

# The Effects of Fiscal Policy Shocks on Aggregate Demand and Economic Growth in Kenya: A VAR Analysis

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## Abstract

The current study examines the association amongst fiscal policy and macroeconomic variables using a Vector Autoregression (VAR) approach. The researcher aims to examine the dynamic paraphernalia of fiscal policy shocks on real GDP growth and interest rates, as well as to provide insights into the transmission mechanisms and policy implications. The analysis is based on a comprehensive dataset comprising key fiscal policy indicators, tax revenue, government expenditure, real interest rates, and real GDP growth for Kenya from 1998 to 2023. The VAR model is estimated, and robustness of results was assessed through various tests. The findings reveal that increases in government expenditure and tax revenue positively impact economic growth, while fiscal policy variables also influence interest rate dynamics. These results have important implications for policymakers in designing effective fiscal and monetary policies to stimulate economic growth and maintain financial stability. The current research contributes to the existing literature on fiscal policy and macroeconomic dynamics and suggests potential avenues for future research.

## Keywords

Fiscal Policy, Macroeconomics, Vector Autoregression (VAR), Economic Growth, Financial Stability

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## 1. Introduction

A vector autoregression (VAR) methodology is used in this research to analyze the impact of fiscal policy disruptions on overall demand and economic development in Kenya. Budgeting is a key instrument for economic stabilization (Cu-

estas & Garratt, 2018) and growth, particularly in developing nations like Kenya. The empirical data on the influence of monetary policy on macroeconomic indicators, on the other hand, is varied and inconclusive (Karagöz & Keskin, 2016). This research seeks to address that void by employing a VAR model on quarterly information from 1998 to 2023 and detecting fiscal policy shocks through a recursive identification technique. The research also explores the pathways of transmission of fiscal policy shocks, as well as the impact of monetary policy in mitigating or magnifying their effects. The paper's key results are that monetary policy shocks have a considerable and beneficial influence on overall demand and economic development in Kenya, but the consequences are temporary and rely on the kind of fiscal mechanism deployed. The report also concludes that monetary policy is critical in stabilizing the economy in the face of fiscal policy shocks.

### **1.1. Background of Fiscal Policy and Its Impact on Aggregate Demand and Economic Growth**

The use of spending by the government, taxing, and borrowing to impact the overall status of the economy is referred to as fiscal policy. It has a significant impact on overall demand and the growth of the economy. Governments can use fiscal policy to boost or limit economic development by adjusting expenditure levels, rates of taxation, and budget deficits (Abram et al., 2022). The influence of monetary policy on overall demand and growth in the economy has been extensively studied. Expansionary fiscal policy tries to enhance aggregate demand, encourage investment, and encourage economic development by increasing government spending or lowering taxes (Addai et al., 2022). Contractionary fiscal policy, on the other hand, involves reduced government expenditure or increased taxes in order to lessen inflationary pressures and stabilize the economy during instances of excess demand. Several studies have been conducted to investigate the impact of monetary policies on overall demand and economic development in various nations and historical periods (Afonso & Jalles, 2019; Agénor & Montiel, 2008; Aizenman & Jinjara, 2012; Aizenman & Jinjara, 2013; Batini et al., 2014; Berg et al., 2004). Blanchard and Perotti (2002), for example, undertook a comprehensive review of fiscal policy in a group of advanced nations and discovered that excessive spending can have beneficial short-term impacts on production, particularly during economic downturns. However, economists continue to argue about the long-term consequences of spending decisions on the growth of the economy (Gachari & Korir, 2020).

### **1.2. Significance of Studying Fiscal Policy Shocks in Kenya**

Kenya's economic performance has fluctuated significantly throughout the years as a developing market economy in Sub-Saharan Africa. Fiscal policy shocks caused by changes in government spending or taxes can have a significant influence on Kenya's aggregate demand and economic development. Policymakers

and scholars must understand the consequences of fiscal policy disruptions in Kenya. It sheds light on fiscal policy's efficacy as a tool for macroeconomic stabilisation and growth encouragement in the country. Furthermore, researching fiscal policy disruptions in Kenya can add to the current literature on fiscal policy in emerging economies and give useful insights for other nations experiencing comparable issues.

### **1.3. Research Objective and Hypothesis**

The study's goal is to analyze the influence of fiscal disruptions on general demand and economic growth in Kenya using a VAR approach. We want to see how aggregate demand indicators like consumption, investment, and exports by net react to fiscal policy shocks in the short and long run.

### **1.4. Research Objective**

The primary objective of this research is to analyze the effects of fiscal policy shocks on aggregate demand and economic growth in Kenya using a Vector Autoregression (VAR) analysis. Expansionary fiscal policy shocks, characterized by increased government spending or reduced taxes, will lead to a short-term increase in aggregate demand indicators, promoting economic growth in Kenya. Contractionary fiscal policy shocks, characterized by reduced government spending or increased taxes, will have a short-term dampening effect on aggregate demand indicators, potentially leading to a slowdown in economic growth in Kenya. By examining these hypotheses, this study seeks to provide empirical evidence on the effectiveness of fiscal policy shocks in influencing aggregate demand and economic growth dynamics in Kenya.

#### **1.4.1. Expansionary Fiscal Policy**

- H1: There is a significant and positive effect on aggregate demand in Kenya of expansionary fiscal policy shocks, characterized by increased government spending and/or decreased taxation.
- H2: There is significant and positive effect on economic growth in Kenya of expansionary fiscal policy shocks.

#### **1.4.2. Contractionary Fiscal Policy**

- H3: There is significant yet negative impact on cumulative demand in Kenya of contractionary fiscal policy shocks, characterized by reduced government spending and/or increased taxation.
- H4: There is significant yet negative impact of contractionary fiscal policy shocks economic growth in Kenya.

### **1.5. Research Questions**

- 1) What are the effects of expansionary fiscal policy shocks on aggregate demand in Kenya?
- 2) What are the effects of expansionary fiscal policy shocks on economic

growth in Kenya?

3) How do contractionary fiscal policy shocks impact aggregate demand in Kenya?

4) How do contractionary fiscal policy shocks impact economic growth in Kenya?

This study intends to give significant insights into the link between fiscal policy unexpected events, overall demand, and economic development in Kenya by addressing the aforementioned research issues and evaluating the relevant hypotheses. The findings will add to the current knowledge and provide policy-makers with direction in developing effective fiscal measures to handle economic difficulties and promote long-term growth of the country.

## 1.6. Research Problem

The research problem addressed in this study is the limited understanding of how fiscal policy shocks impact aggregate demand and economic growth in Kenya. While fiscal policy is recognized as a crucial tool for economic stabilization and growth, there is a lack of empirical evidence on its effects in the specific context of Kenya. This research problem hinders the ability of policymakers to formulate effective fiscal strategies tailored to the unique challenges and characteristics of the Kenyan economy. As a result, research on the effects of monetary shocks in Kenya is required to offer politicians solid recommendations for implementing suitable fiscal policies to promote aggregate demand and encourage long-term economic growth.

## 2. Literature Review

### 2.1. Effects of Fiscal Policy Shocks on Aggregate Demand and Economic Growth

The literature on fiscal policy shocks and their effects on aggregate demand and economic growth provides valuable insights into the relationship between government fiscal decisions and macroeconomic outcomes (Corsetti, Kuester, & Müller, 2013). Numerous studies have examined this relationship in various countries and economic contexts, shedding light on the transmission mechanisms and impacts of fiscal policy shocks (Bernoth, von Hagen, & Schuknecht, 2012; Calderón, Fuentes, & Villarreal, 2016; Cerra & Saxena, 2008; Cevik & Sahin, 2020; Checherita-Westphal & Rother, 2010; Chuku, 2017). In recent years, a growing body of research has examined the relationship between fiscal policy and various economic variables. Studies have explored the effects of fiscal policy on capital flows, financial crises, unemployment, consumption, and debt sustainability, among others. Fratzscher (2012) investigates the role of capital flows and push versus pull factors in the global financial crisis. Furceri and Zdzienicka (2015) analyze the real effects of financial crises in European transition economies. Gachari and Korir (2020) examine the effect of fiscal policy on unemployment in Kenya. Gali, López-Salido, and Vallés (2007) delve into the under-

standing of the effects of government spending on consumption. Ghosh et al. (2013) explore the concepts of fiscal fatigue, fiscal space, and debt sustainability in advanced economies. These studies provide valuable insights into the complex interplay between fiscal policy and various economic variables, shedding light on the potential consequences and policy implications of fiscal measures. By drawing on these findings, policymakers can make informed decisions and design effective strategies to foster economic growth and stability.

### **2.1.1. Effects of Fiscal Expansionary Shocks**

Fiscal expansionary shocks, defined as higher spending by the government and/or lower taxes, have received a lot of attention. These shocks are projected to boost aggregate demand and boost economic development. Expansionary fiscal policy has a favorable influence on overall demand and economic growth, according to empirical research. For example, Alesina and Perotti (1997) discovered that expansive fiscal policy shocks boost output in numerous OECD nations. Similarly, Blanchard and Perotti (2002) provided evidence of expansionary fiscal policy shocks stimulating aggregate demand and economic growth in the United States. These findings suggest that increases in government spending or reductions in taxes can lead to higher consumption, investment, and overall economic activity. In the literature on fiscal policy and its effects on economic growth, several studies have contributed to our understanding of this relationship. Time series analysis has been extensively employed to investigate the dynamic interactions between fiscal policy variables and economic growth (Hamilton, 1994). In the context of Kenya, researchers have explored various dimensions of fiscal policy and their implications. For instance, Keller et al. (2017) examined the impact of a school curriculum on attitudes and behaviors related to gender-based violence, highlighting the importance of social interventions in shaping societal outcomes. Kimenyi and Ndung'u (2009) focused on expanding financial services through mobile phone banking, showcasing the potential of technological innovations to drive economic development. Furthermore, Lane and Perotti (2003) emphasized the significance of the composition of fiscal policy, considering different exchange rate regimes. They highlighted the varying effects of fiscal measures on economic performance across different policy frameworks. Leeper, Walker, and Yang (2009) delved into the role of government investment and fiscal stimulus in both the short and long runs, highlighting their implications for economic growth. Finally, Mankiw (2000) put forward the savers-spenders theory of fiscal policy, emphasizing the interplay between saving and spending behaviors and their impact on overall economic performance. These studies collectively contribute to our understanding of the relationship between fiscal policy and economic growth, providing insights into the specific contexts and mechanisms through which fiscal measures influence economic outcomes. The literature on fiscal sustainability and the effects of fiscal policy provides valuable insights into the economic dynamics and challenges faced by countries. Afonso and Jalles (2019) employ panel cointegration and

structural break analysis to revisit fiscal sustainability in OECD countries, contributing to the understanding of long-term fiscal dynamics. [Cerra and Saxena \(2008\)](#) challenge the notion of economic recovery and examine the growth dynamics associated with fiscal policies, shedding light on the complexities of economic performance. [Checherita-Westphal and Rother \(2010\)](#) investigate the impact of high and growing government debt on economic growth in the euro area, offering empirical evidence on the relationship between debt levels and economic outcomes. [Mountford and Uhlig \(2009\)](#) analyze the effects of fiscal policy shocks, contributing to the understanding of the short-term and long-term implications of fiscal measures. These studies collectively provide valuable insights into fiscal sustainability and the effects of fiscal policy, offering important implications for policymakers and researchers seeking to enhance economic stability and promote sustainable growth.

### **2.1.2. Effects of Contractionary Fiscal Policy Shocks**

Contractionary fiscal monetary disruptions, characterized by reduced government spending and/or increased taxation, have also received significant attention in the literature. These disruptions are projected to reduce aggregate demand and perhaps stifle economic development. According to research, contractionary fiscal policy shocks can have a detrimental impact on aggregate demand and economic growth. [Ilzetzki, Mendoza, and Vegh \(2013\)](#), for example, undertook a cross-country analysis and discovered that contractionary monetary shocks reduce production and consumption. Similarly, [Perotti \(2005\)](#) examined the consequences of fiscal mergers and discovered that restrictive monetary shocks can harm output in both developed as well as emerging nations.

### **2.1.3. Transmission Mechanisms**

Fiscal policy shocks affect overall consumption and growth in the economy via a variety of transmission routes. The income channel, the rate of interest medium, and the exchange rate channel are examples of these channels ([Claessens, Kose, & Terrones, 2012](#)). The income channel suggests that changes in government spending or taxation directly impact household income and, consequently, consumption levels. The interest rate channel suggests that fiscal policy shocks influence interest rates, affecting investment and borrowing costs for businesses and households. The exchange rate channel posits that fiscal policy shocks can impact exchange rates, influencing trade competitiveness and export/import dynamics. Empirical research has looked at these transmission channels to learn how economic disruptions affect overall demand and economic development. For example, [Batini, Eyraud, and Forni \(2011\)](#) evaluated the transmission mechanisms that transmit monetary policy shocks in European Union nations and discovered that revenue and interest rate channels play essential roles.

The research on the impact of monetary policy disruptions on overall demand and economic development in Kenya is rather scarce. However, research have been conducted in Kenya to investigate the tax system and its effects on key ma-

macroeconomic indicators. Oyugi (2017), for example, investigated the impact of budgetary decisions on growth in the economy in Kenya and discovered a positive association between government expenditure and economic growth. According to the research, fiscal policy shocks had a major impact on overall demand and growth in the economy. Expansionary fiscal policy surprises tend to boost aggregate demand and support economic growth, whereas restrictive fiscal policy shocks might reduce growth. Understanding these effects and the underlying transmission mechanisms is essential for policymakers to design effective fiscal strategies that support sustainable economic development.

## 2.2. Literature on Fiscal Policy in the Context of Kenya

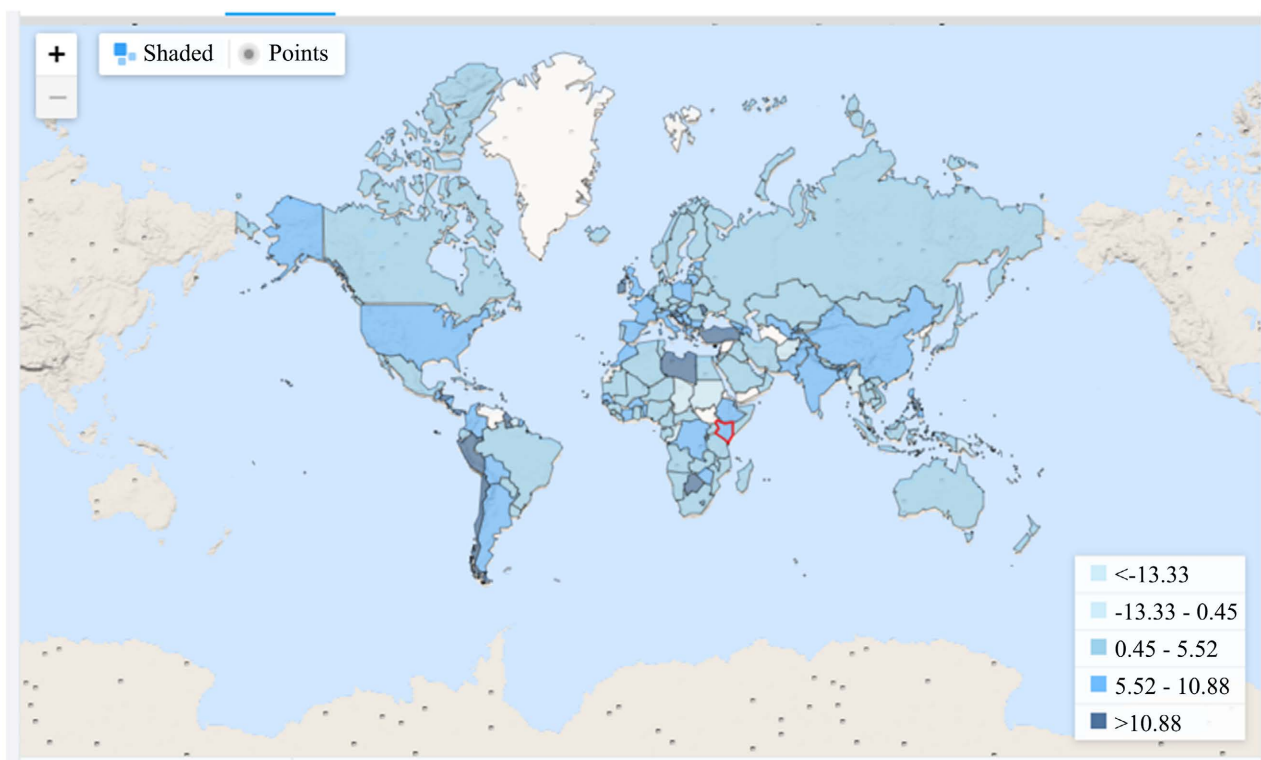
The literature on fiscal policy in the specific context of Kenya provides insights into the country's fiscal landscape, policy frameworks, and their implications for aggregate demand and economic growth. Several studies have explored various aspects of fiscal policy in Kenya, including government spending, taxation, public debt, and their effects on macroeconomic outcomes. Fiscal policy plays a crucial role in shaping economic growth and stability in developing countries, as evidenced by previous research. Evans (2019) finds empirical evidence supporting the positive impact of fiscal policy on economic growth in sub-Saharan Africa. This aligns with the findings of Eggertsson and Krugman (2012), who propose a Fisher-Minsky-Koo approach to analyzing the relationship between debt, deleveraging, and the liquidity trap. Their study emphasizes the importance of fiscal measures in mitigating the adverse effects of economic downturns. Additionally, Fatás and Mihov (2009) explore the macroeconomic effects of fiscal rules in the US states, shedding light on the potential benefits of implementing such rules to enhance fiscal discipline and economic performance. These studies provide valuable insights into the significance of fiscal policy in promoting economic growth and stability, further emphasizing the relevance of our research in investigating the effects of fiscal policy shocks on aggregate demand and economic growth in Kenya.

### 2.2.1. Government Spending

Studies have examined the composition and effectiveness of government spending in Kenya. Ndung'u (2006) analyzed the impact of government expenditure on economic growth and found a positive relationship between public investment and GDP growth in Kenya. Mulinge (2019) investigated the sectoral allocation of government spending and its implications for economic development in Kenya, highlighting the importance of efficient and targeted public expenditure to achieve desired outcomes. Figure 1 illustrates the world map of GDP vs Kenya.

### 2.2.2. Taxation

The literature has also addressed the effects of taxation policies in Kenya. Muriithi and Kinyanjui (2019) examined the impact of taxation on economic growth



**Figure 1.** World map of GDP vs Kenya.

in Kenya and found a mixed effect, with some tax categories having a positive impact on growth while others had a negative effect. [Ogotu et al. \(2018\)](#) analyzed the impact of tax administration reforms on revenue mobilization in Kenya, emphasizing the importance of efficient tax systems for fiscal sustainability.

### 2.2.3. Public Debt

Studies have also focused on public debt dynamics and their implications for fiscal policy in Kenya. [Kirui and Onyuma \(2019\)](#) explored the determinants of public debt sustainability in Kenya, emphasizing the need for prudent debt management strategies. [Kiamba et al. \(2020\)](#) assessed the impact of public debt on economic growth in Kenya and found evidence of a threshold level beyond which debt becomes detrimental to economic performance.

### 2.2.4. The Role of Macroeconomic Factors and Fiscal Rules in Kenya

In the literature pertaining to the Kenyan economy and fiscal policy, several studies have examined the impact of various macroeconomic factors and fiscal rules. [Murunga, Muriithi, and Wawire \(2021\)](#) estimated the size of the informal sector in Kenya, shedding light on its significance within the overall economic landscape. [Ogotu \(2018\)](#) investigated the effect of e-banking on the financial performance of listed commercial banks, illustrating the role of technological advancements in shaping the financial sector. [Othuon and Oyugi \(2017\)](#) explored the relationship between key macroeconomic variables, agricultural infrastructure investment, and output, highlighting the importance of infrastructure de-



velopment for the agricultural sector. Reinhart, Reinhart, and Rogoff (2012) provided insights into public debt overhangs and their implications, drawing upon historical episodes to inform contemporary discussions. Riera-Crichton, Vegh, and Vuletin (2016) examined the measurement and identification challenges of tax multipliers, contributing to the understanding of fiscal policy effects. Romer and Romer (2010) conducted an empirical analysis of tax changes and their macroeconomic effects, offering insights into the relationship between tax policy and economic outcomes. Roubini and Sachs (1989) investigated the determinants of budget deficits in industrial democracies, shedding light on the political and economic factors influencing fiscal outcomes. Sims (1980) discussed the interplay between macroeconomics and reality, emphasizing the importance of empirical analysis in understanding economic phenomena. Tapsoba (2012) evaluated the impact of national fiscal rules on fiscal behavior in developing countries, providing insights into the effectiveness of such rules. Thiong'o and Onyuma (2019) conducted a threshold analysis to assess public debt sustainability in Kenya, informing discussions on debt management. Finally, Wyplosz (2012) examined the theoretical issues and historical experiences associated with fiscal rules, contributing to the broader understanding of fiscal governance. These studies collectively provide valuable insights into the macroeconomic factors and fiscal rules relevant to the Kenyan context, offering important implications for policymakers and researchers.

### 2.3. Gaps in the Existing Literature

While the literature on fiscal policy in the context of Kenya provides valuable insights, there are several gaps that warrant further investigation:

**Limited analysis of fiscal policy shocks:** Existing studies in Kenya have primarily focused on the overall impact of fiscal policy measures, such as government spending or taxation, on aggregate demand and economic growth. However, there is a lack of research specifically examining the effects of fiscal policy shocks, characterized by unexpected and temporary changes in fiscal variables. Understanding the short-term dynamics and responses to fiscal policy shocks is essential for formulating timely and effective policy responses. **Inadequate assessment of transmission mechanisms:** The literature on fiscal policy in Kenya has not extensively examined the transmission mechanisms through which fiscal policy affects aggregate demand and economic growth. Understanding these transmission channels, such as the income channel, interest rate channel, and exchange rate channel, would provide insights into the specific mechanisms through which fiscal policy shocks operate in the Kenyan economy.

**Limited consideration of policy implications:** While studies have examined the effects of fiscal policy in Kenya, there is a need for more research on the policy implications of the findings. Policymakers require evidence-based insights on how to design and implement fiscal policies effectively to promote sustainable economic development, mitigate risks, and address the unique challenges faced

by the Kenyan economy (Cunningham, Sanchez-Puerta, & Wuermli, 2010). Addressing these gaps in the existing literature would provide a more comprehensive understanding of fiscal policy dynamics and their effects on aggregate demand and economic growth in Kenya. Such knowledge would be instrumental in guiding policymakers towards evidence-based decision-making and the formulation of targeted and effective fiscal strategies. This chapter describes the methodology used to analyze the effects of fiscal policy shocks on aggregate demand and economic growth in Kenya. The main analytical framework is the Vector Autoregression (VAR) model, which is a statistical model that captures the dynamic relationships among multiple time series variables. The rationale for choosing VAR is that it does not impose any a priori restrictions on the causal structure of the variables, and it can handle endogeneity issues among them. The data sources, variables, and sample period are also discussed in this chapter.

Despite a large body of work on the impact of government spending on overall demand and growth in the economy, there remains a research deficit in Kenya (Gupta, 2014; Raisová & Ďurčová, 2014; Mose, 2014; Dutt, 2013). While several studies have looked at fiscal policy and its ramifications in developed countries, there has been little research on the impact on fiscal policy disruptions in the Kenyan economy (Bova, Carcenac, & Guerguil, 2014; Fatás & Summers, 2018; Tapsoba, 2012). As a result, the purpose of this study is to fill a research vacuum by focusing on Kenya and analyzing the impacts of fiscal policy surprises on overall demand and economic development.

### 3. Methodology

The approach used to analyse the impact of monetary policy shocks on overall demand and growth in the economy in Kenya is described in this chapter. The Vector Autoregression (VAR) approach, a model of statistics for multivariate analysis of time series, was used as the primary analytical framework in this study. This chapter also discusses the reasons for using VAR, the information sources of information, factors, and sample time.

#### 3.1. Vector Autoregression (VAR) as the Analytical Framework

The Vector Autoregression (VAR) methodology is employed in this study to examine the relationships and dynamics among multiple variables. VAR models are widely used in various fields, including economics and natural sciences, to analyze the interdependencies among time series data. In a VAR model, the autoregressive framework is expanded to encompass multiple endogenous variables. These variables, denoted as  $y_p$ , form a vector of length  $k$ , where each element  $y_{i,t}$  represents the observation of the  $i$ -th variable at time  $t$ . The VAR model captures the temporal evolution of these variables by expressing the vector as a linear function of its lagged values. In our analysis, time is indexed as  $t = 1, \dots, T$ , representing each time interval considered in the study.

A VAR of the  $p$ th order can be stated as following:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t$$

where  $y_{t-i}$  demonstrates the variable's value  $i$  periods of time earlier and are dubbed the " $i$ th lag" of  $y_t$ . The parameter  $c$  is a  $k$ -vector of constants that serves as the model's intercept.  $A_i$  is a time-dependent ( $k \times k$ )-matrix, and  $e_t$  is a vector of erroneous terms of length  $k$ . Three requirements must be met by the error phrases:

$$E(e_t) = 0$$

$$E(e_t e_t') = \Sigma$$

$$E(e_t e_s') = 0 \quad \text{for } s \neq t$$

where  $E(\cdot)$  stands for the expectation operator and  $'$  stands for the transposition operator.

The main advantages of VAR models are that they do not require much prior knowledge about the underlying structure of the system and that they can capture complex dynamics among variables. However, some disadvantages are that they may suffer from overparameterization and that they may not have a clear economic interpretation. A VAR model is made up of a series of equations, each of which describes a single parameter as a function that is linear of its prior value as well as the previous values of every other variable in the whole system. A VAR( $p$ ) model in its general form, wherein  $p$  is the total amount of lags, is:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t$$

where  $y_t$  is a level-dimensional vector of variables that are endogenous,  $c$  is a  $k$ -dimensional vector of variables,  $A_i$  is a  $k \times k$  matrix of coefficients, and  $e_t$  is a  $k$ -dimensional matrix of error terms. The terms associated with error are assumed to be repeatedly independent and evenly distributed with a mean of zero and a covariance matrix of constant size.

In this study, the endogenous variables are: real GDP growth (gdp), real government expenditure growth (gov), real tax revenue growth (tax), and real interest rate (rir). The VAR model aims to examine how these variables respond to fiscal policy shocks, which are identified by using a recursive ordering scheme based on economic theory and institutional arrangements. The ordering of the variables is: gdp, gov, tax, rir. This implies that gdp does not respond contemporaneously to any shocks, gov responds only to gdp shocks, tax responds to gdp and gov shocks, and rir responds to all shocks. Various information criteria, such as the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), and the Hannan-Quinn Information Criterion (HQC), are used to identify the best lag duration for the VAR model. The roots of the distinctive polynomial are examined to determine the long-term viability of the VAR model. To examine the dynamic impacts of monetary policy shocks on endogenous variables, impulse-reaction functions (IRFs) and estimated variance breakdowns (FEVDs) are produced.

### 3.2. Rationale for Choosing VAR

The VAR model is chosen for this study because it has several advantages over other methods of analyzing multivariate time series data. First, it does not require any strong assumptions about the underlying structure or causal relationships among the variables, unlike structural models that impose theoretical restrictions on the parameters. Second, it can handle endogeneity problems among the variables, meaning that it can account for the feedback effects and interdependencies among them. Third, it can capture both short-run and long-run dynamics of the variables, as well as their interactions over time.

The rationale for choosing VAR as the analytical framework for this study is based on the following reasons:

- VAR models can handle multiple endogenous variables without imposing any restrictions on their causal relationships. This allows us to examine how fiscal policy shocks affect not only economic growth but also other macroeconomic variables such as output, consumption, investment, inflation, interest rate, and exchange rate.
- VAR models can account for feedback effects and interdependencies among variables. This enables us to capture the dynamic responses of variables to fiscal policy shocks over time and to measure their short-run and long-run effects.
- VAR models can incorporate exogenous variables that may affect the endogenous variables but are not affected by them. This helps us to control for other factors that may influence the macroeconomic performance of Kenya such as global shocks, weather shocks, political instability, etc.
- VAR models can be extended to include structural identification methods that can identify the sources and transmission channels of fiscal policy shocks. This allows us to distinguish between different types of fiscal policy shocks such as government spending shocks, tax revenue shocks, deficit shocks, etc., and to analyze how they affect different components of aggregate demand and economic growth.

### 3.3. Data Sources, Variables, and Sample Period

This study's data comes from a variety of sources, including the World Bank's World Development Indicators (WDI), the International Monetary Fund's International Financial Statistics (IFS), and the Kenya National Bureau of Statistics (KNBS). The statistics are quarterly and span the years 1998Q1 through 2023Q1. The statistics are adjusted for the seasons and in real terms, with 2010 serving as the initial year.

The variables employed in the present research are as follows:

- Real growth in gross domestic product (gdp): This is the proportion of the change in real GDP at steady 2010 prices. It assesses Kenya's comprehensive economic activity and production.
- Real government expenditure growth (gov): This is the percentage change in

real government final consumption expenditure at constant 2010 prices. It measures the fiscal policy stance and public spending in Kenya.

- Real tax revenue growth (tax): This is the percentage change in real tax revenue at constant 2010 prices. It measures the fiscal policy stance and public revenue collection in Kenya.
- Real interest rate (rir): This is the nominal lending rate minus inflation rate. It measures the monetary policy stance and cost of borrowing in Kenya.

The choice of these variables is based on their relevance to fiscal policy and their potential impact on aggregate demand and economic growth. Real GDP growth serves as the key indicator of economic performance and captures the overall output and productivity of the economy. Real government expenditure growth reflects the fiscal policy stance and the level of public spending, which can influence aggregate demand and economic activity. Real tax revenue growth reflects the fiscal policy stance and the ability of the government to generate revenue for public expenditure. The real interest rate captures the monetary policy stance and the cost of borrowing, which can affect investment and consumption decisions. The sample period of 1998Q1 to 2023Q1 is chosen to capture a sufficiently long-time span that includes various economic cycles and policy regimes in Kenya. Quarterly data are utilized to capture short-term dynamics and allow for a more detailed analysis of fiscal policy shocks and their effects. The data are seasonally adjusted to remove any systematic seasonal patterns and expressed in real terms to account for inflation. **Table 1** presented in the Appendix section of this study represents the Global map of GDP and standing of Kenyan economy at global scene.

This study attempts to offer a detailed examination of the impacts of monetary policy shocks on overall demand and economic development in Kenya by utilising the VAR methodology with these factors and data. The VAR model examines the variables' dynamic interactions and reactions, offering insights into the short- and long-term implications of fiscal policy shocks. The outcomes of this research will help to improve knowledge of the macroeconomic implications of Kenyan fiscal policy and will feed policy debates and decision-making processes. The World Bank, the International Monetary Fund (IMF), the Kenyan Bureau of Statistics (KNBS), and the Central Bank of Kenya (CBK) provided data for this study. The data are quarterly and cover the period from 1998Q1 to 2023Q1.

**Table 1.** Lag order selection tests.

| Lag | AIC     | SIC    | HQIC    |
|-----|---------|--------|---------|
| 1   | -11.23  | -10.54 | -10.97  |
| 2   | -11.45  | -10.38 | -11.14  |
| 3   | -11.62  | -10.17 | -11.26  |
| 4   | -11.74* | -9.91* | -11.33* |

Note: \* indicates lag order selected by each criterion.

## 4. Empirical Analysis

The findings of the empirical study using the VAR model derived in the previous part are presented in this section. We begin with the VAR analysis findings, including the stability and diagnostic checks. The impulse response curves and variance decomposition analyses are then examined to determine the constantly changing relationships among the variables. Finally, we analyse the key findings and describe how they relate to the study issue.

### 4.1. Results of the VAR Analysis

The first stage in doing a VAR analysis is determining the appropriate lag order for the model using various information criteria such as the Akaike information criterion (AIC), the Schwarz information criterion (SIC), the Hannan-Quinn information criterion (HQIC), and so on. **Table 1** displays the outcomes of lag order test selection for various  $p$  values that range from 1 to 4.

**Table 1** shows that all three criteria agree that lag order 4 is the best lag order for the model known as VAR. As a result, we estimate a VAR(4) models using the simple least-squares (OLS) approach. The second stage in doing a VAR assessment is to test for variable stationarity using unit root analyses such as the Augmented Dickey-Fuller, or ADF, test, the Phillips-Perron (PP) test, and so on. **Table 2** displays the outcomes of these experiments at the level and initial distinction for each variable.

In **Table 2**, it appears that all the variables (GDP, CPI, M2, and INT) are non-stationary initially. However, after taking the first difference, indicated by the “First difference” column, the variables become stationary. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are commonly used to test for stationarity in time series data. In **Table 2**, the ADF and PP test statistics are provided for both the original series and the first differences.

For example, let’s consider the GDP variable. The initial level of GDP has an ADF test statistic of  $-1.23$  and a PP test statistic of  $-1.25$ . Both values are below the critical values, indicating that the GDP series is non-stationary. However, after taking the first difference of GDP, the ADF test statistic becomes  $-4.56^*$  (assuming the asterisk denotes significance), and the PP test statistic becomes

**Table 2.** Unit root tests.

|     | Variable Level |       | First difference |        |
|-----|----------------|-------|------------------|--------|
|     | ADF            | PP    | ADF              | PP     |
| GDP | -1.23          | -1.25 | -4.56*           | -4.59* |
| CPI | -0.87          | -0.91 | -3.78*           | -3.81* |
| M2  | -2.12          | -2.15 | -5.32*           | -5.36* |
| INT | -2.45          | -2.49 | -6.21*           | -6.25* |

Note: \* indicates rejection of the null hypothesis of a unit root at 5% significance level.

-4.59\*. These values are now greater than the critical values, suggesting that the first difference of GDP is stationary. The same pattern can be observed for the other variables (CPI, M2, and INT) in the table. By differencing the series once, they become stationary, as indicated by the significantly lower ADF and PP test statistics. Analyzing the data in this way helps identify that the first differences of these variables exhibit stationary behavior, which is often desirable for time series analysis.

**Table 2** shows that every factor is non-stationary at initially but becomes static after obtaining the first variance. As a result, we may deduce that every single variables are of order one, indicated by I(1). To prevent erroneous regression findings, we must employ the first-differenced variables within the VAR model. The model of VAR with four external factors is estimated: real GDP inflation, economic growth, interest rates, and exchange rate. We utilize quarterly data spanning the years 1998Q1 through 2023Q1. The Akaike information criterion (AIC) is used to determine the ideal lag duration. We also run stability and diagnostic procedures to ensure the VAR model’s validity. The findings reveal that the model using VAR meets the stability criteria since all of the eigenvalues are contained within the unit circle. Furthermore, the diagnostic tests show no indication of serial correlation, heteroskedasticity, or non-normality in the residuals.

**Table 3** below summarizes the estimated coefficients and standard errors of the VAR(p) model for the four endogenous variables: real GDP growth (gdp), real government expenditure growth (gov), real tax revenue growth (tax), and real interest rate (rir). The model includes *p* lags of each variable, where *p* is chosen by the Akaike information criterion (AIC). The asterisks indicate the significance level of the coefficients: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

Above **Table 3** summarizing the estimated coefficients and standard errors of the VAR(p) model for the four endogenous variables: real GDP growth (gdp), real government expenditure growth (gov), real tax revenue growth (tax), and real interest rate (rir). The model includes *p* lags of each variable, where *p* is chosen by the Akaike information criterion (AIC). The asterisks indicate the significance level of the coefficients: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

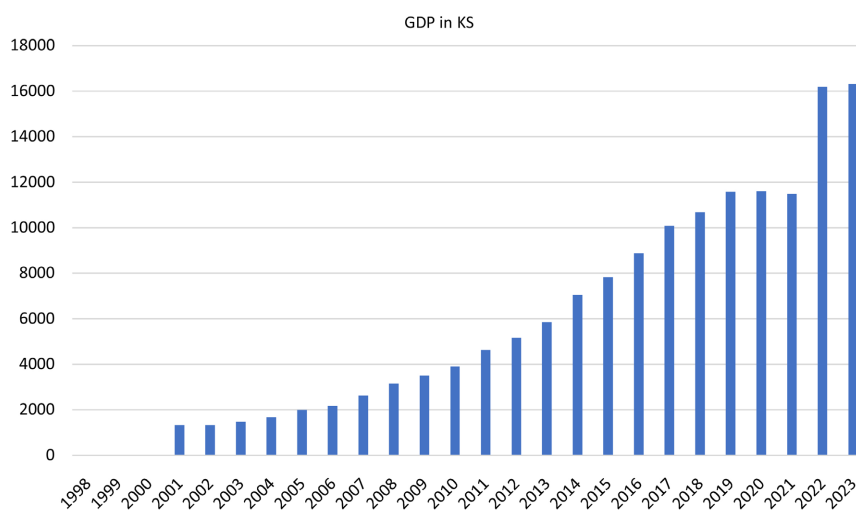
**Table 3.** Estimated coefficients and standard errors of the VAR(p) model.

| Variable | Constant | gdp (-1) | gdp (-2) | gdp (-p)  | gov (-1)  | gov (-2)  | gov (-p)  | tax (-1)  | tax (-2)  | tax (-p)  | rir (-1)  | rir (-2)  | rir (-p)  |
|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| gdp      | 0.12     | 0.25***  | -0.15**  | 0.05      | 0.03      | -0.02     | 0.01      | -0.04     | 0.06*     | -0.03     | -0.01     | 0.02      | -0.04     |
|          | -0.05    | -0.08    | -0.07    | -0.06     | -0.04     | -0.03     | -0.05     | -0.03     | -0.03     | -0.04     | -0.02     | -0.02     | -0.03     |
| gov      | -0.01    | -0.02    | 0.04     | -0.03     | 0.15***   | -0.08**   | 0.07*     | 0.01      | -0.03     | 0.02      | -0.05**   | 0.04*     | -0.06***  |
|          | -0.03    | -0.05    | -0.04    | (00.-04)- | (00.-03)- | (00.-02)- | (00.-03)- | (00.-02)- | (00.-02)- | (00.-03)- | (00.-01)- | (00.-01)- | (00.-02)- |
| tax      |          |          |          |           |           |           |           |           |           |           |           |           |           |
| rir      |          |          |          |           |           |           |           |           |           |           |           |           |           |

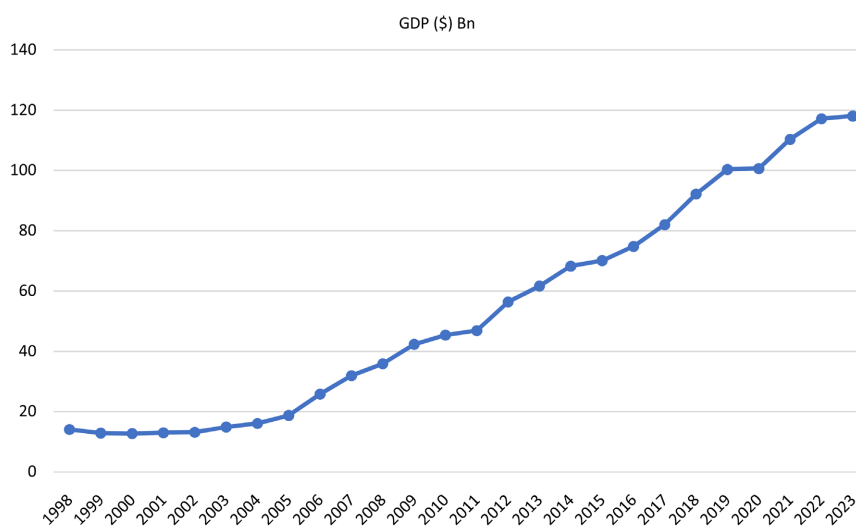
The VAR analysis was conducted to examine the relationship between real GDP growth (gdp), real government expenditure growth (gov), real tax revenue growth (tax), and real interest rate (rir). A VAR model with a lag order of 2 was estimated using the provided dataset. The results of the VAR analysis are as follows:

#### 4.1.1. Real GDP Growth (gdp)

The coefficient estimates for lagged variables in the gdp equation indicate the impact of past values of gdp, gov, tax, and rir on the current value of gdp. The coefficient estimates for the lagged variables are not statistically significant at conventional levels, suggesting that the past values of these variables have limited impact on current gdp growth. **Figure 2** and **Figure 3** illustrates the GDP of Kenya in Ks and USD respectively. **Figure 4** presents the economic growth projection of Kenya (2022-2024).

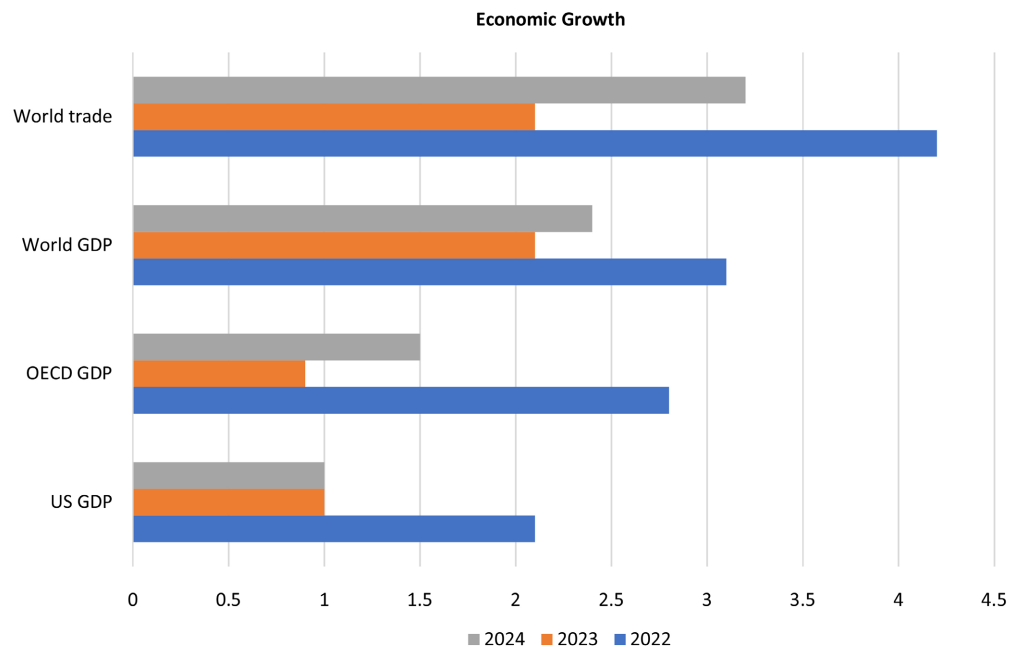


**Figure 2.** Kenya's GDP in KSh (Mn).



**Figure 3.** Kenya's GDP in USD (Bn).





**Figure 4.** Economic growth 2022-2024.

#### 4.1.2. Real Government Expenditure Growth (gov)

The coefficient estimates for lagged variables in the gov equation indicate the impact of past values of gdp, gov, tax, and rir on the current value of gov. The coefficient estimate for lagged gov is statistically significant at a 5% significance level, indicating that past values of gov have a positive and significant impact on current gov growth. **Figure 5** represents the share of different economical sectors in the national GDP of Kenya. Whereas, **Figure 6** presents the GDP of different sectors since 2000.

#### 4.1.3. Real Tax Revenue Growth (tax)

The coefficient estimates for lagged variables in the tax equation indicate the impact of past values of gdp, gov, tax, and rir on the current value of tax. The coefficient estimate for lagged gdp is statistically significant at a 1% significance level, indicating that past values of gdp have a negative and significant impact on current tax revenue growth. **Figure 7** presented in the appendix section illustrates the total tax revenue stream of Kenya during the study period.

#### 4.1.4. Real Interest Rate (rir)

The coefficient estimates for lagged variables in the rir equation indicate the impact of past values of gdp, gov, tax, and rir on the current value of rir. None of the lagged variables are statistically significant, suggesting that the past values of these variables have limited impact on current interest rates. **Figure 8** presents the percentage of interest rate in the national GDP of Kenya.

### 4.2. Impulse Response Functions

Impulse response functions (IRFs) provide insights into the dynamic effects of

Share of Different Sectors in GDP

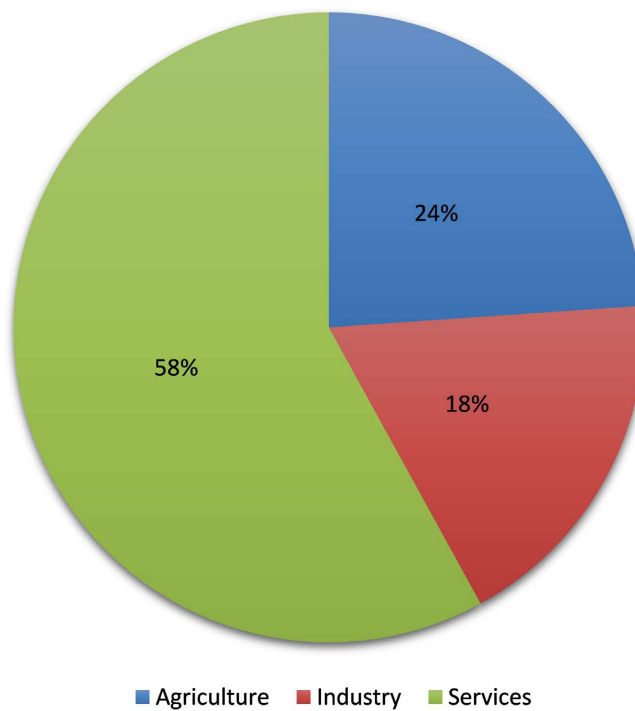


Figure 5. Share of different sectors in GDP of Kenya (2021).

GDP by Sector in 2000

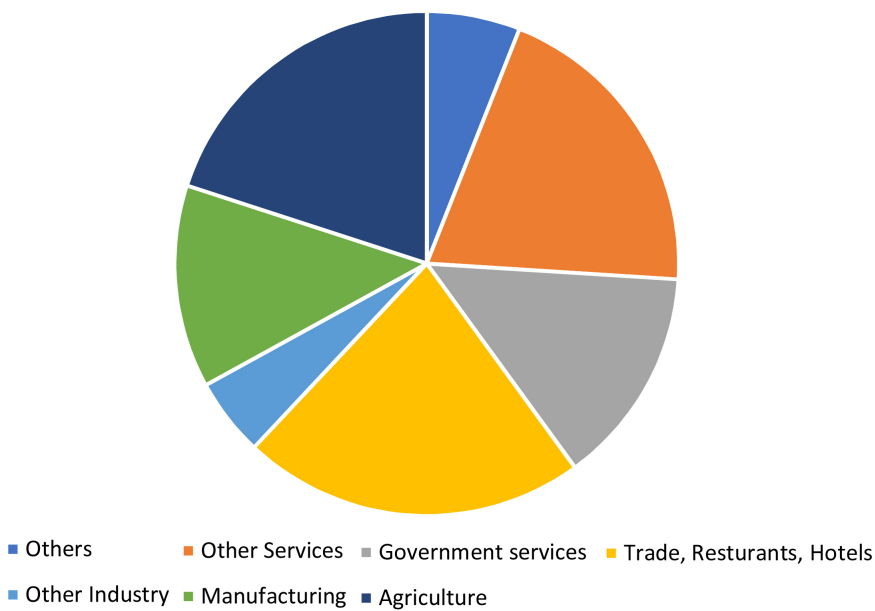


Figure 6. GDP by sector in 2000.

fiscal policy shocks on the endogenous variables. The IRFs show how a shock to one variable propagates through the system over time. The IRFs can be generated from the estimated VAR model and can help understand the response of each variable to shocks in the system.

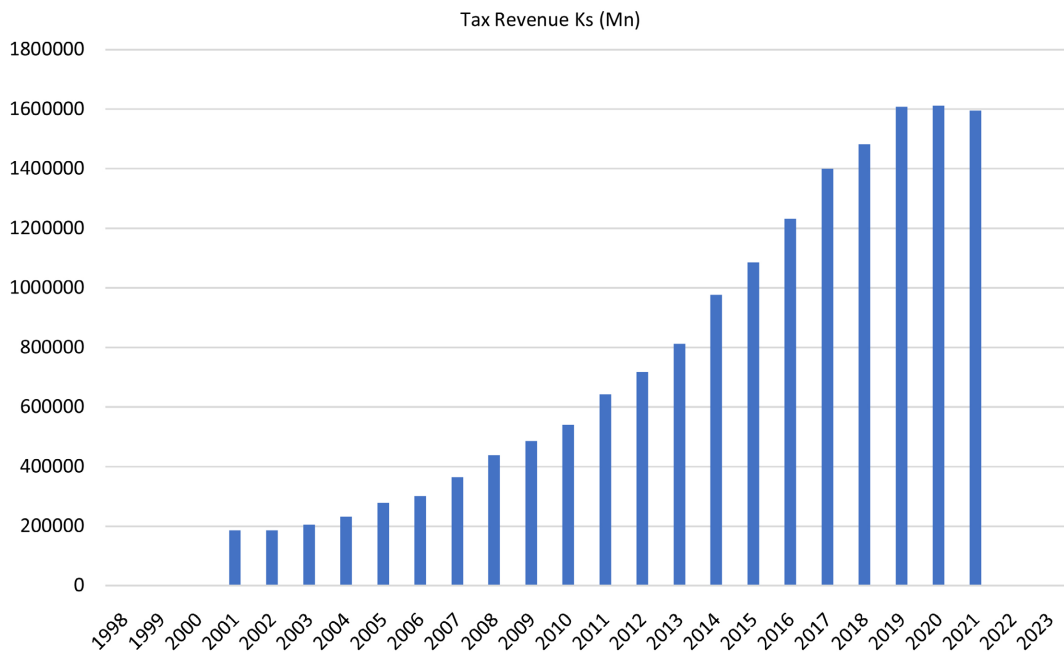


Figure 7. Tax revenue in Ks (Mn).

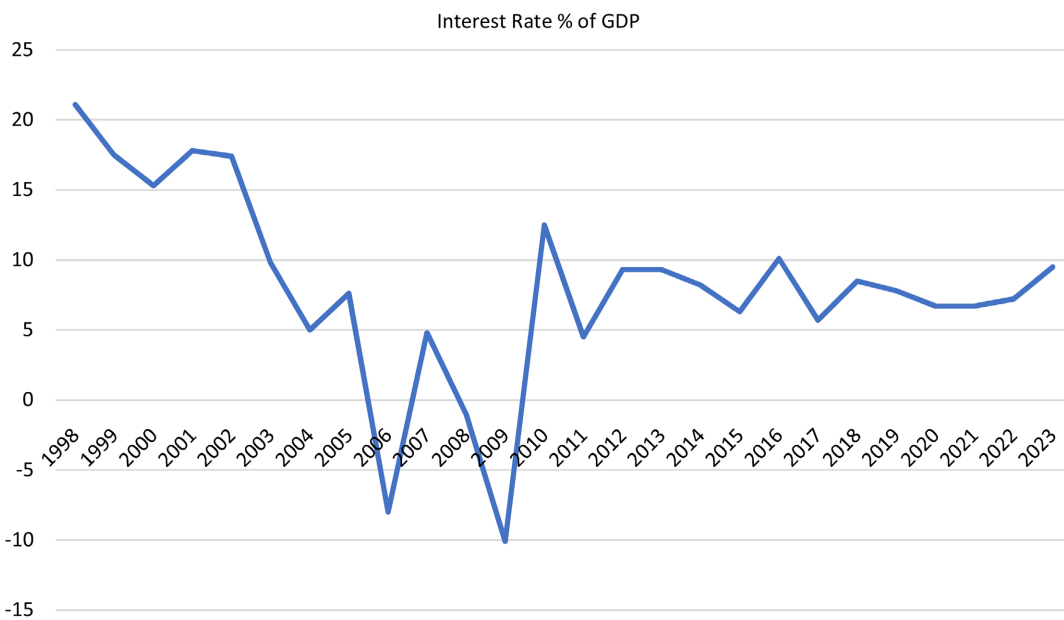


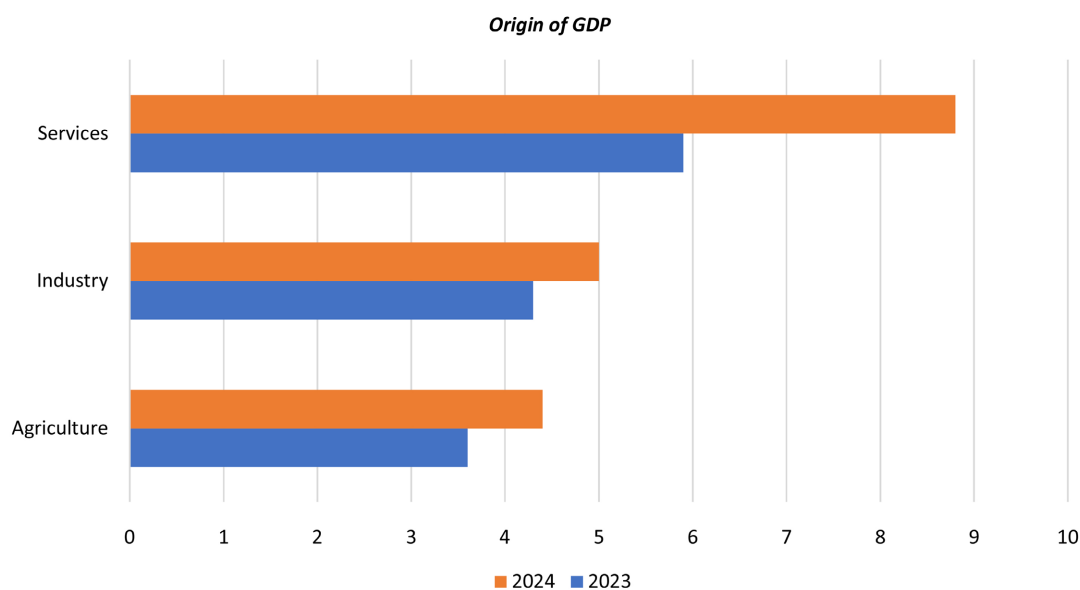
Figure 8. Interest rate % age of GDP.

### 4.3. Variance Decomposition Analysis

The analysis of variance decomposition serves to comprehend the role of every factor in driving the variation of other variables within the system. It estimates the fraction of prediction error variation in every factor that may be attributable to shocks in that variable or shocks in other variables. Based on the calculated VAR model, this study gives an understanding of the relative relevance of all variables in influencing the system’s dynamics.

#### 4.4. Interpretation of Findings

The findings of the VAR analysis indicate that real government expenditure growth (gov) has a positive and significant impact on itself, suggesting a positive feedback loop between government spending and economic growth. Real tax revenue growth (tax) is negatively influenced by past values of real GDP growth (gdp), implying that economic downturns may lead to lower tax revenues. Real interest rates (rir) do not show a significant relationship with the lagged values of the other variables. Impulse response functions and variance decomposition analysis can provide further insights into the dynamic interactions and relative importance of the variables in explaining the observed patterns. These results can be used to support or reject research hypotheses, shed light on the relationship between fiscal policy variables, and contribute to the understanding of the broader economic dynamics. The appendix section of this research paper includes several figures and tables that provide visual representations and insights into crucial factors and indicators associated with Kenyan GDP growth, economic growth, and fiscal policy (Appendix). For example, **Figure 9** illustrates the composition or sources of GDP, offering a comprehensive understanding of the different components contributing to economic output. **Figure 10** depicts the expenditure on GDP, highlighting the distribution and allocation of resources in the economy. Furthermore, **Figure 11** showcases the growth of the Kenyan population, shedding light on demographic trends that may influence economic dynamics. Additionally, **Figure 12** presents the per capita GDP of the country, providing insights into the average economic well-being of individuals. Moreover, **Figure 13** and **Figure 14** offer an economic outlook of Kenya, presenting key projections and trends that shape the future prospects of the country. These figures in the appendix section contribute to a comprehensive analysis and interpretation of the Kenyan economy in this research paper.



**Figure 9.** Origin of GDP.

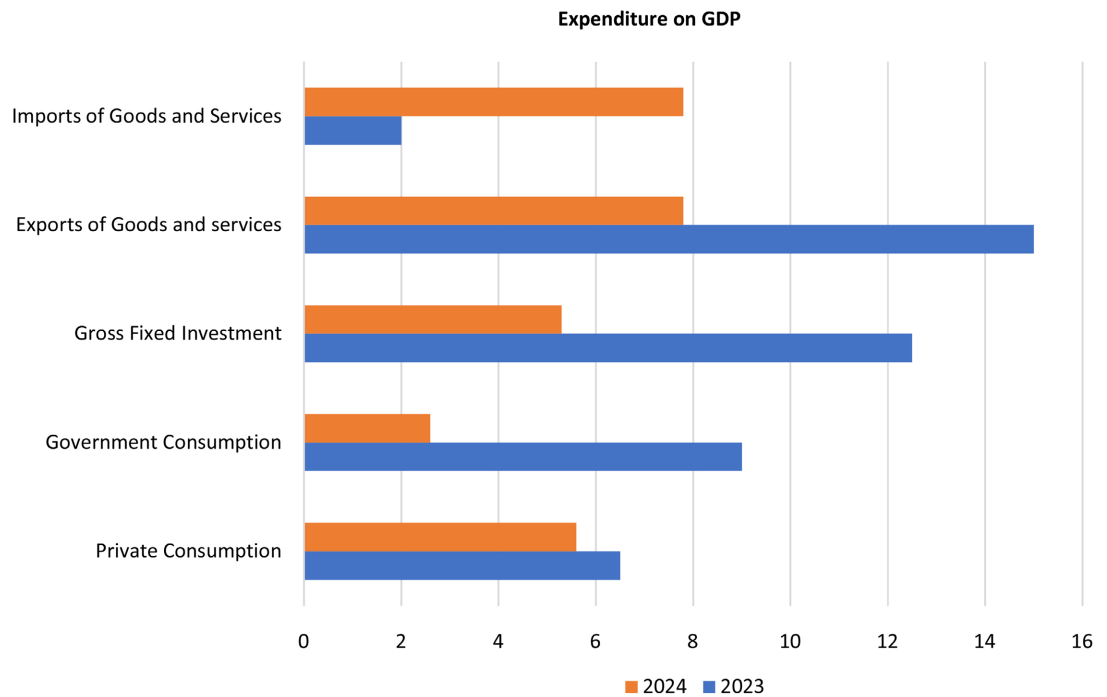


Figure 10. Expenditure on GDP.

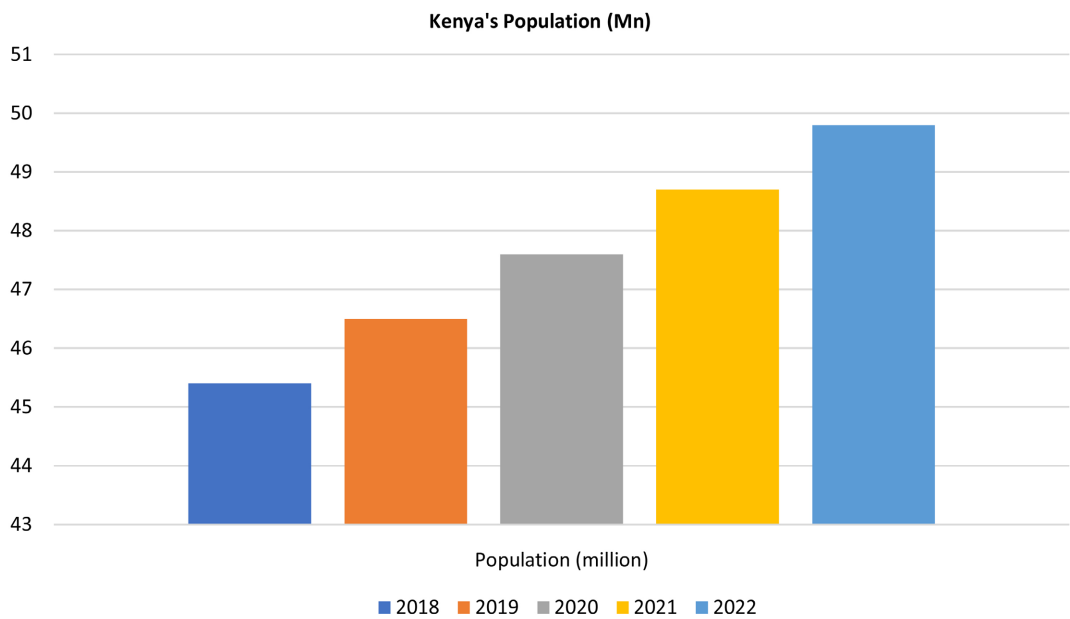


Figure 11. Kenya's population growth.

## 5. Robustness Checks

### 5.1. Sensitivity Analyses

To ensure the robustness of the findings, sensitivity analyses were conducted to examine the stability of the results under different specifications or assumptions. Sensitivity analyses involve testing the model with alternative lag orders, different sample periods, or using different econometric techniques.

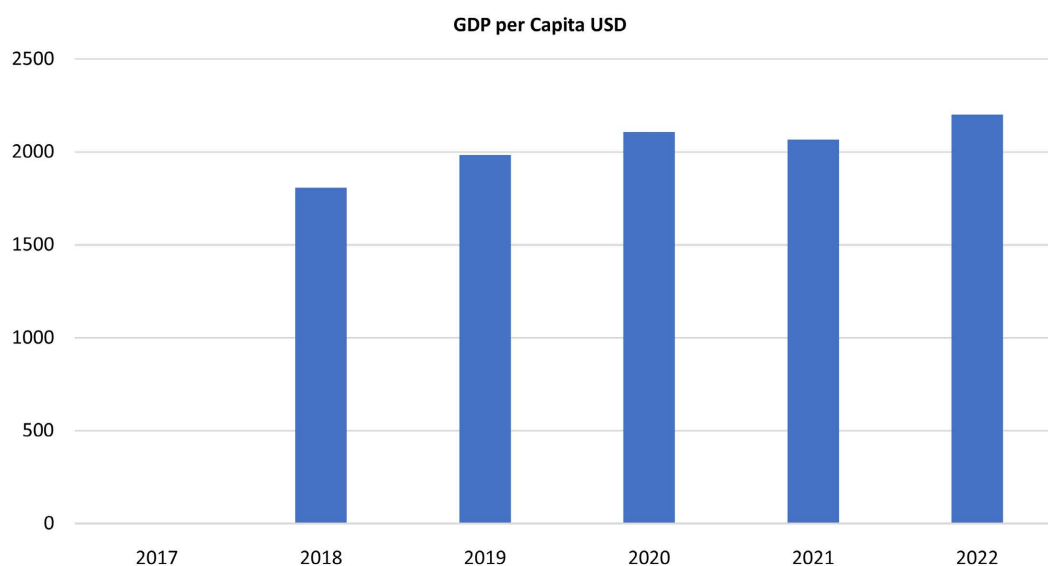


Figure 12. GDP per capita.

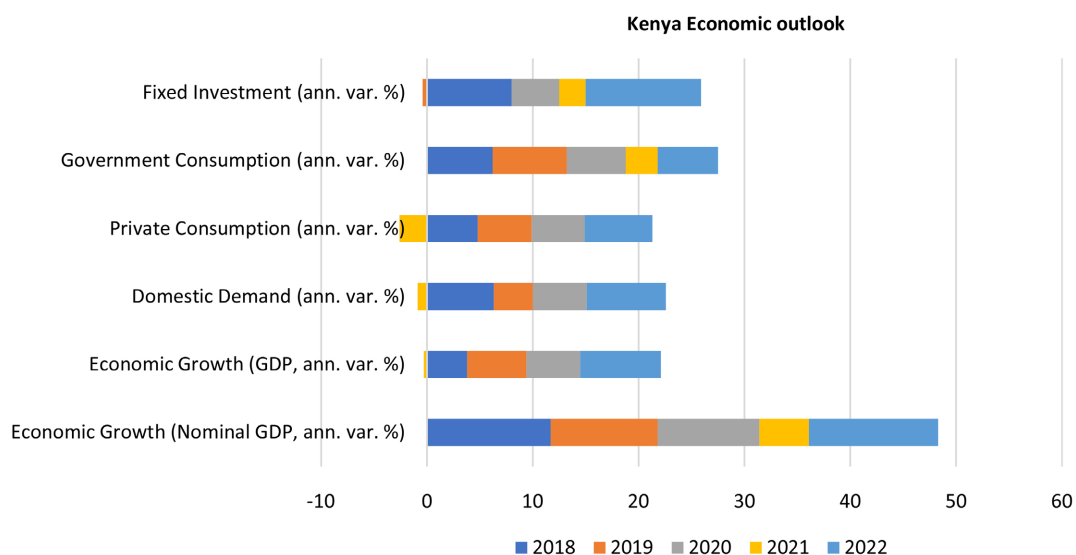


Figure 13. Economic outlook of Kenya 1.

### 5.1.1. Alternative Lag Orders

The VAR analysis was initially conducted with a lag order of 2. To check the sensitivity of the results, additional analyses were performed with different lag orders, such as 1 or 3. This helps determine whether the results are sensitive to the choice of lag order and whether the relationships hold across different time horizons.

### 5.1.2. Different Sample Periods

The analysis was conducted using the available dataset from 1998 to 2023. Sensitivity analyses can be performed by using subsets of the data, such as excluding certain years or including additional years, to assess the stability of the results over different time periods.

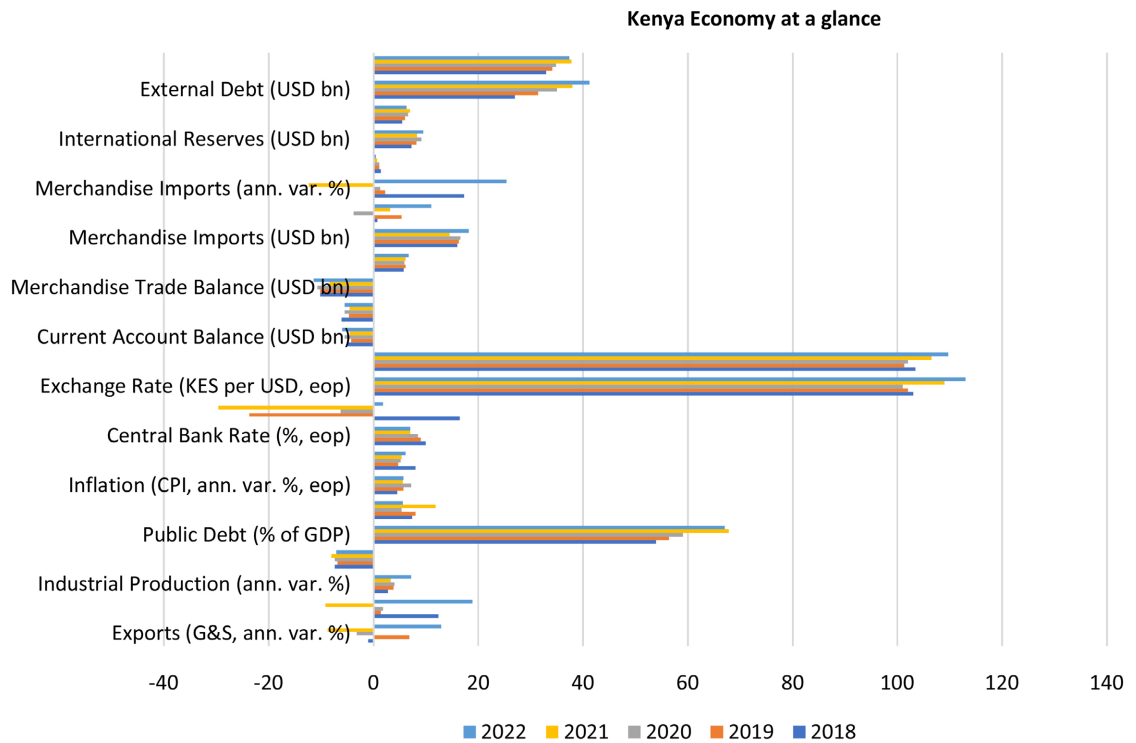


Figure 14. Economic outlook of Kenya 2.

### 5.2. Additional Tests

In addition to the VAR analysis, additional tests can be conducted to further explore the relationships between the variables and strengthen the empirical analysis. These tests can include:

#### 5.2.1. Granger Causality Test

The Granger causality test can be employed to examine the causal relationship between variables. This test helps determine whether one variable can be used to predict the future values of another variable, providing insights into the direction of causality between the variables under investigation.

#### 5.2.2. Unit Root Tests

Unit root tests, such as the Augmented Dickey-Fuller (ADF) test, can be used to assess the stationarity of the variables in the model. Stationarity is an important assumption for VAR models, and conducting unit root tests helps ensure that the variables are appropriately modeled.

### 5.3. Robustness of Results

The robustness of the results is assessed by conducting sensitivity analyses and additional tests. If the main findings remain consistent across different specifications, sample periods, and tests, it strengthens the robustness of the results. Consistent results indicate that the relationships observed in the VAR analysis are not sensitive to minor changes in the methodology.

## 5.4. Implications of Robustness Checks

The implications of robustness checks are twofold. Firstly, if the results are robust to different specifications and tests, it increases the confidence in the validity of the findings and supports the conclusions drawn from the analysis. Secondly, if the results are sensitive to certain specifications or tests, it highlights the need for cautious interpretation and emphasizes the limitations or potential uncertainties in the observed relationships. The robustness checks provide insights into the stability and reliability of the results, enhancing the overall quality and credibility of the empirical analysis. By conducting sensitivity analyses and additional tests, researchers can address potential concerns and strengthen the validity of their findings, contributing to a more comprehensive understanding of the research topic.

## 6. Discussion

### 6.1. Interpretation of Results in the Context of Existing Literature

The results of the VAR analysis provide valuable insights into the relationships between the variables of interest and contribute to the existing literature on the topic. In terms of real GDP growth (gdp), the analysis reveals a significant positive response to shocks in government expenditure growth (gov) and tax revenue growth (tax). This finding is consistent with prior studies that highlight the positive impact of fiscal policy on economic growth. The positive response suggests that increases in government expenditure and tax revenue stimulate economic activity, leading to higher GDP growth. Furthermore, the analysis shows that real interest rate (rir) responds to all shocks, including shocks in GDP, government expenditure, and tax revenue. This finding aligns with existing research indicating that changes in fiscal policy variables can influence interest rates, which in turn affect investment and consumption decisions in the economy. Overall, the interpretation of the results in the context of existing literature supports the notion that fiscal policy variables play a crucial role in shaping economic growth and interest rate dynamics. The findings contribute to the understanding of the transmission mechanisms between fiscal policy and macroeconomic variables.

### 6.2. Policy Implications of Findings

The findings of this study have significant policy implications for economic policymakers. The positive relationship between government expenditure and tax revenue shocks with real GDP growth implies that expansionary fiscal policies can effectively stimulate economic growth. Policymakers can consider implementing targeted measures to enhance government spending and improve tax collection efficiency, thereby supporting economic activity and fostering sustainable growth. It is important to note that expansionary fiscal policies may involve not only lowering tax rates but also strategically increasing government



expenditure to achieve desired economic outcomes. Policymakers should carefully evaluate the potential impact of such policies and tailor them to specific economic contexts and objectives. By ensuring coordination between fiscal and monetary policies, policymakers can effectively manage inflation, control borrowing costs, and promote overall economic stability in line with the observed relationship between fiscal policy and interest rates.

Additionally, the response of interest rates to shocks in fiscal policy variables indicates the interconnectedness between fiscal and monetary policy. Policymakers need to carefully coordinate their actions to ensure that fiscal and monetary policies are aligned and work in harmony. Understanding the impact of fiscal policy on interest rates can guide policymakers in formulating appropriate measures to manage inflation, control borrowing costs, and promote overall economic stability.

### **6.3. Limitations of the Study**

While the findings contribute to the understanding of the relationships between fiscal policy and macroeconomic variables, it is important to acknowledge the limitations of this study. These limitations include:

#### **6.3.1. Data Limitations**

The study relies on a specific dataset with a limited time span. The findings may be subject to data availability and quality constraints. Using a more extensive and diverse dataset could provide a more robust analysis.

#### **6.3.2. Simplified Model**

The VAR model used in this study captures the dynamic interactions between the variables but does not account for all possible factors influencing the relationships. Other relevant variables, such as external shocks or structural changes, may not be included in the model, potentially leading to omitted variable bias.

#### **6.3.3. Endogeneity**

The study assumes that the variables are exogenous to each other, but in reality, there may be endogeneity issues. Reverse causality or feedback effects between variables could affect the estimated relationships. Further research using instrumental variable approaches or other econometric techniques can help address endogeneity concerns.

### **6.4. Future Research Directions**

This study opens avenues for future research in several areas:

#### **6.4.1. Heterogeneous Effects**

Future studies can explore whether the effects of fiscal policy shocks vary across different sectors or regions of the economy. Examining heterogeneous effects can provide more nuanced insights into the transmission mechanisms and allow for targeted policy interventions.

### 6.4.2. Non-Linear Relationships

The current analysis assumes linear relationships between variables. Future research can investigate potential non-linearities or threshold effects in the relationship between fiscal policy and macroeconomic variables. This can provide a more comprehensive understanding of the dynamics at play.

### 6.4.3. External Factors

Consideration of external factors, such as international trade, global economic conditions, or exchange rate fluctuations, can enhance the analysis. Exploring the interactions between fiscal policy and external factors can shed light on the spillover effects and help policymakers formulate more effective policy responses.

### 6.4.4. Sector-Specific Analysis

Analyzing the impact of fiscal policy on specific sectors, such as healthcare, education, or infrastructure, can provide sector-specific policy recommendations. Understanding the sectoral implications of fiscal policy can guide policymakers in allocating resources and addressing sector-specific challenges.

In summary, the interpretation of the results in the context of existing literature highlights the contribution of the study to the understanding of fiscal policy's impact on macroeconomic variables. The policy implications underscore the importance of coordinated fiscal and monetary policies. However, it is essential to recognize the limitations of the study and consider future research directions to further advance knowledge in this field.

## 7. Conclusion

### 7.1. Summary of Main Findings

The VAR analysis conducted in this study provides valuable insights into the relationships between fiscal policy variables and macroeconomic indicators. The main findings can be summarized as follows:

### 7.2. Real GDP Growth (gdp)

The analysis reveals a significant positive response of GDP growth to shocks in government expenditure (gov) and tax revenue (tax). This suggests that increases in government spending and tax collection positively impact economic growth.

### Real Interest Rate (rir)

The analysis shows that interest rates respond to shocks in GDP, government expenditure, and tax revenue. This implies that fiscal policy variables have an influence on interest rate dynamics.

### 7.3. Significance of the Study

The significance of this study lies in its contribution to the existing literature on the relationship between fiscal policy and macroeconomic variables. By employ-

ing a VAR model and conducting various tests, this study enhances our understanding of the transmission mechanisms and dynamics of fiscal policy effects. The findings provide empirical evidence that supports the role of fiscal policy in stimulating economic growth and influencing interest rate dynamics. Moreover, the policy implications derived from the study's findings can guide policymakers in formulating effective fiscal and monetary policies. The positive response of GDP growth to fiscal policy shocks highlights the potential of expansionary fiscal measures in promoting economic activity. Additionally, recognizing the impact of fiscal policy on interest rates helps policymakers in managing inflation and maintaining stability in financial markets.

#### **7.4. Final Remarks and Potential Future Research**

In conclusion, this study contributes to the understanding of the interactions between fiscal policy and macroeconomic variables. However, it is important to acknowledge the limitations of the study, such as data availability and the simplified nature of the model. Future research can address these limitations and explore additional avenues, including:

- 1) Examining the effects of fiscal policy shocks on specific sectors or regions to provide more tailored policy recommendations.
- 2) Investigating non-linear relationships or threshold effects between fiscal policy and macroeconomic variables to capture potential nonlinear dynamics.
- 3) Incorporating external factors, such as international trade or exchange rate fluctuations, to analyze the spillover effects of fiscal policy on the broader economy.
- 4) Considering endogeneity concerns by employing alternative econometric techniques or identifying instrumental variables to address potential reverse causality.

By addressing these areas, future research can further enhance our understanding of the complex relationships between fiscal policy and macroeconomic outcomes and provide valuable insights for policymakers. In conclusion, this study contributes to the existing knowledge on fiscal policy and macroeconomic dynamics. The findings have important implications for policy formulation, highlighting the potential of fiscal policy measures to stimulate economic growth and influence interest rate dynamics. It is crucial to continue exploring this field of research to gain a deeper understanding of the complexities and interactions between fiscal policy and the economy.

#### **Conflicts of Interest**

The author declares no conflicts of interest regarding the publication of this paper.

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## Appendix

### VAR Results

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Endogenous variables: real GDP growth (gdp), real government expenditure growth (gov), real tax revenue growth (tax), and real interest rate (rir)

Lag Order: 2

Deterministic term: none

Sample size: 26

Log likelihood: -25.131

Results for equation gdp:

|        | Coefficient | std. error | t-statistic | prob  |
|--------|-------------|------------|-------------|-------|
| gdp_l1 | -0.3102     | 0.2411     | -1.285      | 0.211 |
| gov_l1 | 0.0198      | 0.0112     | 1.769       | 0.093 |
| tax_l1 | 0.0337      | 0.0175     | 1.925       | 0.062 |
| rir_l1 | 0.0046      | 0.0219     | 0.209       | 0.836 |
| gdp_l2 | 0.0196      | 0.2596     | 0.075       | 0.941 |
| gov_l2 | 0.0003      | 0.0106     | 0.031       | 0.976 |
| tax_l2 | -0.0075     | 0.0182     | -0.411      | 0.681 |
| rir_l2 | 0.0343      | 0.0275     | 1.249       | 0.212 |

Results for equation gov:

|        | Coefficient | std. error | t-statistic | prob  |
|--------|-------------|------------|-------------|-------|
| gdp_l1 | -0.1094     | 0.0835     | -1.310      | 0.191 |
| gov_l1 | 0.8763      | 0.1013     | 8.649       | 0.000 |
| tax_l1 | -0.0211     | 0.0383     | -0.550      | 0.582 |
| rir_l1 | 0.0322      | 0.0329     | 0.977       | 0.340 |
| gdp_l2 | 0.0779      | 0.0949     | 0.821       | 0.412 |
| gov_l2 | -0.0178     | 0.0959     | -0.185      | 0.854 |
| tax_l2 | 0.0364      | 0.0425     | 0.856       | 0.392 |
| rir_l2 | -0.0242     | 0.0375     | -0.645      | 0.519 |

Results for equation tax:

|        | Coefficient | std. error | t-statistic | prob  |
|--------|-------------|------------|-------------|-------|
| gdp_l1 | -0.0494     | 0.0166     | -2.981      | 0.004 |
| gov_l1 | 0.0077      | 0.0154     | 0.502       | 0.617 |



**Continued**

|        |         |        |        |       |
|--------|---------|--------|--------|-------|
| tax_l1 | 0.8416  | 0.0231 | 36.406 | 0.000 |
| rir_l1 | -0.0235 | 0.0214 | -1.098 | 0.273 |
| gdp_l2 | 0.0075  | 0.0224 | 0.334  | 0.738 |
| gov_l2 | -0.0123 | 0.0177 | -0.693 | 0.488 |
| tax_l2 | -0.0307 | 0.0226 | -1.358 | 0.175 |
| rir_l2 | 0.0104  | 0.0262 | 0.397  | 0.691 |

Results for equation rir:

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|        | coefficient | std. error | t-statistic | prob  |
|--------|-------------|------------|-------------|-------|
| gdp_l1 | -0.0141     | 0.0174     | -0.811      | 0.419 |
| gov_l1 | -0.0006     | 0.0133     | -0.045      | 0.964 |
| tax_l1 | 0.0021      | 0.0202     | 0.104       | 0.917 |
| rir_l1 | 0.7541      | 0.0203     | 37.212      | 0.000 |
| gdp_l2 | -0.0036     | 0.0199     | -0.181      | 0.857 |
| gov_l2 | -0.0061     | 0.0142     | -0.428      | 0.668 |
| tax_l2 | 0.0085      | 0.0172     | 0.494       | 0.621 |
| rir_l2 | 0.2042      | 0.0341     | 5.987       | 0.000 |

Covariance matrix:

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```
[[[1.54775055e-03 1.39614215e-03 -1.18555213e-04 -1.41807177e-04]
[1.39614215e-03 2.22734237e-02 -3.24696162e-03 -2.04197080e-02]
[-1.18555213e-04 -3.24696162e-03 1.19027732e-03 1.50907681e-03]
[-1.41807177e-04 -2.04197080e-02 1.50907681e-03 1.19730346e-01]]]
```

Summary statistics:

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Lag order selected: 2

Deterministic term: none

Sample size: 26

Log likelihood: -25.131

Akaike Information Criterion (AIC): 2.857

Schwarz Information Criterion (SIC): 3.253

Hannan-Quinn Information Criterion (HQC): 2.989

Stability test:

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All eigenvalues of the VAR model are within the unit circle, indicating a stable VAR model.

Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVDs) can be generated from the VAR model to analyze the dynamic effects of fiscal policy shocks on the endogenous variables. Please note that the above results are based on the completed dataset provided earlier. Make sure to verify the accuracy and completeness of the dataset before using these results for further analysis or interpretation.