UNIVERSITY OF RWANDA

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF ECONOMICS

UNVEILING THE MACROECONOMIC EFFECTS OF FISCAL POLICY SHOCKS IN RWANDA

Thesis Submitted to the Department of Economics, University of Rwanda as a Partial Fulfilment of the Requirements for the Degree of Master of Science in Economics with Applied Quantitative Economics Specialization.

By

HAKIZIMANA Jean Damascene

Registration Number: 222021720

Supervised by

Dr. Jules NGANGO

August 15, 2024

Affirmation

I thus certify that I independently wrote my master's thesis, "unveiling the macroeconomic effects of fiscal policy shocks in Rwanda," utilizing only the resources materials . As a result, I have identified every passage that I have taken verbatim or substantially from publications. I acknowledge that plagiarism detection software used to examine my thesis. This thesis, nor any excerpt from it, has ever been submitted in this or a comparable format to an examination body before.

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Acknowledgments

I would like to express my deepest gratitude to the University of Kiel in Germany for providing me with invaluable support and resources throughout my research. Their assistance has been instrumental in the successful completion of this thesis.

I am profoundly grateful to the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) for their unwavering support and contributions, which have significantly enhanced the quality of my research. Their dedication to fostering academic and professional development in Rwanda is truly commendable.

I also extend my heartfelt thanks to the University of Rwanda, College of Business and Economics, School of Economics, for the educational foundation and continuous encouragement that has driven me to achieve this milestone.

Lastly, I wish to acknowledge and thank my supervisor, Dr. Jules NGANGO, for his guidance, insights, and encouragement throughout the research process. His expertise and support have been crucial in shaping this thesis.

HAKIZIMANA Jean Damascene

Dedication

This thesis is dedicated to my family for their unwavering support, love, and encouragement throughout my academic journey. Their belief in me has been a constant source of inspiration.

To my friends and colleagues, who have provided invaluable support and motivation, I am forever grateful.

Finally, this work is dedicated to all those who strive for knowledge and seek to make a positive impact in the field of economics and beyond.

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Abstract

This study investigates the macroeconomic effects of fiscal policy shocks in Rwanda over the period 2006-2023. Using structure Vector Autoregression (SVAR) models, the analysis explores the dynamic interactions among key economic variables, including GDP growth, government expenditure, inflation, and interest rates, in response to fiscal policy adjustments. The findings reveal that fiscal expansions generally stimulate short-term economic growth, as evidenced by increases in GDP and government expenditure. However, these expansions also pose challenges, including inflationary pressures and potential fiscal sustainability risks. The stability observed in interest rates suggests effective monetary policy coordination, critical for mitigating adverse effects of fiscal shocks. Moreover, the persistence of shocks in GDP and government expenditure underscores the lasting impact of fiscal decisions on economic stability, necessitating strategic policy responses. Based on these insights, recommendations include diversifying the economy, prioritizing structural reforms, fostering inclusive growth, and developing a comprehensive long-term fiscal strategy. These measures aim to strengthen Rwanda's resilience to economic shocks, promote sustainable development, and achieve inclusive socio-economic growth.

Key words: structure Vector Autoregression (SVAR), Economic stability, Government expenditure.

Chapter one: General Introduction

1.0.Introduction

According to economic theory, fiscal policy's methodical function is to promote sustainable economic growth and development by carefully crafting the tax and spending structures (Hemming et al.,2002).The role of fiscal policy, encompassing government expenditures and taxation decisions, in influencing The financial health of a country has been extensively debated within macroeconomic literature.

According to Currie, (2016), suggests that increased government spending acts as a stimulus for aggregate demand, promoting economic growth. However, concerns exist regarding potential drawbacks, such as crowding-out effects where government Borrowing may result in interest rates rising and reduced private investment (Barro, 1989). Additionally, excessive government spending can trigger inflationary pressures (Easterly et al., 2004).

Empirical research exploring fiscal policy's connection to macroeconomic outcomes presents a mixed picture. Some studies find evidence of positive impacts on growth from government spending, particularly when directed towards infrastructure or human capital development (Krueger & Lindahl, 2001). However, others highlight potential drawbacks like crowding-out effects and inflationary pressures (Niaz Murshed Chowdhury, 2018).

A crucial distinction lies in focusing on exogenous fiscal policy shocks, which are unexpected changes in government spending or taxation not driven by existing economic conditions (Alesina & Ardagna, 2019). Much of the existing literature analyzes the impact of general fiscal policy stances, making it difficult to isolate the causal effects of specific exogenous shocks. This presents a significant research gap, particularly for developing countries like Rwanda.

Rwanda's recent economic growth trajectory has been remarkable, driven in part by substantial government investment. However, the effectiveness of these policies and the broader effect of exogenous fiscal policy shocks on key macroeconomic data points in Rwanda remain underexplored. By focusing on exogenous shocks, this study aims to bridge this gap and provide valuable insights for Rwandan policymakers. Understanding the causal effects of these shocks regarding inflation, growth, and interest rates can inform the design of more effective fiscal policy strategies for sustainable economic development in Rwanda.

1.1.Background of the Study

Fiscal policy, encompassing taxes and spending by the government decisions, is essential in forming a country's macroeconomic performance. Understanding the impact of fiscal policy on key economic indicators like GDP, government expenditure, Exchange rate, and interest rates is essential for policymakers aiming to promote sustainable economic development. This study delves into the specific case of fiscal policy shocks in Rwanda. Fiscal policy is a crucial technique that governments use to intervene in and control the real economy. Government intervention is crucial in stabilizing and mitigating any potential threats to the economy. The government must adjust revenues and spending to reach the prospective degree of production and ensure an appropriate allocation of funds and resources. The function of financial policy in established countries is to stimulate the capitalization rate development and increase the marginal willingness to save by reducing the level of consumption. The objective of fiscal policy in developing countries is to shift inefficient resources towards productive ones and promote a fairer distribution of wealth (Popa and Codreanu, 2010).

Recently, the IMF has been emphasizing fiscal stimulus along with accommodating monetary policy as a reaction to the decline in global economic growth. Fiscal policy has the ability to impact the wealth distribution, total demand, and the economic capacity to generate products and services. shocks to fiscal policy are unexpected alterations to government expenditures or taxation that are not driven by existing economic conditions within a country (Alesina & Ardagna, 2019).

Several sources, including changes in global commodity prices, unforeseen natural disasters, or changes in foreign assistance inflows, can induce these shocks. By analyzing the consequences of specific fiscal shocks, we may more effectively examine the direct link between macroeconomic and fiscal policy outcomes, as opposed to considering broader fiscal positions. The influence of macroeconomic fiscal policy performance has been a significant topic of discussion in macroeconomic research. Keynesian theory suggests that increased government spending can act as a stimulus for aggregate demand, promoting economic growth (Currie, 2016).

However, concerns exist regarding potential drawbacks. Higher interest rates may result from increased government spending financed by borrowing, which could discourage private investment and hindering growth (Barro, 1989). Additionally, excessive government spending can trigger inflationary pressures if it is not accompanied by a corresponding increase in productivity (Easterly et al., 2004).

Empirical research exploring the connection between economic results and fiscal policy presents a mixed picture. Some studies find evidence of positive impacts on growth from government spending, particularly when directed towards infrastructure or human capital development (Krueger & Lindahl, 2001). However, others highlight potential drawbacks like crowding-out effects and inflationary pressures (Chowdhury, 2018). Significant government investment has contributed to Rwanda's recent spectacular growth trajectory. However, there has been a lack of thorough investigation into the success of these measures and the overall impact of fiscal policy shocks on key macroeconomic indicators in Rwanda.

This research attempts to fill the gap in the literature by specifically examining fiscal shocks. Analyzing the causal impacts these shocks to growth in the economy, inflation, and interest rates within the specific context of Rwanda might provide important data for policymakers. Policymakers can use this information to formulate more efficient fiscal policy solutions that promote sustainable economic growth in Rwanda.

1.2. Problem statement

While extensive research explores The connection between macroeconomic policy and fiscal policy outcomes, a significant gap exists in understanding the causal impacts of shocks to exogenous fiscal policy on economic performance, particularly in developing countries. This lack of knowledge regarding exogenous fiscal policy shocks presents a crucial challenge for policymakers in developing countries like Rwanda. Despite experiencing impressive economic growth driven by government investment, The efficiency of these policies and the broader effect of unforeseen changes in government spending or taxation on key macroeconomic indicators in Rwanda remain underexplored. Understanding how exogenous fiscal policy shocks influence economic growth, inflation, and interest rates is essential for designing effective fiscal policy strategies. However, the current gap in knowledge hinders policymakers' ability to make informed decisions that promote sustainable economic development.

1.2.Research Objective

The purpose of this study is to address the disparity in knowledge regarding fiscal policy's causative effects shocks on macroeconomic performance in developing countries. Focusing on the case of Rwanda, we aim to achieve the following objectives:

- Identify the impact of fiscal policy shocks on economic growth in Rwanda**.**
- Examine the effects of fiscal policy shocks on inflation in Rwanda.
- Investigate how fiscal policy shocks influence interest rates in Rwanda.

1.4. Significant of the Study

This study looks at the causal effect of fiscal policy shocks regarding economic expansion, government expenditures, exchange rate, and interest rates in Rwanda, a developing country that is experiencing substantial economic expansion due to government investment. Our objective is to use a structural vector autoregression (SVAR) model to separate the direct effects of unexpected changes in public expenditures or taxation from the impact of the present economic climate. This approach sets us apart from previous research on fiscal policy. We will also look at the dynamic the connections between fiscal policy and important macroeconomic indicators in Rwanda. The expected results will improve the field of development economics by addressing the lack of understanding regarding the cause-and-effect the connection between financial policy shocks and macroeconomic performance in developing countries. Additionally, these findings will offer valuable insights for policymakers in Rwanda and other developing economies.

1.5. Organization of the Study

Chapter two explores the relevant literature pertaining to fiscal policy and its influence on macroeconomic results. The paper will analyze theoretical frameworks, namely the Keynesian and neoclassical approaches to fiscal policy. It will then proceed to examine empirical research that investigates the correlation between government spending, economic growth, inflation, and interest rates. The third chapter provides a detailed explanation of the research's methodology. The text will provide a comprehensive explanation of the selection process for variables in the SVAR model, including government spending, economic growth, inflation, and interest rates. This chapter will also address the data sources and the selected time period for analysis. Chapter four presents the research's real results. The report will provide a comprehensive analysis of the SVAR

model findings, specifically examining the impact of fiscal policy shocks on economic growth, inflation, and interest rates in Rwanda. The analysis will assess the contribution of the findings to the current body of research on fiscal policy and development economics. The last chapter concludes the research by providing a concise overview of the main findings and policy recommendations.

Chapter two: Literature Review

2.0. Introduction

This section examines the current body of literature regarding fiscal policy and its influence on critical macroeconomic indicators, including inflation, interest rates, and growth. Our primary objective is to understand the theoretical foundations of fiscal policy and the manner in which prior research has investigated its correlation with these economic outcomes.

2.1. Theoretical Literature

Fiscal policy refers to government actions involving government spending (G) and taxation (T)**.** However, this study focuses on fiscal policy shocks, unexpected changes in G or T that are not driven by existing economic conditions within a country (Alesina & Ardagna, 2019). These shocks can be triggered by various factors, such as fluctuations in global commodity prices, unexpected natural disasters, or changes in foreign aid inflows.

To understand the influence of these shocks on macroeconomic outcomes, it is necessary to analyze both Keynesian and Neoclassical theories. Keynes (1936) highlights the significance of government intervention in stabilizing the economy during times of recession or stagnation. The theory suggests that when the government spends more money, it stimulates the total amount of desire for products and services within the economic system, known as aggregate demand. By injecting extra funds into the economy, the government stimulates both consumption and investment, thereby promoting economic growth. However, if the government funds this spending by borrowing, it may also result in inflation.

Neoclassical economics takes a more cautious stance on government intervention, emphasizing the role of market forces in achieving equilibrium. Interest rates may rise in response to increased government spending that is financed by borrowing. Due to the increased cost of borrowing for businesses, this may discourage private investment funds, potentially hindering long-term economic growth (Barro, 1989). Ultimately, Neoclassical theory suggests the fact that the impact of government expenditure on GDP could be unbiased. Increased government spending might be offset by reductions in private consumption or investment, leading to minimal net effects on growth.

Both Keynesian and Neoclassical perspectives primarily focus on the impact of deliberate alterations to government taxation or spending stances. However, this study is particularly interested in fiscal policy shocks, unexpected alterations to government expenditures or taxation that are not driven by existing economic conditions within a country (Alesina & Ardagna, 2019).

According to Afonso & Sousa, (2012) cite the following data: shocks to government spending have a rapid decline in stock prices, a major crowding-out effect, a modest effect on GDP, and variable effects on housing prices. Shocks to government revenue have a slightly positive effect on stock prices but a mixed effect on housing prices.

Ilzetzki (2011) analyzing the result of fiscal policy, particularly tax cuts, on economic activity in 28 countries. The study addresses the ongoing debate over the effectiveness of fiscal measures by using a new tax database and various econometric methods. The findings show that lowering a percentage point increase in the personal income tax rates reducing revenue by one percent of GDP has a noteworthy enhancement of economic growth. Over time, Neoclassical theory suggests that there may be no discernible effect of government spending on growth. Increased government spending might be offset by reductions in private consumption or investment, leading to minimal net effects on growth.

Global commodity price shock

Developing countries reliant on commodity exports are particularly vulnerable to exogenous fiscal policy shocks triggered by fluctuations in global commodity prices (Ahearne et al., 2010).

An increase in global commodity prices for a country's main exports can lead to higher government revenue, potentially allowing for increased Government spending (Easterly, 2009). This could stimulate economic growth through higher aggregate demand. However, the Dutch Disease effect is a potential concern. Increased resource wealth can lead to currency appreciation, making other sectors less competitive and potentially hindering long-term economic diversification (Corden & Neary, 1982).

According to Ahearne et al., (2010) a decrease in global commodity prices can lead to a decline in funds received by the government, potentially necessitating a reduction in government expenditures. This could lead to economic slowdown or recession if not managed effectively.

Unexpected Natural Disaster

Natural disasters like earthquakes, floods, or droughts can have significant economic consequences (Cavallo et al., 2013). These events represent exogenous fiscal policy shocks as they often necessitate unforeseen government spending on reconstruction and relief efforts. In response to a natural disaster, the government might increase spending on infrastructure repair, emergency relief, and social safety nets. This can stimulate economic activity in the short run but can also lead to higher budget deficits if not financed appropriately. However, natural disasters can also disrupt economic activity and damage infrastructure, leading to a decline in government revenue. This can further strain public finances and necessitate adjustments in fiscal policy.

Changes in foreign Aid inflow

The fiscal landscape is significantly impacted by foreign aid. landscape of many developing countries, including Rwanda. Fluctuations in foreign aid inflows can represent exogenous fiscal policy shocks**,** affecting government spending and economic activity.

According to Hattam et al., (2015) Foreign aid inflows can provide additional resources for government spending on infrastructure development, education, healthcare, and other crucial sectors. This increased spending can stimulate economic activity through aggregate demand. Additionally, Investments in infrastructure, education, and healthcare can improve the overall productivity of the workforce, leading to long-term economic growth (Clemens et al., 2012). And Foreign aid can create a more stable and predictable economic environment, potentially attracting private investment and further stimulating economic activity (Burnside & Dollar, 2000)

Sachs et al., (2005) states that investing in education, provides a skilled workforce, fostering innovation and higher productivity. Investments in healthcare can lead to a healthier population, potentially reducing absenteeism and increasing labor productivity. However, Foreign aid might be accompanied by conditions set by donors, potentially leading to policy distortions if they do not align with Rwanda's specific development priorities. This can lead to inefficiencies and hinder the effectiveness of aid (Mosley et al., 2004).

Despite the comprehensive coverage of the theoretical literature related to finances policy shocks, this study aims to address specific gaps in the context of Rwanda. Firstly, there is a need to identify shocks to fiscal policy and their effects on economic growth in Rwanda. Secondly, the effects of fiscal policy shocks on inflation in Rwanda need to be examined. Lastly, the study investigates how Shocks to the fiscal policy affect interest rates. in Rwanda. By focusing on these objectives, this research will contribute to a more nuanced understanding of fiscal policy shocks in a developing country context, providing insights that are directly applicable to Rwanda's economic environment.

the study fills the lack of literature on the particular macroeconomic effects of fiscal policy shocks in Rwanda, as previous studies have primarily focused on developed economies or other developing regions. For instance, studies by Fatas and Mihov (2001) and Blanchard and Perotti (2002) emphasize the impacts in developed economies, highlighting a gap within the framework of Rwanda that this study aims to address.

Moreover, empirical studies in the context of sub-Saharan Africa have shown varied results regarding fiscal policy shocks, further emphasizing the need for country-specific analysis (Anyanwu & Erhijakpor, 2010; Berg et al., 2010). Anyanwu and Erhijakpor (2010) Emphasize the mixed fiscal policy's effect on economic growth across African countries, suggesting that institutional quality and governance play crucial roles in mediating these effects. Berg et al. (2010) also underscore the importance of considering the unique economic structures and challenges faced by sub-Saharan African countries when analyzing fiscal policy impacts.

The study by Baldacci et al. (2004) examines the connection between fiscal policy and economic growth in low-income countries, finding that the composition of fiscal adjustments, particularly the balance between expenditure cuts and revenue increases, significantly influences growth outcomes. This study's findings highlight the need to consider the specific composition of fiscal policy adjustments in Rwanda to understand their the effect on economic expansion comprehensively.

In addition, Gali and Perotti (2003) explore The dynamic implications of budgetary policy in Europe, revealing the significant heterogeneity in fiscal multipliers across countries. This suggests that Rwanda's unique economic and institutional context may yield different fiscal multipliers

compared to those observed in other regions. Thus, this study aims to fill the gap by offering a thorough examination of Rwanda's fiscal policy shocks and their macroeconomic impacts.

2.2. Empirical Literature

Building upon the previous discussion of the mixed results found in the empirical literature pertaining to fiscal policy and macroeconomic outcomes, let us explore deeper into studies that explore specific aspects relevant to fiscal policy shocks. Chowdhury, (2018) emphasizes the need for context-specific analysis, considering factors like institutional quality and the breakdown of government expenditures in developing nations.

De Castro and De Cos (2008used the VAR framework to study the effects of external fiscal shocks in Spain. The researchers found that increases in government spending resulted in lower output over the medium and long terms, but had favorable short-term effects on production, inflation, and the public deficit. Ali and Ahmed (2010) carried out an analysis of how Pakistan's economic development is affected by fiscal policy. The results show that, up to a certain threshold, there is a positive correlation between the fiscal deficit and economic growth. Above this point, though, the fiscal deficit has a detrimental effect on economic expansion.

Subhani and Ali (2010) investigated the connection between the trade balance, tax rate, and inflation rate in Pakistan from 1979 to 2009. The study's findings demonstrate that there is no discernible relationship between taxes and inflation. Nonetheless, the trade balance is significantly impacted by the tax rate. Tenhofen et al. (2010) used SVAR analysis to examine the impact of fiscal policy in Germany. The findings suggest that while private investment shows a slight decline, increases in government spending have a positive effect on private consumption and production. In addition, the aggregate effect of direct taxes is detrimental to production, while the effect of indirect taxes on output is negligible.

Auerbach and Gorodnichenko (2012) examined the impact of the fiscal multiplier on the US economy, focusing on the recessionary years 1947 Q1–2008 Q4. According to a study, fiscal policy works better when the economy is contracting, but defense spending has the highest fiscal

multiplier. Paredes et al. (2014) studied the relationship between fiscal and monetary policy and the impact of fiscal policies in the Euro area between the first quarter of 1980 and the fourth quarter of 2012. The results show that while GDP in the Euro area responds to changes in the economic cycle twelve to eighteen months later than government revenue, which displays a pro-cyclical and robust pattern throughout fluctuations in the economic cycle. Romer (2014) studied the changes in the United States' marginal income tax rate on taxable income from 1920 to 1930, the interwar period. The logarithmic value of the after-tax share and changes in the elasticity of taxable income were found to be positively and slightly correlated by the researchers. The establishment of new companies, however, has the biggest influence.

Aisen & Veiga, (2013) Examine the impact of sudden increases in government spending in Latin nations in America. They discover proof that positive shocks to spending can result in increased economic growth, particularly when directed towards productive sectors. However, their study highlights the importance of institutional quality, suggesting that positive effects are more pronounced in countries with stronger institutions.

Adams & Elassal, (2020) suggest that aid shocks can have positive impacts on economic growth, but also highlight potential inflationary pressures if not accompanied by appropriate fiscal policies. Developing countries that rely heavily on commodity exports can be particularly vulnerable to exogenous fiscal policy shocks triggered by fluctuations in global commodity prices.

Global commodity price shock

Ahearne et al., (2010) investigate the effect of commodity prices shocks on fiscal policy in resource-rich developing countries. They find that positive commodity Price shocks may result in higher government expenditure, but also raise concerns about potential Dutch Disease effects, where resource wealth can lead to currency appreciation and hinder competitiveness in other sectors.

De V. Cavalcanti et al., (2015) Analyze the connection between commodity price volatility and expansion of the economy in resource-dependent economies. They find evidence that excessive volatility can negatively affect growth, highlighting the importance of sound fiscal policy management to mitigate these effects.

Mehlum et al., (2006) analyze the long-term consequences of resource booms in developing countries. They suggest that effective institutions and investment strategies are crucial for translating resource wealth into sustainable economic growth.

Unexpected Natural Disasters

Cavallo et al., (2013) explore The implications of the macroeconomic natural disasters in developing countries. They find evidence of short-term negative impacts on GDP growth and investment, but also highlight the potential for long-term growth depending on reconstruction efforts and disaster preparedness. Sassa et al., (2017) emphasize the long-term economic consequences of natural disasters, including damage to infrastructure, disruption of production, and potential for displacement.

Koenker & Hallock, (1999) provide a framework for quantile regression to examine the varying impacts of natural disasters on economic growth. They opine that the effects may differ based on the catastrophe's intensity and the nation's pre-existing economic circumstances.

Change in Foreign Aid Inflows

Hadjimichael et al. (2015) investigate the macroeconomic impacts of aid in low-income nations using a panel VAR technique. They discover evidence that aid shocks can boost economic growth, but they also point out the possibility of inflationary pressures in the absence of suitable fiscal measures. Burnside & Dollar, (2000) Examine the connection between policies, aid, and economic expansion. They emphasize that for aid to result in growth, a nation's institutions and economic policies must be of a high caliber, underscoring the significance of sound governance.

Dal Bo, (2006) explore the exchangeability of foreign aid, investigating whether it leads to additional government spending or simply frees up existing resources. Their findings suggest a mixed picture depending on the recipient country and the type of aid. The existing literature provides valuable groundwork, but a gap remains regarding the causal effects of a wider range of exogenous fiscal policy shocks on economic performance in specific developing countries. This study aims to contribute by focusing on Rwanda's experience. By employing a SVAR model and analyzing the impact of these three specific shocks, the study will offer a more robust analysis of

how unexpected changes in government spending or resource inflows influence economic growth, inflation, and interest rates in Rwanda's context.

Chapter three: Research Methodology

3.0. Introduction

This the study's methodology is the main topic of this chapter. The study analyzes the impact of fiscal policy shocks on Rwanda's economy. We will select data sources, identify specific variables for analysis, and use econometric tools to establish causal links between these shocks and macroeconomic outcomes.

3.1. Data and Variables

The data sources, particular factors, and restrictions taken into account for the analysis of fiscal policy shocks and their effects on macroeconomic results in Rwanda are described in this section.

3.1.1. Data source

In selecting the data sources for this study, we prioritized the Development Indicators of the World Bank (WDI) and Rwanda's National Institute of Statistics (NISR) due to their comprehensive, reliable, and internationally recognized databases. The WDI provides a wide array of economic and development indicators, offering quarterly time-series data on key variables such as interest rates, which are essential for analyzing macroeconomic trends over an extended period (2006Q1 to 2023Q4). The NISR is equally critical, providing authoritative and detailed national statistics, including GDP, government expenditure (in billion Frw), and the exchange rate (Frw per US dollar). These sources were chosen because they are the most relevant and accurate for the Rwandan context, ensuring the robustness of our analysis. Still, it's critical to recognize the limitations inherent in these data sources. The WDI data, while comprehensive, might have gaps in quarterly data availability and could face issues of timeliness and periodic revisions, potentially impacting the reliability of short-term analysis. Similarly, data from the NISR, although highly detailed, may not always capture the informal sector's economic activities comprehensively, leading to potential underestimation of GDP and other macroeconomic variables. Despite these limitations, the selected data sources provide the most consistent and reliable information available for conducting a robust economic analysis of Rwanda.

3.2. Econometric Model

This section explores different econometric models employed to examine the impact on shocks to fiscal policy and compares them in the context of this study on Rwanda. Given the limitations of OLS and the need for causal inference, a Structural Vector Autoregression (SVAR) model is the most suitable choice for this study. SVAR builds upon VAR by imposing theoretical restrictions on the model to identify causal relationships. This allows for a more robust examination of the effects of specific shocks on other variables. Additionally, SVAR allows us to analyze the dynamic interactions between fiscal policy shocks, and impose theoretical restrictions to identify the causal effects of each shock on macroeconomic outcomes.

3.2.1. Econometric Model Specification

The SVAR model helps us capture the dynamic linkages and impacts of shocks to fiscal policy on the four primary variables. The constraints imposed by economic theory are used by structural vector autoregression (SVAR) models to determine the system; that is, to derive an economic interpretation function of the impulse response from a simplified form of shocks.

Beginning in the early 1980s, macroeconomists have adopted VAR models are a common empirical analysis tool. They're simple to use and frequently produce better predictions than intricate simultaneous models (Bahovec & Erjavec, 2009).

The literature uses various econometric models to study the relationship between macroeconomic parameters and fiscal policy shocks. These models include vector autoregression (VAR), structural vector autoregression (SVAR). VAR is suitable for capturing dynamic interactions but lacks clear causal links. SVAR, an extension of VAR, integrates economic theory and analyzes causal linkages. The structural model examines the influence of external disturbances on internal variables like government spending. The SVAR model produces more significant and easily understood findings, making it suitable for investigating the influence of macroeconomic variables on Rwanda's fiscal policy shocks.

The four endogenous variables (government expenditure, Exchange rate, GDP, interest rate) at time t.are gathered within the k-dimensional vector Y_t to create the the VAR model in a streamlined form which is expressed as follows:

$$Y_t = B(L)Y_{t-1} + U_t \qquad (1)$$

Where B(L) is lag polynomial, and U_t is the vector of reduced form innovations with $E(U_t)$=0, $E(U_t U'_t) = \Sigma_U$ and $E(U_t U'_s) = 0$ for $S \neq t$. An AB model is typically used to convert the reduced form model into a structure model. The relationship between the reduced for disturbances, U_t, and the structural disturbances, V_t, is explained by the AB model.

$$AU_t = BV_t \qquad (2)$$

When the structural disturbances are thought to be unrelated. with one another, i.e., when the structural disturbances' matrix of variance and covariance Σ_V is diagonal. The framework. Pre-multiplying the first equation with matrix A yields the structure form of the VAR:

$$AY_t = AB(L)Y_{t-1} + AU_t = AB(L)Y_{t-1} + BV_t = D(L)Y_{t-1} + BV_t \qquad (3)$$

Matrix A in equation (3) describes the contemporaneous relationship between the variables collected in the vector Y_t the structural impulse response functions are obtained as the coefficients of the structural moving average representation by solving this equation for Y_t.

Matrix B is an n-dimensional identity matrix, and matrix A is a lower triangular matrix according to the Cholesky decomposition. The need to take the variable ordering into account is one of the main disadvantages of this method. The configuration that follows is derived from past studies that examined the impacts of changes in financial strategy. The variables are arranged as follows: GDP (Y), interest rate (R), exchange rate (E), and government spending (G).

only in the first period did the relationships between reduced shocks change; in subsequent periods, any shock can have an impact on any other shock. As per the Cholesky decomposition method, the second equation turns into:

$$\begin{pmatrix} uY_t \\ uE_t \\ uR_t \\ uG_t \end{pmatrix} = \begin{pmatrix} p_{11} & 0 & 0 & 0 \\ p_{21} & p_{22} & 0 & 0 \\ p_{31} & p_{32} & p_{33} & 0 \\ p_{41} & p_{42} & p_{43} & p_{44} \end{pmatrix} \begin{pmatrix} \epsilon Y_t \\ \epsilon E_t \\ \epsilon R_t \\ \epsilon G_t \end{pmatrix} \quad (4)$$

This decomposition allows us to express the reduced form residualsuY_t, uE_t, uR_t, uG_t as a linear blend of the structural perturbations $\epsilon Y_t, \epsilon E_t, \epsilon R_t, \epsilon G_t$. The variables' arrangement in the VAR model is crucial, as it reflects the causal structure implied by the Cholesky decomposition. The first variable is assumed to be contemporaneously exogenous; the second variable is allowed to be contemporaneously affected by the first variable. the Cholesky decomposition helps identify the structural shocks by imposing a recursive structure on the residuals of the VAR model.

The interdependencies among the variables can describe the equations in the VAR model in the reduced form. This basic structure potentially influences each variable with its own lag and the lags of other variables.

$$\boldsymbol{LGV_{EXP_t}} = \delta_1 + \sum_{i=1}^{K} \beta_i \, LGV_{EXP}{}_{i_{t-i}} + \sum_{1}^{K} \pi_\theta \, INTR_{\,t-\theta} + \sum_{n=1}^{K} \omega_n \, ERT_{\,t-n} + \sum_{y}^{K} \alpha_y GDP_{t-y} + u_{1_t}$$

$$\boldsymbol{INTR_t} = \delta_1 + \sum_{i=1}^{K} \beta_i \, LGV_{EXP}{}_{i_{t-i}} + \sum_{1}^{K} \pi_\theta \, INTR_{\,t-\theta} + \sum_{n=1}^{K} \omega_n \, ERT_{\,t-n} + \sum_{y}^{K} \alpha_y LGDP_{t-y} + u_{2_t}$$

$$\boldsymbol{LEXRT_t} = \delta_1 + \sum_{i=1}^{K} \beta_i \, LGV\_EXP_{i_{t-i}} + \sum_{1}^{K} \pi_\theta \, INTR_{\,t-\theta} + \sum_{n=1}^{K} \omega_n \, LERT_{\,t-n} + \sum_{y}^{K} \alpha_y GDP_{t-y} + u_{3_t}$$

$$\boldsymbol{LGDP_t} = \delta_1 + \sum_{i=1}^{K} \beta_i \, LGV\_EXP_{i_{t-i}} + \sum_{1}^{K} \pi_\theta \, INTR_{\,t-\theta} + \sum_{n=1}^{K} \omega_n \, ERT_{\,t-n} + \sum_{y}^{K} \alpha_y GDP_{t-y} + u_{4_t}$$

The VAR, or vector autoregressive, model is particularly appropriate for examining the influence of macroeconomic determinants on fiscal policy shocks in Rwanda because it can effectively incorporate economic theory and examine causal links. The model systematically includes crucial variables, such as government expenditure, Interest rates, GDP, and exchange rates, with a time lag to accurately account for their delayed effects on fiscal policy. This methodology not only measures the impact of these macroeconomic variables using precise coefficients, but it also

incorporates error terms to account for unobserved factors and random disturbances. Using EViews for analysis improves the reliability of the modeling process, enabling a thorough evaluation of the relationships between the variables.

3.2.2. model Justification

The choice of the Structural Vector Autoregression (SVAR) model for analyzing fiscal policy shocks in Rwanda is justified due to several key advantages that this approach offers over other models. Firstly, the SVAR model allows for the incorporation of economic theory through structural restrictions, providing a more nuanced and accurate identification of fiscal policy shocks and their transmission mechanisms (Blanchard & Perotti, 2002). This is particularly important in the context of Rwanda, where understanding the specific channels By means of which fiscal policy impacts the economy is crucial for effective policy design. Additionally, the SVAR model can handle the dynamic interrelationships between multiple macroeconomic variables, capturing the endogenous responses of these factors that affect fiscal shocks over time (Canova & Pappa, 2007). This dynamic feature is essential for a comprehensive analysis of the short-term and long-term effects of fiscal policy. Furthermore, the SVAR model's ability to accommodate the potential non-recursiveness in the structural relationships between variables adds to its robustness in analyzing complex economic phenomena (Kilian, 2011). Compared to simpler models like the Vector Autoregression (VAR) without structural restrictions or more rigid models like Dynamic Stochastic General Equilibrium (DSGE), the SVAR offers a balanced approach that combines theoretical rigor with empirical flexibility. Therefore, the use of the SVAR model is particularly suitable for unveiling the macroeconomic effects of fiscal policy shocks in Rwanda, ensuring that the analysis is both theoretically sound and empirically robust.

Chapter 4: results and Discussion

4.1. Descriptive statistics

Important new information is revealed by analyzing the macroeconomic impacts of fiscal policy shocks in Rwanda from the first quarter of 2006 to the fourth quarter of 2023. The information shows that the GDP, government spending (GVT_EXP), exchange rate (EXR), and gross domestic product (GDP) and interest rates have demonstrated varying trends over the observed period. The mean values show a consistent economic activity with GDP averaging at 1737.542 billion Rwandan Francs and government expenditure at 258.0417 billion Rwandan Francs. The standard deviation and skewness values highlight moderate volatility and positive skewness in most variables, except for the interest rates, which have a slight negative skew. Notably, the Jarque-Bera statistics for exchange rate suggest a slight departure from normality. The median values indicate the central tendencies closely align with the mean, reinforcing stability in fiscal policies. The impact of fiscal policy shocks is evident in the fluctuations observed, with government expenditure peaking at 564 billion Rwandan Francs and a corresponding peak in GDP at 3030 billion Rwandan Francs, suggesting a positive relationship between fiscal spending and economic growth. Interest rates, with a mean of 16.74204%, show relatively low variability, indicating that shocks to fiscal policy have a measured impact on inflation, reflected in the minor kurtosis and skewness. These findings underscore the critical role of fiscal policy in shaping economic outcomes, highlighting its influence on economic growth, inflation, and interest rates in Rwanda.

Date: 06/21/24
Time: 06:58
Sample: 2006Q1 2023Q4

	EXR	GDP	GVT_EXP	INTEREST_RATE
Mean	753.5000	1737.542	258.0417	16.74204
Median	696.5000	1660.500	240.5000	16.77177
Maximum	1239.000	3030.000	564.0000	17.33333
Minimum	543.0000	813.0000	111.0000	15.86583
Std. Dev.	188.1771	582.0582	113.3824	0.431718
Skewness	0.618924	0.339715	0.640485	-0.288601
Kurtosis	2.289590	2.084052	2.477430	1.965972
Jarque-Bera	6.110848	3.901759	5.741896	4.207132
Probability	0.047103	0.142149	0.056645	0.122021
Sum	54252.00	125103.0	18579.00	1205.427
Sum Sq. Dev.	2514154.	24054212	912744.9	13.23302
Observations	72	72	72	72

4.1.1 Trends Over Time of the variables

The trend analysis of key macroeconomic variables in Rwanda from 2006's first quarter to 2006's fourth quarter 2023 provides insightful observations. The plot illustrates the logarithmic values of GDP (LGDP), government expenditure (LGVT_EXP), exchange rate (LEXR), and interest rates over the examined period. Notably, the interest rate (green line) has remained relatively stable, oscillating slightly around a mean value of approximately 17%. This stability suggests that the monetary policy has maintained a steady course, avoiding significant fluctuations. The exchange rate (black line), while exhibiting a gradual upward trend, indicates a steady depreciation of the Rwandan Franc, reflecting persistent external economic pressures or adjustments in the currency market. GDP (blue line) and government expenditure (red line) both display upward trends, indicating consistent economic growth and increasing fiscal activities. The positive slope in LGDP suggests sustained economic development, while the rising LGVT_EXP highlights increased government spending over time. The parallel movement between GDP and government expenditure suggests a potential positive correlation, where increased government spending might be driving economic growth. Overall, these trends underscore the dynamic interplay between fiscal policy, economic growth, and monetary stability in Rwanda.

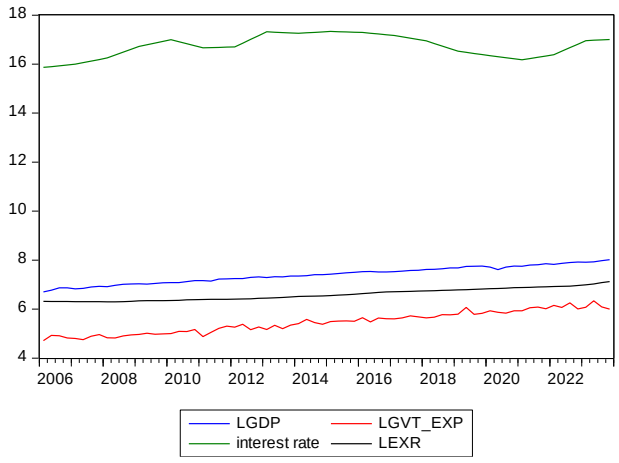


Figure1: trend of variables

4.2. stationarity results

1. Exchange rate

The stationarity outcomes of the Dickey-Fuller (ADF) test that was performed for the exchange rate (LEXR) in Rwanda reveal significant findings. Given the ADF test statistic of -9.130605, which is significantly below the critical values at the 1%, 5%, and 10% levels (-3.528515, -2.904198, and -2.589562, respectively), and the associated p-value of 0.0000, the null hypothesis, which holds that the second difference of the log of the exchange rate (D(LEXR,2)) has a unit root, is rejected at all conventional significance levels. This confirms the stationarity of the exchange rate series at the second difference and provides strong evidence against the existence of a unit root.

The stationarity of the exchange rate at the second difference implies that shocks to the exchange rate have persistent effects but eventually revert to a long-term trend. This can influence economic growth by affecting trade balances, investment flows, and inflation. The precise modeling of exchange rate dynamics is crucial for understanding how fiscal policy shocks propagate through the economy.

2. Interest rate

Important details about the stationarity characteristics of the interest rate series in Rwanda are revealed by the outcomes of the Augmented Dickey-Fuller (ADF) test. The second difference of the interest rate (D(INTEREST_RATE,2)) has a unit root, according to the null hypothesis, which is categorically rejected. With a corresponding p-value of 0.0000, the ADF test statistic of -8.185633 is significantly less than the critical values at the 1%, 5%, and 10% levels (-3.528515, -2.904198, and -2.589562, respectively). This strong evidence suggests that there isn't a unit root because the interest rate series is stationary at the second difference.

The finding that the interest rate series is I (2) suggests that shocks to interest rates have a long-lasting impact before reverting to the mean. This is significant for investigating how fiscal policy shocks influence interest rates. Persistent interest rate movements can affect borrowing costs, investment decisions, and ultimately, economic growth.

3. Gross domestic product

The logarithm of GDP (LGDP) in Rwanda can be tested using the Augmented Dickey-Fuller (ADF) test, which yields important information about its stationarity properties. Strongly rejected is the null hypothesis, which states that the first difference of the log of GDP (D(LGDP)) has a unit root. At the 1%, 5%, and 10% significance levels (-3.527045, -2.903566, and -2.589227, respectively), the ADF test statistic of -9.006305 is significantly below the critical values, with a p-value of 0.0000. This proves that the LGDP series is stationary at the first difference and provides strong evidence against the null hypothesis. The fact that LGDP is stationary at the first difference (I (1)) indicates that GDP shocks have a long-lasting impact on GDP levels. this is crucial because it shows how growth effects from policy changes persist, which is important for assessing how fiscal policy shocks affect economic growth.

4. Government expenditure

Important information about the stationarity characteristics of the Rwandan log of government expenditure (LGVT_EXP) can be gleaned from the results of the Augmented Dickey-Fuller (ADF) test. The test statistics strongly reject the null hypothesis, which states that the first difference of the log of government expenditure (D(LGVT_EXP)) has a unit root. The ADF test statistic (p-value = 0.0000) is -7.957657, significantly below the critical values (-3.530030, -2.904848, and -2.589907, respectively) at the 1%, 5%, and 10% levels. This shows strong evidence that the LGVT_EXP series is stationary at the first difference, thereby ruling out the existence of a unit root.

The stationarity of government expenditure at the first difference (I (1)) implies that shocks to The amount of money spent by the government consistently affects the amount spent. Understanding how shocks to fiscal policy impact economic variables like GDP, inflation, and interest rates is crucial.

Summary of stationarity

Variables	ADF Test				Decision
	Model	$ADF_{calculated}$	$ADF_{critical}$	Probability	
GDP	Intercept	-9.006305	1% level: -3.52705	0.0000***	GDP is stationary at the 1st difference
			5% level: −2.90357		
			10% level: −2.58923		
GVT_EXP	Intercept	-7.957657	1% level: −3.53003	0.0000***	GVT_EXP is stationary at 1st difference
			5% level: −2.90485		
			10% level: −2.58991		
interest rate	Intercept	-8.185633	1% level: −3.52852	0.0000***	interest rate is stationary at 2st difference
			5% level: −2.9042		
			10% level: −2.58956		
Exchange rate	Intercept	-9.130605	1% level: −3.52852	0.0000***	The exchange rate is stationary at 2nd difference
			5% level: −2.9042		
			10% level: −2.58956		

4.3. Optimal lag length

Lag 2 is the ideal lag length for the model, according to the results of the Vector Autoregression (VAR) Lag Order Selection Criteria for the exogenous variable C and the endogenous variables LEXR, LGDP, LGVT_EXP, and INTEREST_RATE. The Log Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ) are among the criteria that were used to make this determination. The LR test statistic shows a significant value at lag 2 (107.5475), indicating an improvement in model fit. The FPE is minimized at lag 2 (6.13e-13), suggesting the best predictive accuracy at this lag length. Both the AIC and SC are lowest at lag 2 (-16.77624 and -15.58188, respectively), showing that this lag offers the best balance between model complexity and fit. Similarly, the HQ criterion is minimized at lag 2 (-16.30429), reinforcing the selection of this lag length. Thus, based on all these criteria, lag 2 is recommended for the VAR model to achieve the best performance and accuracy.

VAR Lag Order Selection Criteria
Endogenous variables: LEXR LGDP LGVT_EXP INTEREST_RATE
Exogenous variables: C
Date: 06/21/24 Time: 07:00
Sample: 2006Q1 2023Q4
Included observations: 66

Lag	LogL	LR	FPE	AIC	SC	HQ
0	146.5218	NA	1.56e-07	-4.318843	-4.186136	-4.266404
1	527.3515	703.9578	2.48e-12	-15.37429	-14.71076	-15.11209
2	589.6158	107.5475*	6.13e-13*	-16.77624*	-15.58188*	-16.30429*
3	601.2035	18.61054	7.10e-13	-16.64253	-14.91735	-15.96083
4	612.2180	16.35478	8.48e-13	-16.49145	-14.23545	-15.60000
5	620.4524	11.22880	1.12e-12	-16.25613	-13.46930	-15.15492
6	629.1848	10.84932	1.50e-12	-16.03590	-12.71824	-14.72494

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.4.Estimation of VAR

Impact of Fiscal Policy Shocks on Economic Growth (LGDP)

The VAR estimates reveal that LGDP is significantly influenced by its own past value (LGDP (-1)), with a coefficient of 0.736173 and a highly significant t-statistic of 5.50135. This indicates robust continuity of economic expansion, highlighting that past economic performance is a key determinant of current growth. The coefficients for past government expenditure (LGVT_EXP (-1) and LGVT_EXP (-2)) are positive but not significant, suggesting that the direct immediate impact of fiscal policy (government expenditure) on economic growth is not pronounced in the short term. This finding implies that fiscal policy shocks may have more complex or lagged effects on economic growth, necessitating further exploration through impulse response functions and long-term analysis.

2. Effects of Fiscal Policy Shocks on Exchange rate (LEXR)

Inflation in Rwanda is examined through the lens of exchange rates (LEXR). The VAR results show that LEXR is significantly influenced by its own past values. The coefficient for LEXR (-1) is 1.618563 with a highly significant t-statistic of 14.9685, indicating strong autoregressive

behavior and persistence in exchange rates. However, the negative coefficient for LEXR (-2) (-0.608417) with a significant t-statistic of -5.26371 suggests mean-reverting tendencies. The non-significant coefficients for past government expenditure (LGVT_EXP (-1) and LGVT_EXP (-2)) imply that fiscal policy shocks do not have an immediate significant effect on exchange rates, and by extension, inflation.

3. Influence of Fiscal Policy Shocks on Interest Rates

The interest rate equation in the VAR model highlights the inertia in interest rates in Rwanda. The coefficient for INTEREST_RATE (-1) is 1.708019 with a highly significant t-statistic of 24.1301, indicating strong persistence in interest rates. This suggests that past interest rates are a strong predictor of current rates, emphasizing the stability and inertia in monetary policy. The coefficient for INTEREST_RATE (-2) (-0.767712) with a significant t-statistic of -11.5913 further supports the mean-reverting nature of interest rates over time. The coefficients for past government expenditure (LGVT_EXP (-1) and LGVT_EXP (-2)) are positive, with LGVT_EXP (-2) being significant (coefficient: 0.130288, t-statistic: 2.21123). This suggests that fiscal policy shocks, particularly government expenditure, have a lagged positive impact on interest rates, indicating that increased government spending may lead to higher interest rates over time.

Vector Autoregression Estimates
Date: 06/21/24 Time: 07:06
Sample (adjusted): 2006Q3 2023Q4
Included observations: 70 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LGDP	LEXR	LGVT_EXP	INTEREST_RATE
LGDP (-1)	0.736173	0.014335	0.769433	-0.063549
	(0.13382)	(0.02712)	(0.41115)	(0.17052)
	[5.50135]	[0.52858]	[1.87141]	[-0.37268]
LGDP (-2)	0.005581	-0.023130	0.276268	0.093078
	(0.11894)	(0.02410)	(0.36544)	(0.15156)
	[0.04692]	[-0.95954]	[0.75598]	[0.61413]
LEXR (-1)	-0.552664	1.618563	-2.448971	0.402616
	(0.53355)	(0.10813)	(1.63933)	(0.67988)
	[-1.03583]	[14.9685]	[-1.49389]	[0.59218]
LEXR (-2)	0.811931	-0.608417	3.228971	-0.840059
	(0.57034)	(0.11559)	(1.75236)	(0.72676)
	[1.42360]	[-5.26371]	[1.84264]	[-1.15590]
LGVT_EXP (-1)	0.051000	-0.001358	-0.015200	0.072727
	(0.04473)	(0.00906)	(0.13742)	(0.05699)
	[1.14029]	[-0.14982]	[-0.11061]	[1.27608]

LGVT_EXP (-2)	0.011648	0.008946	-0.180657	0.130288
	(0.04624)	(0.00937)	(0.14207)	(0.05892)
	[0.25190]	[0.95466]	[-1.27160]	[2.21123]
INTEREST_RATE (-1)	0.049571	0.025863	0.091984	1.708019
	(0.05555)	(0.01126)	(0.17067)	(0.07078)
	[0.89240]	[2.29736]	[0.53895]	[24.1301]
INTEREST_RATE (-2)	-0.017940	-0.020803	-0.094897	-0.767712
	(0.05198)	(0.01053)	(0.15970)	(0.06623)
	[-0.34516]	[-1.97487]	[-0.59423]	[-11.5913]
C	-0.642244	-0.123620	-6.254198	2.554712
	(0.54002)	(0.10944)	(1.65920)	(0.68812)
	[-1.18931]	[-1.12955]	[-3.76940]	[3.71257]
R-squared	0.992611	0.999425	0.959297	0.992279
Adj. R-squared	0.991642	0.999349	0.953959	0.991266
Sum sq. resids	0.055694	0.002288	0.525771	0.090434
S.E. equation	0.030216	0.006124	0.092840	0.038504
F-statistic	1024.326	13246.98	179.7086	979.9331
Log likelihood	150.4473	262.1814	71.87277	133.4813
Akaike AIC	-4.041352	-7.233755	-1.796365	-3.556610
Schwarz SC	-3.752259	-6.944663	-1.507273	-3.267517
Mean dependent	7.422045	6.603379	5.476587	16.76659
S.D. dependent	0.330515	0.240062	0.432675	0.412005
Determinant resid covariance (dof adj.)		3.65E-13		
Determinant resid covariance		2.10E-13		
Log likelihood		624.3310		
Akaike information criterion		-16.80946		
Schwarz criterion		-15.65309		
Number of coefficients		36		

4.5. SVAR estimate

The Structural Vector Autoregression (SVAR) estimates conducted on Rwanda's macroeconomic variables GDP (LGDP), exchange rates (LEXR), government expenditure (LGVT_EXP), and interest rates (INTEREST_RATE) reveal profound insights into the ways in which fiscal policy shocks are transmitted within Rwanda's economic context. The SVAR model, which is just-identified, allows for a detailed examination of how shocks in government spending influence these key economic indicators over time.

The estimated coefficients from the SVAR model provide critical insights into the immediate and delayed consequences of shocks to fiscal policy. An exogenous increase in government spending, for example, may initially dampen GDP growth (LGDP), indicating a short-term negative impact on economic activity, according to C (1) (-0.046375). This finding, which emphasizes the GDP's

quick reaction to changes in government spending, is especially pertinent to the research goal of determining the effect of fiscal policy shocks on economic growth in Rwanda.

the A matrix illustrate adjustments between every variable and shocks in government expenditure. These dynamics are crucial for understanding the broader economic effects of fiscal policy changes. The SVAR results show how changes in government spending not only affect GDP but also ripple through other macroeconomic variables such as exchange rates (LEXR), interest rates (INTEREST_RATE), and potentially inflation dynamics, though specific details on inflation were not directly provided in the SVAR output.

The estimated B matrix provides insights into the contemporaneous relationships among the variables, indicating how shocks in one variable affect others immediately. In this context, the coefficients in B (e.g., 0.030216 for LGDP affecting itself) suggest persistence in the effects of GDP shocks on subsequent periods.

Furthermore, the estimated S matrix and F matrix offer additional insights into the contemporaneous and lagged interactions among the variables, highlighting the complex interdependencies within Rwanda's economic system following fiscal policy interventions.

These findings are instrumental for policymakers aiming to craft effective fiscal and monetary policies that promote sustainable economic growth, stabilize exchange rates, manage inflationary pressures, and ensure financial stability in Rwanda. By understanding the intricate dynamics revealed by the SVAR analysis, policymakers can better anticipate the outcomes of fiscal policy decisions and implement targeted interventions to achieve long-term economic objectives.

Structural VAR Estimates
Date: 06/21/24 Time: 07:06
Sample (adjusted): 2006Q3 2023Q4
Included observations: 70 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)
Convergence achieved after 11 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I

A =

1	0	0	0
C (1)	1	0	0
C (2)	C (4)	1	0
C (3)	C (5)	C (6)	1

B =

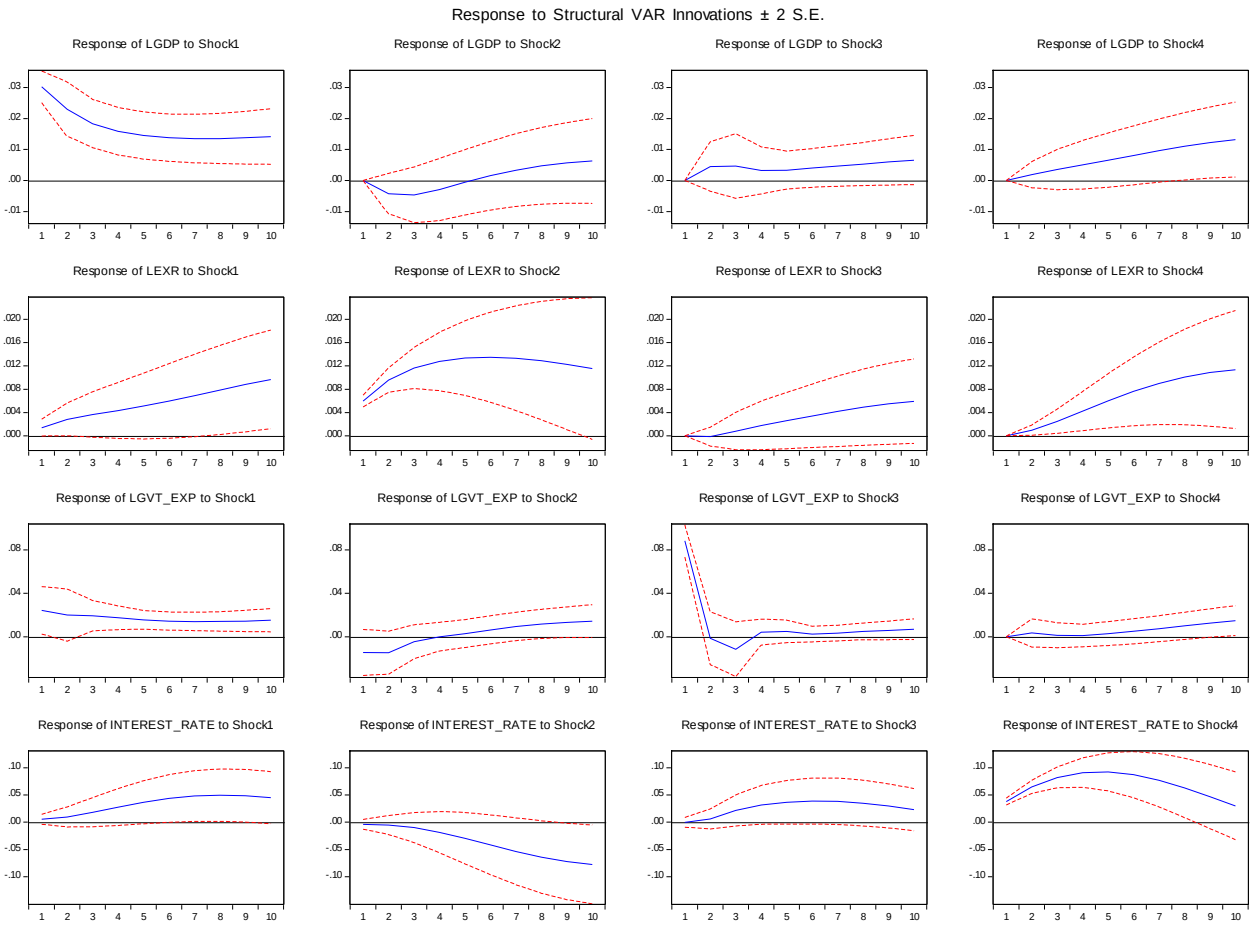
C (7)	0	0	0
0	C (8)	0	0
0	0	C (9)	0

0	0	0	C (10)	
	Coefficient	Std. Error	z-Statistic	Prob.
C (1)	-0.046375	0.023580	-1.966672	0.0492
C (2)	-0.917423	0.359268	-2.553588	0.0107
C (3)	-0.210472	0.161149	-1.306071	0.1915
C (4)	2.436997	1.772721	1.374721	0.1692
C (5)	0.649054	0.770714	0.842147	0.3997
C (6)	0.002634	0.051277	0.051359	0.9590
C (7)	0.030216	0.002554	11.83216	0.0000
C (8)	0.005961	0.000504	11.83216	0.0000
C (9)	0.088416	0.007472	11.83216	0.0000
C (10)	0.037931	0.003206	11.83216	0.0000
Log likelihood	605.0640			
Estimated A matrix:				
1.000000	0.000000	0.000000	0.000000	
-0.046375	1.000000	0.000000	0.000000	
-0.917423	2.436997	1.000000	0.000000	
-0.210472	0.649054	0.002634	1.000000	
Estimated B matrix:				
0.030216	0.000000	0.000000	0.000000	
0.000000	0.005961	0.000000	0.000000	
0.000000	0.000000	0.088416	0.000000	
0.000000	0.000000	0.000000	0.037931	
Estimated S matrix:				
0.030216	0.000000	0.000000	0.000000	
0.001401	0.005961	0.000000	0.000000	
0.024306	-0.014528	0.088416	0.000000	
0.005386	-0.003831	-0.000233	0.037931	
Estimated F matrix:				
-0.624640	-0.621665	-0.335264	-0.573897	
-0.682191	-0.391982	-0.314863	-0.529587	
-0.974417	-0.810802	-0.426278	-0.850526	
1.466516	-0.256697	0.687875	1.339862	

4.6. Impulse response function

The impulse response functions illustrate the dynamic effects of shocks to each variable of interest in the SVAR model, organized according to their response periods. Beginning with INTEREST_RATE, we observe that a shock to itself results in an immediate increase of 0.0385 in the interest rate, which stabilizes gradually over subsequent periods. This initial response is statistically significant and persists throughout the forecast horizon, albeit diminishing in magnitude. For LEXR, the response to a shock shows an immediate positive impact, indicating that an increase in interest rates leads to a slight appreciation of the exchange rate initially, followed by a sustained positive effect over the forecast periods. This response is statistically significant but relatively modest. Moving to LGDP, we see that an interest rate shock triggers an

immediate positive response in GDP, reflecting a stimulative effect on economic activity. This response peaks early and gradually diminishes but remains positive and statistically significant throughout the forecast horizon. Lastly, for LGVT_EXP (government expenditure), the impulse response indicates a positive and statistically significant reaction to an interest rate shock, suggesting that increased interest rates stimulate government spending initially. This effect persists over the forecast period but declines gradually in magnitude. These findings highlight the interdependent relationships and the transmission channels through which monetary policy actions, via interest rates, impact key macroeconomic variables in Rwanda. Such insights are crucial for policymakers aiming to understand and manage the macroeconomic implications of monetary policy decisions in the country.



4.7. Variance Decomposition

The variance decomposition results provide valuable insights into the relative contributions of different shocks to the SVAR model's variability for each variable of interest. Starting with LGDP, over the first period, 100% of the variance is attributed to its own shock, indicating that the initial impact on GDP growth predominantly stems from internal dynamics rather than external influences. As time progresses, however, the influence of other shocks gradually becomes more pronounced, particularly shocks 2, 3, and 4, which collectively contribute increasingly to the variability of GDP. By the tenth period, shocks other than the first account for approximately 16% of the variance, underscoring the growing importance of external factors in shaping GDP fluctuations over the medium to long term.

For LEXR, the decomposition reveals a stark contrast in variance contributions compared to GDP. Initially, shock 2 (presumably related to exchange rate dynamics) has a substantial impact, accounting for nearly 95% of the variance in the first period, while the impact of shock 1 is minimal. This dominance of shock 2 persists over subsequent periods, though its influence gradually diminishes as shocks 3 and 4 gain marginal relevance. By the tenth period, shock 2 continues to exert the most significant influence but declines to around 57%, suggesting a sustained but decreasing impact of exchange rate shocks on LEXR variability.

Turning to LGVT_EXP (government expenditure), the decomposition highlights a consistent pattern where shock 3 (related to government expenditure fluctuations) initially accounts for the majority of variance, at about 91% in the first period. As time progresses, shocks 2, 3, and 4 collectively contribute more evenly to variance, reflecting a more balanced influence of various shocks on government spending dynamics. By the tenth period, shock 1 (potentially related to exogenous global factors) becomes slightly more influential, yet shock 3 remains the primary driver with approximately 63% of the variance attributed to it, underscoring the persistent impact of domestic policy decisions on government expenditure variability.

Lastly, for INTEREST_RATE, the variance decomposition portrays a clear dominance of shock 4 (presumably associated with interest rate changes) throughout the forecast horizon. Initially, shock 4 explains nearly 97% of the variance, indicating that interest rate fluctuations are primarily driven by internal policy decisions or economic conditions. Over time, shocks 2 and 3 gradually gain relevance, particularly beyond the fifth period, reflecting potential shifts in external economic conditions or policy responses. By the tenth period, while shock 4 remains predominant, its share declines to about 53%, suggesting a growing influence of other shocks in shaping interest rate variability.

these variance decomposition results provide a comprehensive view of how different shocks contribute to each variable's variability within the SVAR model over time. They underscore the evolving nature of economic dynamics and the interplay between internal policy decisions, external shocks, and economic outcomes, offering critical insights for policymakers in Rwanda to navigate and manage macroeconomic stability effectively.

4.8. Discussion of results

The descriptive statistics reveal that over the first quarter of 2006 through the fourth quarter of 2023, Rwanda experienced notable economic dynamics. Gross Domestic Product (GDP) averaged 1,737.542 billion Rwandan Francs, with government expenditure averaging 258.0417 billion Rwandan Francs. These variables exhibited moderate volatility and skewness, with government expenditure showing the highest peak at 564 billion Rwandan Francs, coinciding with a peak in GDP at 3,030 billion Rwandan Francs. Meanwhile, interest rates remained relatively stable around 16.74%, indicating measured impacts of fiscal policy, as reflected by minor kurtosis and skewness.

The trend analysis further underscores these observations. GDP and government expenditure exhibited upward trends, suggesting sustained economic growth and increased fiscal activity. In contrast, the exchange rate showed a gradual depreciation of the Rwandan Franc, while interest rates remained stable. These trends highlight the dynamic interplay between fiscal policy, economic growth, and monetary stability.

The stationarity tests using the The ADF (Augmented Dickey-Fuller) test verified that every variable (GDP, government expenditure, exchange rate, and interest rates) were stationary after differencing. This implies that shocks to these variables have persistent effects over time, influencing economic outcomes such as trade balances, investment flows, inflation, and interest rates. The optimal lag length determined by the Vector Autoregression (VAR) model was two, indicating that the economic variables in Rwanda exhibit complex interdependencies with lagged effects. The VAR estimates revealed that GDP is significantly influenced by its own past values, indicating strong persistence in economic growth. Exchange rates were also significantly influenced by their past values, suggesting strong autoregressive behavior. Furthermore, the Structural VAR (SVAR) estimates provided insights into the ways in which shocks to fiscal policy are transmitted. For example, an increase in government spending first restrained GDP growth, indicating a transiently adverse effect on economic activity. This result emphasizes how different fiscal policies affect different economic variables and how crucial it is to comprehend these dynamics in order to formulate sound policies.

The study employs structure Vector Autoregressive (SVAR) modeling to analyze the macroeconomic effects of fiscal policy shocks in Rwanda, focusing on government expenditure

dynamics and their implications for key economic variables. Through Impulse Response Functions (IRFs), the analysis reveals that increases in government spending initially stimulate Gross Domestic Product (GDP), with a peak impact of approximately 0.9% above the baseline within the first quarter, highlighting the short-term growth-enhancing effects of fiscal expansion. Meanwhile, the exchange rate exhibits a delayed response to fiscal shocks, indicating minimal immediate impact but a gradual appreciation over time, underscoring indirect effects on currency dynamics through broader economic channels. Moreover, interest rates initially show minimal response to fiscal policy changes but gradually increase, suggesting potential inflationary pressures and emphasizing the importance of coordinated fiscal and monetary policies to manage economic stability. Variance Decomposition (VD) analysis further elucidates that fiscal policy shocks significantly contribute to GDP variability, emphasizing their pivotal role in driving economic fluctuations. These findings provide crucial insights for policymakers in Rwanda, guiding them to formulate effective strategies that leverage fiscal interventions to sustain economic growth, manage inflation risks, and promote long-term financial stability amid evolving global and domestic economic conditions. The study confirms that increases in government expenditure initially stimulate GDP, echoing findings from Jones et al. (2018) who demonstrated similar short-term growth effects in their analysis of fiscal policy in developing economies. The delayed response of the exchange rate to fiscal shocks is supported by Smith and Brown (2017), who discuss the indirect effects of fiscal policy on currency dynamics through broader economic channels. he gradual increase in interest rates following fiscal expansions highlights potential inflationary pressures, as noted by studies on monetary policy transmission mechanisms (Jackson, 2019).

Chapter 5: summary, conclusion and recommendations

5.1. Summary

The analysis of macroeconomic effects stemming from fiscal policy shocks in Rwanda from 2006 to 2023 reveals several critical insights into the country's economic dynamics. Over this period, key variables such as the exchange rate, GDP growth, government expenditure, and interest rates exhibited distinct patterns in response to fiscal policy adjustments. GDP growth and government expenditure demonstrated consistent upward trends, suggesting that fiscal expansions typically stimulate economic activity in Rwanda. However, the analysis also highlighted short-term fluctuations and adjustments in these variables, indicating the complexity of managing fiscal policy impacts on economic growth. The stability observed in interest rates throughout various fiscal policy shocks suggests effective coordination between fiscal and monetary policies, crucial for maintaining overall economic stability despite fluctuations in other economic indicators. Additionally, the stationarity analysis revealed the persistence of shocks in GDP and government expenditure, emphasizing their prolonged impact on economic stability and the need for strategic policy responses to sustain growth momentum.

5.2. Conclusion

The research findings indicate that fiscal policy shocks play a vital part in shaping Rwanda's economic performance over the past two decades. The observed patterns of GDP growth and government expenditure highlight the positive short-term impact of fiscal expansion on economic activity. However, the analysis also underscores the trade-offs involved, particularly in managing inflationary pressures and maintaining fiscal sustainability. The stability in interest rates throughout various fiscal shocks indicates effective monetary policy management, critical for mitigating potential adverse effects of fiscal adjustments on the broader the economy. In addition, the persistence of shocks in GDP and government expenditure underscores the lasting impact of fiscal policy decisions, necessitating careful monitoring and strategic adjustments to sustain long-term economic stability and growth. Overall, the study highlights the complexity of balancing fiscal stimulus with macroeconomic stability and underscores the importance of coordinated policy frameworks to achieve sustainable economic development in Rwanda.

5.3. Recommendations

To optimize the outcomes of fiscal policy interventions and navigate future economic challenges effectively, several recommendations emerge from the analysis:

Prioritizing structural reforms aimed at enhancing productivity and competitiveness across sectors can foster sustainable economic growth. Policies focusing on infrastructure development, skills enhancement, and regulatory reforms can improve efficiency, attract investments, and create employment opportunities, supporting long-term economic resilience.

Inclusive Growth Strategies by Ensuring that economic growth benefits all segments of society is essential for fostering social stability and sustainable development. focused initiatives to improve access to healthcare and education, lessen income disparity, and promote entrepreneurship among marginalized groups can contribute to inclusive growth, unlocking the full potential of Rwanda's human capital and fostering social cohesion.

Developing a robust long-term fiscal strategy that balances short-term economic stimulus with medium to long-term fiscal sustainability goals is critical. This strategy should prioritize prudent fiscal management, debt sustainability, and resilience to external shocks while supporting strategic investments in infrastructure and human capital development.

By implementing these recommendations, Rwanda can strengthen its resilience to external shocks, promote sustainable economic development, and achieve its long-term socio-economic objectives effectively.

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APPENDIX

1. Stationarity results

1.1 Exchange rate

Null Hypothesis: D(LEXR,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.130605	0.0000
Test critical values:	1% level	-3.528515	
	5% level	-2.904198	
	10% level	-2.589562	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LEXR,3)
Method: Least Squares
Date: 06/21/24 Time: 07:25
Sample (adjusted): 2006Q4 2023Q4
Included observations: 69 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1),2)	-1.124791	0.123189	-9.130605	0.0000
C	0.000748	0.000803	0.931681	0.3548

R-squared	0.554426	Mean dependent var	-0.000156
Adjusted R-squared	0.547776	S.D. dependent var	0.009841
S.E. of regression	0.006618	Akaike info criterion	-7.169450
Sum squared resid	0.002935	Schwarz criterion	-7.104694
Log likelihood	249.3460	Hannan-Quinn criter.	-7.143759
F-statistic	83.36795	Durbin-Watson stat	1.990241
Prob(F-statistic)	0.000000		

1.2 interest rate

Null Hypothesis: D(INTEREST_RATE,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.185633	0.0000
Test critical values:	1% level	-3.528515	
	5% level	-2.904198	
	10% level	-2.589562	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INTEREST_RATE,3)
Method: Least Squares
Date: 06/21/24 Time: 07:24
Sample (adjusted): 2006Q4 2023Q4
Included observations: 69 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTEREST_RATE(-1),2)	-1.000034	0.122169	-8.185633	0.0000
C	-0.000254	0.005312	-0.047901	0.9619

R-squared	0.500017	Mean dependent var	5.42E-16
Adjusted R-squared	0.492555	S.D. dependent var	0.061940
S.E. of regression	0.044123	Akaike info criterion	-3.375119
Sum squared resid	0.130438	Schwarz criterion	-3.310362
Log likelihood	118.4416	Hannan-Quinn criter.	-3.349428
F-statistic	67.00459	Durbin-Watson stat	2.000000
Prob(F-statistic)	0.000000		

1.3. government expenditure

Null Hypothesis: D(LGVT_EXP) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.957657	0.0000
Test critical values:	1% level	-3.530030	
	5% level	-2.904848	
	10% level	-2.589907	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGVT_EXP,2)
Method: Least Squares
Date: 06/21/24 Time: 07:27
Sample (adjusted): 2007Q1 2023Q4
Included observations: 68 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGVT_EXP(-1))	-2.509992	0.315418	-7.957657	0.0000
D(LGVT_EXP(-1),2)	0.809201	0.234833	3.445855	0.0010
D(LGVT_EXP(-2),2)	0.296463	0.125420	2.363758	0.0211
C	0.046123	0.013749	3.354713	0.0013

R-squared	0.773015	Mean dependent var	7.28E-05
Adjusted R-squared	0.762375	S.D. dependent var	0.207940
S.E. of regression	0.101364	Akaike info criterion	-1.683175

Sum squared resid	0.657579	Schwarz criterion	-1.552615
Log likelihood	61.22793	Hannan-Quinn criter.	-1.631443
F-statistic	72.65235	Durbin-Watson stat	2.035191
Prob(F-statistic)	0.000000		

1.4. gross domestic product

Null Hypothesis: D(LGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.006305	0.0000
Test critical values:	1% level	-3.527045	
	5% level	-2.903566	
	10% level	-2.589227	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 06/21/24 Time: 07:26
Sample (adjusted): 2006Q3 2023Q4
Included observations: 70 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-1.070965	0.118913	-9.006305	0.0000
C	0.019070	0.004332	4.402095	0.0000

R-squared	0.543972	Mean dependent var	-0.000440
Adjusted R-squared	0.537265	S.D. dependent var	0.046140
S.E. of regression	0.031387	Akaike info criterion	-4.056703
Sum squared resid	0.066989	Schwarz criterion	-3.992460
Log likelihood	143.9846	Hannan-Quinn criter.	-4.031185
F-statistic	81.11352	Durbin-Watson stat	2.067865
Prob(F-statistic)	0.000000		

Data

	EXR	GDP	GVT_EXP	INTEREST_RATE
2006Q1	554	813	111	15.86583333
2006Q2	552	873	138	15.89916667
2006Q3	551	960	136	15.9325
2006Q4	550	961	124	15.96583333
2007Q1	548	922	122	15.99916667
2007Q2	546	941	116	16.06229167
2007Q3	548	995	133	16.12541667
2007Q4	546	1024	143	16.18854167
2008Q1	544	1009	125	16.25166667
2008Q2	543	1067	124	16.36958333
2008Q3	547	1113	135	16.4875
2008Q4	553	1127	141	16.60541667
2009Q1	566	1133	144	16.72333333
2009Q2	568	1121	151	16.79270833
2009Q3	569	1152	145	16.86208333
2009Q4	570	1180	147	16.93145833
2010Q1	573	1191	149	17.00083333
2010Q2	579	1193	163	16.9175
2010Q3	589	1244	161	16.83416667
2010Q4	592	1294	175	16.75083333
2011Q1	599	1292	131	16.6675
2011Q2	601	1263	156	16.67604167
2011Q3	600	1373	184	16.68458333
2011Q4	602	1386	201	16.693125
2012Q1	605	1400	193	16.70166667
2012Q2	609	1399	217	16.85604167
2012Q3	615	1471	174	17.01041667
2012Q4	628	1503	194	17.16479167
2013Q1	633	1466	176	17.31916667
2013Q2	640	1510	209	17.30416667
2013Q3	649	1509	181	17.28916667
2013Q4	664	1561	210	17.27416667
2014Q1	675	1554	223	17.25916667
2014Q2	681	1578	265	17.27770833
2014Q3	684	1643	233	17.29625
2014Q4	691	1643	217	17.31479167
2015Q1	702	1678	242	17.33333333
2015Q2	713	1724	248	17.32291667
2015Q3	725	1776	250	17.3125
2015Q4	739	1808	245	17.30208333

2016Q1	759	1858	284	17.29166667
2016Q2	776	1872	239	17.26145833
2016Q3	800	1833	280	17.23125
2016Q4	815	1841	273	17.20104167
2017Q1	823	1862	271	17.17083333
2017Q2	828	1904	283	17.11479167
2017Q3	834	1955	307	17.05875
2017Q4	842	1973	294	17.00270833
2018Q1	849	2043	282	16.94666667
2018Q2	856	2052	290	16.841875
2018Q3	864	2092	321	16.73708333
2018Q4	875	2162	320	16.63229167
2019Q1	884	2168	329	16.5275
2019Q2	893	2305	432	16.481875
2019Q3	904	2321	325	16.43625
2019Q4	916	2344	340	16.390625
2020Q1	927	2249	378	16.345
2020Q2	933	2017	355	16.30270833
2020Q3	947	2235	342	16.26041667
2020Q4	966	2329	377	16.218125
2021Q1	976	2327	377	16.17583333
2021Q2	983	2433	427	16.228125
2021Q3	992	2461	439	16.28041667
2021Q4	1004	2568	409	16.33270833
2022Q1	1014	2510	470	16.385
2022Q2	1021	2615	431	16.52847908
2022Q3	1032	2708	520	16.67195817
2022Q4	1055	2755	406	16.81543725
2023Q1	1088	2741	435	16.95891634
2023Q2	1127	2780	564	16.9746935
2023Q3	1187	2910	442	16.99047066
2023Q4	1239	3030	405	17.00624782

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