania 1993-2023** ". He will collect his data at your office from July 30th, 2024 to 30th Sept, 2024.

4. In case you need any further information, kindly do not hesitate to contact the Deputy Vice Chancellor (Academic) of the Open University of Tanzania, P.O.Box 23409, Dar es Salaam. Tel: 022-2-2668820.We lastly thank you in advance for your assumed cooperation and facilitation of this research academic activity.

Yours sincerely,

THE OPEN UNIVERSITY OF TANZANIA

Prof.Gwahula Raphael Kimamala

For: VICE CHANCELLOR

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

THE OPEN UNIVERSITY OF TANZANIA

Ref. No OUT/PG202186386 **27th July, 2024**

Director of Economics

National Bureau of Statistics ,

P.O Box 2683,

DODOMA.

Dear Director of Economics, ,

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THE OPEN UNIVERSITY OF TANZANIA

Prof.Gwahula Raphael Kimamala

For: VICE CHANCELLOR

Kinondoni Biafra, Kawawa Road; P.O 23409; Dar es Salaam; Tel: +255 22 2668 445;
E-Mail:vc@out.ac.tz|| Website:www.out.ac.tz

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

THE OPEN UNIVERSITY OF TANZANIA

Ref. No OUT/PG202186386 **27th July, 2024**

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Bank of Tanzania ,

P.O Box 2683,

DODOMA.

Dear Governor ,

RE: RESEARCH CLEARANCE FOR MR.THABIT MUSA BOMBWEREG NO: PG202186386

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Prof.Gwahula Raphael Kimamala

For: VICE CHANCELLOR