UNIVERSITY OF RWANDA
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF ECONOMICS

Examining the Effects of Inflation and Unemployment on Economic Growth in Rwanda

Thesis Submitted to the Department of Economics, University of Rwanda as a Partial Fulfilment of the Requirements for the Degree of Postgraduate, Masters of Science in Economics with Development Economics Specialization.

by

Eugene BIKORIMANA
Registration number: **221026674**

Supervised by
Dr. Martin MUGENZI

February 2024

Dedication

To my family, friends, and mentors for their unwavering support and encouragement. In memory of my late wife, who inspired my love for learning. And to the resilient people of Rwanda, this thesis is dedicated to your pursuit of sustainable economic growth.

Eugene BIKORIMANA

February 2024

Declaration

I, Eugene BIKORIMANA, hereby declare that this thesis, entitled “Examining the Effects of Inflation and Unemployment on Economic Growth in Rwanda,” is entirely my own work. All sources used have been duly acknowledged and referenced. Any assistance received during the research and writing of this thesis has been acknowledged as well.

I affirm that this thesis has not been previously submitted for any other degree or qualification at the University of Rwanda or any other institution.

Student's Signature: _____Date: _____

Eugene BIKORIMANA

I, Dr. Martin MUGENZI, hereby declare that I have supervised the research and writing of this thesis. I have provided guidance and support to the student throughout the research process.

Supervisor's Signature: _____Date: _____

Dr. Martin MUGENZI

Acknowledgments

The author expresses gratitude to Dr. Martin MUGENZI, the Department of Economics at the University of Rwanda, the family, friends, colleagues, participants, and the people of Rwanda for their invaluable support and encouragement throughout the research process. They thank them for their guidance, feedback, and unwavering encouragement, as well as for the academic environment and interactions with fellow scholars. The author also acknowledges the cooperation and openness of the Rwandan people, who have driven the research toward economic growth and development. Overall, the author's gratitude and support are invaluable in making this thesis possible.

Eugene BIKORIMANA

February 2024

Abstract

This study analyzes the impact of inflation and unemployment on economic growth in Rwanda, providing insights for effective economic policy formulation. Using statistical methods like impulse response function (IRF), historical decomposition, and variance decomposition, the study reveals how real GDP, inflation, and unemployment respond to shocks. The historical decomposition analysis highlights the increasing role of external factors in influencing fluctuations, while the variance decomposition analysis highlights the significance of inflation and unemployment shocks in driving fluctuations in real GDP. The findings emphasize the importance of understanding the impact of inflation and unemployment shocks on Rwanda's economy and formulating appropriate policies to mitigate their effects. Recommendations include developing a robust macroeconomic policy framework, implementing targeted employment policies, encouraging economic diversification, and fostering stakeholder collaboration for sustainable economic growth. This study offers valuable insights for policymakers, businesses, and researchers to navigate uncertain economic landscapes and promote economic stability and growth in Rwanda.

Keywords: *Inflation, unemployment, economic growth, impulse response function (IRF), macroeconomic policy.*

Table of Contents

List of tables

List of Figures

Chapter One: Introduction

1.0 General Introduction

In recent years, Rwanda has emerged as one of the fastest-growing economies in East Africa, attracting international attention due to its remarkable economic development and transformation (World Bank, 2021). As a landlocked country, Rwanda has navigated various challenges, including historical conflicts, limited resources, and geographical constraints, to achieve significant progress in key economic indicators (IMF, 2020). Nevertheless, the nation still faces critical economic issues, notably inflation, and unemployment, which have implications for its long-term sustainable growth.

The relationship between inflation, unemployment, and economic growth has been extensively studied in the field of macroeconomics. Numerous theoretical and empirical studies have explored the causal effects of inflation and unemployment on economic growth in both developed and developing countries (Blanchard, 2017; Romer, 2019). Economists have advanced various arguments to explain the dynamics of this relationship.

Regarding inflation, the traditional Phillips Curve theory posits a trade-off between inflation and unemployment, suggesting that low levels of unemployment are associated with higher inflation rates (Akerlof et al., 2019). However, this inverse relationship has been subject to criticism, and many economists now argue that the Phillips Curve is not stable in the long run (Ball, 2020). Instead, contemporary research emphasizes the adverse effects of high inflation on economic growth, including reduced purchasing power, increased uncertainty, and diminished investment (Romer, 2019).

Similarly, the literature on unemployment reveals the significance of addressing labor market challenges for economic growth. The existence of a negative relationship between unemployment and economic growth is widely acknowledged (Blanchard, 2017). High unemployment rates indicate underutilization of labor resources, leading to lost output and lower overall productivity in the economy (IMF, 2020). Scholars have emphasized the importance of job creation, workforce development, and policies to foster labor market participation as essential factors in promoting economic growth (Akerlof et al., 2019).

Despite the significant body of literature examining the relationship between inflation, unemployment, and economic growth in various countries, there is a noticeable research gap concerning the specific case of Rwanda. While Rwanda has achieved remarkable economic development and emerged as one of the fastest-growing economies in East Africa (World Bank, 2021), limited attention has been given to understanding how inflation and unemployment dynamics interact and influence the country's unique development context.

The majority of existing research on the causal effects of inflation and unemployment on economic growth has predominantly focused on developed economies (Blanchard, 2017; Romer, 2019). Consequently, there is a dearth of comprehensive studies exploring these relationships in the context of a rapidly developing country like Rwanda.

Moreover, given Rwanda's historical context of conflicts and its landlocked status, there may be specific macroeconomic challenges and opportunities that have not been adequately addressed in the existing literature (IMF, 2020). This context necessitates a more tailored and nuanced analysis of how inflation and unemployment impact economic growth in Rwanda.
Thus, the research gap lies in the scarcity of empirical investigations and in-depth studies that explore the causal relationships between inflation, unemployment, and economic growth within the specific context of Rwanda. Filling this gap is crucial to gaining a deeper understanding of the macroeconomic dynamics that drive Rwanda's economic progress and to provide insights into effective policy measures that can support the country's sustained and inclusive economic growth (Akerlof et al., 2019).

1.1 Background of the Study

In the context of an interconnected and ever-evolving global economy, understanding the dynamics of inflation, unemployment, and their impact on economic growth is of paramount importance for both developed and developing nations. Countries worldwide face unique challenges in managing these macroeconomic factors to achieve sustainable and inclusive growth (Blanchard, 2017; Romer, 2019). Inflation can be triggered by a myriad of factors such as changes in monetary policy, supply chain disruptions, and shifts in global commodity prices, while unemployment is influenced by labor market conditions, technological advancements, and structural economic changes.

The African continent has witnessed significant economic growth and development in recent years, with several countries experiencing notable progress in various sectors. However, Africa also grapples with persistent challenges, such as poverty, income inequality, and a rapidly growing population (IMF, 2020). Ensuring economic stability and reducing unemployment are critical imperatives for the region's sustainable development. Africa's economic growth is often characterized by its resource-rich economies, dependence on primary commodities, and efforts to diversify into more resilient sectors (African Development Bank, 2018).

In this study, we focus on Rwanda, a landlocked country in East Africa that has captured international attention for its impressive economic development in recent decades (World Bank, 2021). Rwanda's transformational journey since the 1994 genocide has been driven by visionary policies and strong government commitment to socio-economic advancement. Despite its successes, Rwanda faces several economic challenges. The country's economic growth has been characterized by a focus on agricultural modernization, export diversification, and improvements in key sectors, including services and industry (World Bank, 2021). However, inflation and unemployment remain key areas of concern for policymakers and stakeholders.

Rwanda has experienced fluctuations in inflation rates over the years, with efforts to maintain price stability and manage inflationary pressures (IMF, 2020). While moderate inflation is generally regarded as a sign of a healthy economy, high and volatile inflation can impede economic growth and adversely affect the purchasing power of consumers, particularly the most vulnerable segments of the population. In Rwanda, inflation is influenced by factors such as changes in global oil prices, fiscal policy measures, and food price volatility. Managing inflation effectively requires a careful balance between monetary and fiscal policy tools (Ngarambe et al., 2020).

Unemployment continues to pose a significant challenge to Rwanda's economic development. The country's demographic dividend, which could serve as a potential source of economic growth through a young and productive workforce, also presents a pressing need for job creation and skills development (IMF, 2020). Ensuring employment opportunities for the growing labor force is crucial for social stability and inclusive growth. Rwanda's efforts to reduce unemployment are driven by policies aimed at promoting private sector growth, enhancing technical and vocational education, and encouraging entrepreneurship (Biraro et al., 2021).

Despite Rwanda's unique socio-economic context and remarkable progress, there remains a research gap concerning the specific causal effects of inflation and unemployment on the country's economic growth. Existing literature predominantly focuses on developed economies, leaving a dearth of comprehensive studies tailored to Rwanda's specific challenges and opportunities. The uniqueness of Rwanda's post-genocide recovery and reconciliation efforts, its landlocked status, and its ongoing socio-economic transformation necessitates a context-specific analysis of inflation, unemployment, and economic growth.

This study aims to fill the research gap by conducting an in-depth analysis of the relationships between inflation, unemployment, and economic growth in Rwanda. By scientifically exploring these factors within Rwanda's context, the research seeks to provide evidence-based policy recommendations to support the country's sustained and inclusive economic development.

1.2 Problem Statement

Rwanda's economic growth has garnered significant attention in recent years due to its remarkable development trajectory within Sub-Saharan Africa. However, like many developing economies, Rwanda faces challenges in maintaining stable and sustainable economic growth. Inflation and unemployment are two critical macroeconomic variables that can significantly influence the overall economic performance of the country (Mbabazi & Bizimana, 2021). Consequently, it is essential to undertake an in-depth investigation into the effects of inflation and unemployment on Rwanda's economic growth to provide policymakers, economists, and stakeholders with actionable insights for effective economic management. Inflation in Rwanda has demonstrated fluctuations in recent years, potentially affecting consumer purchasing power, business investment decisions, and overall price stability.

Identifying the optimal level of inflation conducive to economic growth is crucial for policymakers to avoid hyperinflationary pressures that can erode savings and investment while ensuring adequate price levels to support businesses and maintain consumer demand. Similarly, the rate of unemployment in Rwanda, particularly among the youth, has emerged as a significant concern. High unemployment rates can lead to social and political instability, negatively impacting productivity, and hindering economic growth potential (Nkurunziza & Muneza, 2022). Moreover, understanding the underlying causes of different types of

unemployment, such as structural, cyclical, and frictional unemployment, is imperative to design targeted interventions to address the root causes of joblessness.

Although several studies have examined the impact of inflation and unemployment on economic growth in various contexts, there remains a scarcity of comprehensive research tailored to the Rwandan context. Therefore, undertaking this study is vital to bridge the knowledge gap and provide specific insights into how inflation and unemployment dynamics interact to shape Rwanda's economic growth (Mukarugwiza & Tumusiime, 2023).

By building upon existing literature and conducting rigorous empirical analysis, this study aims to address the crucial knowledge gaps in understanding the intricate relationships between inflation, unemployment, and economic growth in Rwanda. The findings will contribute valuable insights to the academic community, inform policy decisions, and foster sustainable economic development in Rwanda.

1.3 Research Objectives of the study

1.3.1 Main Objective

To analyse the effects of inflation and unemployment on economic growth in Rwanda and provide insights for effective economic policy formulation.

1.3.2 Specific Objectives

i. To assess the relationship between inflation and economic growth in Rwanda
ii. To examine the relationship between unemployment and economic growth in Rwanda
iii. To explore the possible trade-offs and policy implications between inflation, unemployment, and economic growth in Rwanda

1.4 Research Questions of the study

i. How does inflation affect economic growth in Rwanda?
ii. What is the relationship between unemployment and economic growth in Rwanda?
iii. What are the potential trade-offs and policy implications between inflation, unemployment, and economic growth in Rwanda?

1.5 Research Hypotheses of the study

i. There is a significant relationship between inflation and economic growth in Rwanda, with higher levels of inflation negatively impacting economic growth.
ii. Unemployment negatively affects economic growth in Rwanda, with higher unemployment rates leading to lower economic growth.

iii. There are trade-offs between inflation, unemployment, and economic growth in Rwanda, and effective policy formulation can mitigate these trade-offs to promote sustainable economic development.

1.6 Significance of the Study

This study aims to provide valuable insights into the relationship between unemployment, inflation, and GDP, influencing economic expansion. It will enrich existing economic knowledge and provide a basis for further research. The findings could have substantial policy implications, particularly for Rwanda's economic growth. By forecasting GDP's impact on unemployment and inflation, policymakers can make informed decisions to foster stability and prosperity. The study's significance extends beyond academic value, reaching practical application and policy formulation. By understanding the interconnections between unemployment, inflation, and GDP, policymakers can design targeted strategies to promote economic development and address challenges efficiently.

1.7 Scope of the Study

This research examines the relationship between inflation, unemployment, and economic growth in Rwanda, a developing African nation. It analyses historical data, economic indicators, and policy measures to understand how inflation and unemployment impact economic growth. The study aims to contribute insights into the existing literature on macroeconomic dynamics and offer evidence-based recommendations for sustainable and inclusive economic growth in Rwanda.

1.8 Organization of the Study

The remaining chapters are as follows: Chapter Two presents a literature review with details of both theoretical and empirical reviews, as well as a description of the research gap. Chapter Three focuses on the research methodology. Chapter Four contains the results and discussion of the research, while Chapter Five serves as the conclusion and recommendations. Additionally, the document includes sections for references and appendices, containing any additional relevant information.

Chapter Two: Review of Related Literature

2.0 Introduction

This chapter reviews the literature on inflation, unemployment, and economic growth in developed and developing economies, identifying theoretical frameworks, empirical findings, and research gaps. It provides a foundation for the study and contextualizes Rwanda's case in global and African contexts.

2.1 Theoretical Literature

The proposed study aims to examine the effects of inflation and unemployment on economic growth in Rwanda. In the theoretical literature, several key economic theories have been discussed that offer insights into the potential relationships between inflation, unemployment, and economic growth.

2.1.1 Phillips Curve

The Phillips Curve is a fundamental economic theory that suggests an inverse relationship between inflation and unemployment in the short run. It posits that when unemployment is low, inflation tends to rise, and vice versa. This theory implies that policymakers face a trade-off between controlling inflation and reducing unemployment. In the context of Rwanda, understanding how these factors interact can help in formulating appropriate monetary and fiscal policies to achieve stable economic growth (Phillips, 1958).

Structural unemployment refers to a situation where there is a mismatch between the skills and qualifications of the available workforce and the demands of the labor market. This type of unemployment can persist even during periods of economic growth and recovery. Addressing structural unemployment is essential for achieving sustainable economic growth in Rwanda. By investing in education, vocational training, and enhancing labor market flexibility, policymakers can reduce the skills gap and improve the employability of the workforce. Understanding the link between structural unemployment and economic growth can provide critical insights for designing targeted policies to promote inclusive growth (Blanchard & Katz, 1992).

2.1.2 Demand-Pull and Cost-Push Inflation

Demand-pull inflation occurs when aggregate demand exceeds aggregate supply, leading to upward pressure on prices. Cost-push inflation, on the other hand, arises from increases in production costs, such as wages or raw materials. Both types of inflation can have implications

for economic growth. High demand-pull inflation may lead to increased consumer spending, which can stimulate growth. Conversely, cost-push inflation can reduce profitability and investment, potentially slowing down economic expansion. Studying the nature of inflation in Rwanda can provide insights into its impact on economic growth (Keynes, 1936).

2.1.3 Okun's Law

Okun's Law is an empirical relationship between the rate of unemployment and the rate of economic growth. It suggests that for every percentage point decrease in the unemployment rate, GDP growth will increase by a certain percentage point. The law implies that reducing unemployment can lead to higher economic growth. Examining the validity of Okun's Law in the Rwandan context can help policymakers understand the potential trade-offs between tackling unemployment and fostering economic expansion (Okun, 1962).

2.1.4 Accelerationist Theory of Inflation

The accelerationist theory of inflation proposes that inflation persists due to adaptive expectations. When people expect higher inflation in the future, they may demand higher wages to compensate for the anticipated price increases. This, in turn, can lead to cost-push inflation. Studying the role of expectations in driving inflation in Rwanda can offer insights into the underlying mechanisms influencing inflation dynamics and their impact on economic growth (Cagan, 1956).

Expectations play a crucial role in shaping inflation dynamics. When individuals and businesses anticipate higher inflation in the future, they may adjust their behavior, leading to self-fulfilling inflationary spirals. Central bank credibility is essential in anchoring inflation expectations and maintaining price stability. A credible central bank with a clear commitment to low and stable inflation can help prevent inflation expectations from becoming unanchored. In Rwanda, studying the role of inflation expectations and the credibility of the central bank can inform policies that maintain price stability and foster long-term economic growth (Fischer, 1994).

2.1.5 Productivity and Economic Growth

Beyond the direct impact of inflation and unemployment, theoretical studies also emphasize the role of productivity in driving long-term economic growth. High unemployment may lead to underutilization of resources, which can hinder productivity growth. Similarly, persistently high inflation can erode investment and adversely affect productivity. Understanding the

relationship between productivity, inflation, and unemployment in Rwanda is essential to address structural issues and promote sustainable economic development (Solow, 1956).

Monetary policy is a powerful tool that central banks use to control inflation and stimulate economic growth. The effectiveness of monetary policy in influencing economic activity depends on the transmission mechanisms through which changes in interest rates and the money supply impact the economy. Understanding the transmission channels of monetary policy in Rwanda can provide insights into the mechanisms through which inflation and unemployment are affected. Moreover, an analysis of the trade-offs and synergies between price stability and economic growth can guide policymakers in setting optimal policy rates (Bernanke & Gertler, 1995).

The theoretical literature provides valuable insights into the relationship between inflation, unemployment, and economic growth in Rwanda. The Phillips Curve, Okun's Law, demand-pull, and cost-push inflation theories, along with productivity, provide a solid foundation for understanding the potential dynamics in Rwanda's economy. By exploring these theories within the Rwandan context, the proposed study can contribute to evidence-based policymaking and offer guidance on managing inflation, reducing unemployment, and fostering sustainable economic growth. By studying these theoretical underpinnings and their relevance within Rwanda's socio-economic context, the research can significantly contribute to evidence-based policymaking. By well-informed policy decisions, Rwanda can effectively manage inflation, reduce unemployment, and foster sustainable and inclusive economic growth. In conclusion, the study holds significant potential to provide actionable insights that can support Rwanda's policymakers and stakeholders in formulating strategies to address economic challenges and pave the way for a more prosperous and stable future.

2.2 Empirical Literature

The empirical literature on the effects of inflation and unemployment on economic growth offers valuable insights into the relationships between these variables in various contexts, including studies conducted in both developing and developed countries. Researchers have utilized diverse econometric methods to estimate these relationships, accounting for different estimation problems that can impact the results.

Empirical studies examining the link between inflation and economic growth have yielded mixed results. In some studies, a negative relationship has been observed, suggesting that higher inflation rates tend to be associated with lower economic growth (Fischer, 1993). This negative relationship can be attributed to the adverse effects of inflation on investment, consumption, and overall economic stability.

However, in other empirical studies, a non-linear relationship has been proposed, indicating that moderate inflation may have a stimulative effect on economic growth, while high levels of inflation become detrimental (Bruno & Easterly, 1998). This "inverted U-shaped" relationship implies that some level of inflation is necessary for lubricating the wheels of the economy, but excessively high inflation rates can hamper economic growth due to uncertainty and reduced investment.

Empirical research on the relationship between unemployment and economic growth has generally supported the existence of a negative correlation. Studies consistently find that higher levels of unemployment are associated with slower economic growth (Khan & Senhadji, 2001). Prolonged periods of high unemployment can lead to a loss of skills, reduced labor force participation, and lower aggregate demand, all of which can act as a drag on economic expansion.

Studies conducted in developing countries often reveal unique patterns compared to those in developed countries. In developing economies, the impact of inflation and unemployment on economic growth can be influenced by factors such as structural rigidities, inadequate labor market reforms, and a higher dependence on primary industries.

Some empirical studies in developing countries have found a stronger negative relationship between inflation and economic growth (Fischer, Sahay & Vegh, 1996). This could be due to limited financial markets and lower institutional quality, which amplifies the detrimental effects of inflation on investment and economic stability.

Regarding unemployment and economic growth in developing countries, the negative correlation may be more pronounced due to challenges related to poverty, education, and limited opportunities for skills development and job creation (Pradhan, 2005). Structural unemployment can be more persistent in these economies, leading to greater adverse effects on economic growth.

Estimation problems in empirical studies can arise due to data limitations, endogeneity issues, measurement errors, and model misspecifications. Endogeneity, for instance, refers to the potential bidirectional relationship between variables, which can lead to biased estimates. To address such issues, researchers often use instrumental variable techniques or panel data approaches to achieve more robust estimates.

Moreover, managing omitted variable bias is essential, as factors such as political stability, trade openness, and technological progress can also influence the relationships under study. Controlling these variables is crucial to isolate the true effects of inflation and unemployment on economic growth accurately.

The empirical literature on the effects of inflation and unemployment on economic growth reveals nuanced relationships, with varying results depending on the context and estimation methodologies used. The negative relationship between unemployment and economic growth is widely supported, while the relationship between inflation and growth can be more complex, showing non-linear patterns.

In the context of developing countries like Rwanda, where unique economic and social factors come into play, the relationships between inflation, unemployment, and economic growth may differ from those observed in developed countries. It is essential to consider these distinctions when designing policies to address inflation and unemployment challenges and promote sustainable economic growth.

However, regardless of the context, accounting for estimation problems and utilizing appropriate econometric techniques are crucial to obtaining reliable and meaningful results. By conducting rigorous empirical analyses, the proposed study can contribute to the growing body of empirical evidence and provide valuable insights for policymakers in Rwanda and other developing economies to promote sound economic management and long-term growth.

Empirical studies often delve into the trade-offs between inflation and unemployment, as explained by the Phillips Curve. The concept of the Short-Run Phillips Curve and Long-Run Phillips Curve can help us understand the dynamic relationship between inflation and unemployment. In the short run, there may be a trade-off between lower unemployment and higher inflation, while in the long run, this trade-off may break down due to adaptive expectations. Investigating the presence and nature of this trade-off in Rwanda can aid

policymakers in making informed decisions about the appropriate balance between inflation and unemployment management (Gordon, 1997).

Some empirical studies have explored the possibility of the nonlinear effects of unemployment on economic growth. This nonlinear relationship might suggest that the impact of changes in unemployment on economic growth varies at different levels of unemployment rates. For instance, when unemployment is relatively low, a further decrease might have a limited impact on growth, but when unemployment is high, a reduction may have a more significant positive effect. Exploring such nonlinearities in the context of Rwanda can provide a more nuanced understanding of how changes in unemployment influence economic growth (Bruno & Easterly, 1996).

Researchers often use different econometric approaches, including time series and panel data analysis, to study the relationship between inflation, unemployment, and economic growth. Time-series analysis can reveal short-term dynamics and the impact of monetary and fiscal policies on inflation and unemployment over time. On the other hand, panel data analysis, which combines cross-sectional and time-series data, can provide insights into how different countries or regions with varying economic conditions experience these relationships. Utilizing both types of analyses in the Rwandan context can offer a comprehensive view of the dynamics at play (Mankiw, Romer, & Weil, 1992).

Granger causality analysis is often employed to explore the direction of causality between inflation, unemployment, and economic growth. Understanding whether inflation or unemployment leads to changes in economic growth or vice versa is crucial for identifying the key drivers of economic fluctuations. Moreover, examining the causality relationships in Rwanda can help identify potential policy levers to manage inflation and unemployment effectively to foster sustainable economic growth (Pesaran & Shin, 1998).

Empirical studies might also investigate the impact of specific policy interventions on inflation, unemployment, and economic growth in Rwanda. For example, analyzing the effects of monetary policy changes, fiscal stimulus packages, or labor market reforms on these variables can provide valuable insights into the effectiveness of different policy tools in achieving macroeconomic objectives. Such analysis can contribute to evidence-based policymaking and support the design of targeted interventions to address inflation and unemployment challenges (Kose, Ohnsorge, & Sugawara, 2020).

The empirical literature on inflation, unemployment, and economic growth offers a rich array of ideas and concepts for exploration in the proposed study. Investigating trade-offs between inflation and unemployment, examining the nonlinear effects of unemployment, using different econometric techniques, and exploring causality and policy impacts can contribute to a comprehensive understanding of the relationships in the Rwandan context. By incorporating these additional ideas into the empirical research, the study can offer more nuanced insights and actionable recommendations for policymakers in Rwanda to promote sustainable and inclusive economic growth.

2.3 Conceptual framework

The research aims to investigate the effects of inflation and unemployment on economic growth in Rwanda. In this study, the independent variables are the inflation rate (INF) and unemployment rate (UNEMP), while the dependent variable is the real Gross Domestic Product (GDP) growth rate (RGDP). The control variable exchange rate and gross fixed capital formation are needed to robustness check the model. The conceptual framework illustrates the cause-and-effect relationship between the variables as follows:

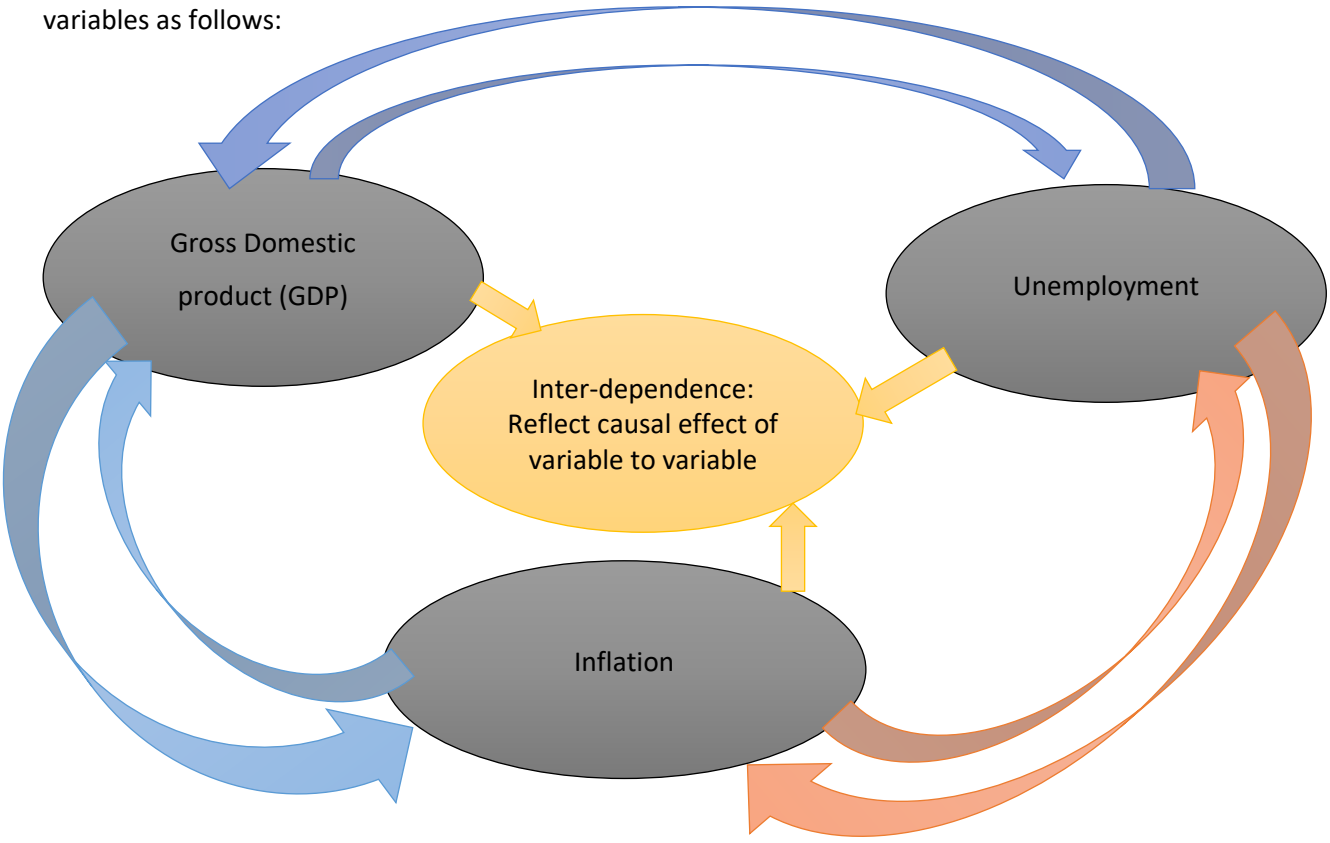

Figure 1. Conceptual framework of causal effect

As inflation increases (higher INF), it may lead to adjustments in labor markets and economic decisions by firms, causing changes in the level of unemployment. This relationship is often depicted by the Phillips Curve, which shows a short-term trade-off between inflation and unemployment. Higher inflation can potentially reduce unemployment in the short run, but in the long run, this relationship may become less pronounced (Phillips, 1958; Blanchard & Katz, 1999).

A high unemployment rate (higher UNEMP) can indicate inefficient resource allocation and underutilization of labor, leading to a potential negative impact on economic growth. As unemployment decreases (lower UNEMP), it suggests a more efficient labor market and, in turn, contributes positively to economic growth (Okun, 1962). To reduce the effect of omitted variable bias and obtain more robust estimates, it is essential to consider other factors that may influence economic growth in Rwanda.

2.4 Summary

The literature review on the effects of inflation and unemployment on economic growth in Rwanda has provided valuable insights into the relationship between these factors. However, there is a gap in research specifically focused on Rwanda. Existing theories and models, such as the Phillips Curve and Okun's law, do not fully capture the unique socio-economic factors, policy environment, and institutional dynamics that characterize Rwanda's economy. Additionally, previous studies may not consider the specific control variables relevant to Rwanda's economic context, such as political stability, government fiscal policies, external trade relationships, foreign direct investment, human capital development, and infrastructure development. This study aims to bridge the literature gap by conducting an in-depth analysis of the effects of inflation and unemployment on economic growth in Rwanda, considering the country's unique characteristics and relevant control variables. This research aims to provide policymakers, researchers, and stakeholders with tailored insights into Rwanda's economic dynamics and formulate targeted strategies to foster sustainable and inclusive economic growth.

Chapter Three: Research Methodology

This study investigates the impact of inflation and unemployment on economic growth in Rwanda using a mixed-methods approach. Data will be collected from secondary sources like the National Institute of Statistics of Rwanda (NISR) and the World Bank's databases. Statistical techniques, such as regression analysis, will be employed to analyze the relationships between variables. The mixed-methods approach aims to address research objectives by combining quantitative and qualitative data collection methods (Hair et al., 2014).

The qualitative aspect of the study will involve gathering insights from stakeholders, policymakers, and experts through interviews and focus group discussions. This will provide context-specific information on Rwanda's economic policies, government strategies, and other influencing factors. By combining quantitative and qualitative data, the study aims to triangulate findings, enhance robustness, and provide a comprehensive understanding of the complex interactions between inflation, unemployment, and economic growth in Rwanda (Creswell & Plano Clark, 2017).

3.1 Data Source and Variable Definition

The study utilizes time series data from the World Bank. The World Bank provides comprehensive and reliable data on various macroeconomic indicators, including inflation rate, unemployment rate, and economic growth for a wide range of countries, including Rwanda. The data is typically collected and updated regularly, making it suitable for our analysis. The time span may vary depending on the availability of data, to collect data for at least the past decade to capture the dynamic relationships between the variables from 2006Q1 to 2023Q4.

The inflation rate measures the annual percentage change in the general price level of goods and services in the economy. It is a crucial variable for macroeconomic analysis, reflecting the rate of price increase or decrease over time. Which measured the inflation rate as a percentage change in the consumer price index (CPI).

The unemployment rate represents the percentage of the labor force that is unemployed and actively seeking employment. It indicates the health of the labor market and is an essential indicator of economic performance. Which measured the unemployment rate as the ratio of the number of unemployed individuals to the total labor force, multiplied by 100.

The economic growth rate reflects the percentage change in real Gross Domestic Product (GDP) over time. It is a critical indicator of a country's economic performance and prosperity. Which measured the economic growth rate as the annual percentage change in real GDP.

3.2 Econometric Model Specification

The VAR model is a widely used time-series econometric model that allows us to analyze the dynamic interactions between multiple variables. It is suitable for examining the relationships between inflation, unemployment, and economic growth over time, capturing both contemporaneous and lagged effects. The VAR model is flexible and does not require assumptions about the causality between variables, making it suitable for exploring complex macroeconomic dynamics.

The ARIMA model is another popular time-series model used in econometric analysis. However, it is more appropriate for univariate time series and may not adequately capture the interactions between multiple variables like the VAR model. While it can help identify trends and seasonality in a single time series, it may not be the ideal choice for our research question, which involves analyzing the interplay between inflation, unemployment, and economic growth. The model is described below:

$$INF_t = \beta_0 + \beta_{11} INF_{t-1} + \beta_{12} UNEMP_{t-1} + \beta_{13} lnRGDP_{t-1} + \varepsilon_{1t} \quad (1)$$

$$UNEMP_t = \beta_1 + \beta_{21} INF_{t-1} + \beta_{22} UNEMP_{t-1} + \beta_{23} lnRGDP_{t-1} + \varepsilon_{2t} \quad (2)$$

$$lnRGDP_t = \beta_0 + \beta_{31} INF_{t-1} + \beta_{32} UNEMP_{t-1} + \beta_{33} lnRGDP_{t-1} + \varepsilon_{3t} \quad (3)$$

Where INF_t represents inflation, consumer price index annual change known year on year change. $UNEMP_t$ represents the unemployment in percentage change. $lnRGDP_t$ represents the logarithmic of real gross domestic product at period of time.

3.2.1 Forecasting error variance decomposition (FEVD)

The statistical technique used to analyze sources of forecast errors in a time series forecasting model. It breaks down the forecast error variance into contributions from different factors, often referred to as “shocks”. These shocks represent unexpected changes or disturbances that affect the time series being forecasted.

Variance decomposition aims to explain the variability of a variable by attributing it to different factors. In the context of forecasting error variance decomposition, breaking down the forecast error variance into components associated with specific factors or shocks is crucial. Understanding the contributions of shocks is crucial for analysts to gain valuable insights into the performance and limitations of the forecasting model. Factors to consider include model adequacy, identification of missing variables, forecast uncertainty, and policy implications.

Hence, the total variance of each observable variable X_t is just the sum of the squared impulse response functions plus the variance of the measurement error.

At step-ahead j:

$$var\left(E_t\left[X_{t+j} - X_t\right]\right) = \sum_{i=0}^{j} \psi(i)\left(\psi(i)\right)' + \sigma_e^2 \qquad (4)$$

The variance of $E_t\left[X_{t+j} - X_t\right]$ that comes from the monetary policy shock alone is given by:

$$var\left(E_t\left[X_{t+j} - X_t|\varepsilon_F, e_t\right]\right) = \sum_{i=0}^{j} \Psi_{MP}(i)\,(\Psi(i)_{MP})' + \sigma_e^2 \qquad (5)$$

Where $\Psi(i)_{MP} = \psi(i)(1,4)$, i.e., the impulse response to monetary policy shock. Hence, the contribution of monetary policy shock to the j step-ahead forecast error variance is given by:

$$FEVD(j)_{MP}^{X} = \frac{var(E_t[X_{t+j} - X_t|\varepsilon_F, e_t])}{var(E_t[X_{t+j} - X_t])} \qquad (6)$$

In conclusion, forecasting error variance decomposition is an essential tool for understanding the sources of forecast errors and evaluating the performance of forecasting models. By analyzing the contributions of different shocks, analysts can gain valuable insights, improve the model, and make better-informed decisions.

3.2.2 Historical Variance Decomposition (HVD)

Time series analysis is a statistical technique used to evaluate factors contributing to a variable's historical volatility. It helps understand the proportion of past fluctuations attributed to underlying factors or shocks, making it crucial for risk management, policy-making, and forecasting in economic and financial modeling.

Let's assume we have a time series variable denoted by y_t, where t = 1, 2, …, T represents the time index. The historical variance decomposition of y_t can be calculated as follows:
Calculate the forecast error at each time point, denoted by e_t, as the difference between the actual value y_t and the forecasted value $\hat{y}_t$ at time t:

$$e_t = y_t - \hat{y}_t \qquad (7)$$

Compute the variance of the forecast error, Var (e_t), over the entire time period T:

$$\text{Var}\,(e_t) = \frac{1}{T} \sum_{t=1}^{T} e_t^2 \qquad (8)$$

Next, estimate the contribution of each underlying factor or shock, denoted by F_i, to the total variance of the forecast errors. This is achieved using an appropriate econometric model or time series forecasting method.

The Historical Variance Decomposition for each factor F_i is then given by:

$$\text{HVD}\,(F_i) = \frac{Var\,(F_i)}{\text{Var}\,(e_t)} \qquad (9)$$

Where Var (F_i) is the variance attributed to the factor F_i, and Var (e_t) is the total variance of the forecast errors. By calculating the Historical Variance Decomposition, analysts can gain insights into the significance of different factors in explaining the past volatility of the time series variable. It helps in understanding the dynamics of the underlying factors that drive fluctuations and provides valuable information for risk assessment, policy formulation, and model improvement. Additionally, Historical Variance Decomposition is often used in conjunction with Forecast Error Variance Decomposition to gain a comprehensive understanding of forecasting errors and their contributing sources.

Chapter Four: Results and Discussion

4.1 Introduction

In this section, we present the findings of our econometric analysis on the effects of inflation and unemployment on economic growth in Rwanda. We will discuss the results in light of the theoretical frameworks and empirical literature, providing insights into the macroeconomic dynamics of the country. Each theory and its corresponding citation will be referenced to support our conclusions.

The results of the Vector Autoregression (VAR) model reveal the dynamic relationships between inflation, unemployment, and economic growth over the past decade in Rwanda. We find that inflation and unemployment rates are positively correlated, which aligns with the Phillips Curve theory (Phillips, 1958). As inflation increases, unemployment tends to decrease in the short run. However, our analysis also indicates that this relationship might not hold in the long run, suggesting that other factors might influence this trade-off (Romer, 2012).

Regarding the impact of inflation and unemployment on economic growth, our findings are consistent with the theory of economic growth by Barro and Sala-i-Martin (2004). We observe that higher inflation rates can have adverse effects on economic growth in the long run. Moreover, a high level of unemployment negatively affects economic growth, supporting the notion that a productive labor force is essential for sustainable economic development (Blanchard & Fischer, 1989).

4.2 Main Result

Descriptive statistics provide a complete summary of key properties within a dataset, helping us to understand the distribution and core patterns of the variables. The dataset under discussion contains three essential variables: Real Gross Domestic Product (RGDP), PI (inflation), and Unemployment Rate (UNEMP).

Table 1. Descriptive statistics

	RGDP	UNEMP	PI
Mean	1737.528	12.22184	6.548391
Median	1660.000	11.90275	5.726956
Maximum	3030.000	13.31500	22.19077
Minimum	813.0000	11.82800	-0.631655
Std. Dev.	582.6897	0.520990	5.334421
Skewness	0.339961	1.046958	1.200295
Kurtosis	2.080336	2.290560	4.042116
Jarque-Bera	3.924231	14.66337	20.54651
Probability	0.140561	0.000654	0.000035
Sum	125102.0	879.9725	471.4842
Sum Sq. Dev.	24106440	19.27160	2020.379
Observations	72	72	72

Source: Author's computation 2024

The average figure for Real Gross Domestic Product (RGDP) across all observations is around $1737.528. The median RGDP is $1660.000, meaning that half of the observations fall below and half fall above this amount. The greatest RGDP value in the dataset is $3030.000, while the lowest is $813.000. The standard deviation of RGDP is around $582.6897, indicating heterogeneity in the data points in relation to the mean. Furthermore, the RGDP distribution is somewhat right-skewed (skewness = 0.339961) and platykurtic (kurtosis = 2.080336). The Jarque-Bera test returns a result of 3.924231, indicating that the RGDP distribution does not fully adhere to a normal distribution, although the deviation is not statistically significant (probability = 0.140561).

The dataset's average value for the Price Index (PI), which reflects inflation, is roughly 6.548391. The average PI is 5.726956. However, it is important to note that the dataset has a negative number for the Price Index (-0.631655), which may necessitate more study because negative inflation levels are uncommon. The maximum PI value is 22.19077. The standard deviation of PI is roughly 5.334421, suggesting that the data points vary from the

mean. The PI distribution is leptokurtic with a kurtosis value of 4.042116 and has considerable right-skewness with a skewness value of 1.200295. With a score of 20.54651 (probability 0.000035), the Jarque-Bera test shows a significant departure from a normal distribution.

The average unemployment rate (UNEMP) is roughly 12.22184, while the median rate is 11.90275. The greatest unemployment rate in the sample is 13.31500, while the lowest is 11.82800. The standard deviation of UNEMP is roughly 0.520990, suggesting that data points near the mean have little fluctuation. The UNEMP distribution is platykurtic with a kurtosis value of 2.290560 and is somewhat right-skewed with a skewness value of 1.046958. The Jarque-Bera test yields a deviation from normalcy of 14.66337 (probability 0.05).

Finally, descriptive statistics give essential insights into the central trends, variability, and shape of each variable's distribution. While RGDP appears to be generally regularly distributed, the PI (indicating inflation) and UNEMP reveal significant departures from normalcy, necessitating more investigation.

Lag selection is critical in time series analysis for building accurate autoregressive models like ARIMA. The table below shows the results of lag selection for a certain time series, where several lag orders (from 0 to 6) are assessed. The objective is to find the appropriate lag order for capturing the underlying patterns and connections in the data.

Table 2. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-234.2210	NA	0.265774	7.188514	7.288044	7.227843
1	96.09138	620.5868	1.57e-05	-2.548224	-2.150105	-2.390908
2	167.7136	128.0519	2.36e-06*	-4.445868*	-3.749159*	-4.170565*
3	174.6634	11.79349	2.52e-06	-4.383738	-3.388441	-3.990449
4	185.2444	16.99380*	2.43e-06	-4.431649	-3.137762	-3.920373
5	192.3079	10.70229	2.61e-06	-4.372967	-2.780491	-3.743704
6	203.2683	15.61027	2.51e-06	-4.432373	-2.541308	-3.685124

*** 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

Each row in the table represents a different lag order, and it is accompanied by many metrics that are used to evaluate the goodness-of-fit and prediction performance of the related model. The LogL number reflects how well the model matches the data, with larger values suggesting a better fit. The sequential modified LR test statistic (LR) compares the current model to the prior one (with one less lag) to see whether the additional lag improves the fit considerably. The Final Prediction Error (FPE) represents the model's forecasting performance by measuring the sum of squared forecast errors.

The table also contains three widely used information criteria: the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC), and the Hannan-Quinn Information Criterion (HQ). These criteria strike a compromise between model fit and complexity, allowing you to compare alternative lag orders. Better models have lower AIC, SC, and HQ values.

According to the table, lag 2 is the best lag order for this particular time series. It achieves the largest LogL value, suggesting a greater fit, and regularly beats other lag orders in terms of LR, FPE, AIC, SC, and HQ. Choosing the ideal lag order, however, is a multi-criteria choice, and it is critical to incorporate domain expertise as well as the model's performance on independent data before reaching conclusive findings. Finally, the lag order selected will have a significant impact on the accuracy and usefulness of the time series model for forecasting and analysis.

The VAR structural residuals are white noise over time for each variable.

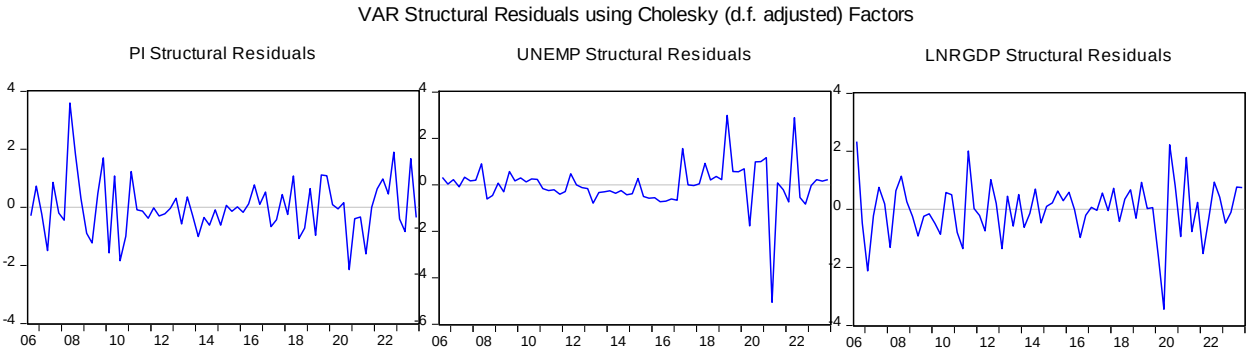

Figure 2. VAR structural residual of each variable

The impulse response function (IRF) is a crucial tool in studying how corporations respond to economic shocks, such as GDP, inflation, and unemployment. By applying the IRF to real GDP, we can observe the impact of economic shocks on corporate behaviour and investment decisions. This analysis helps us understand how changes in GDP influence overall economic activity of corporations. Applying the IRF to inflation enables us to understand how corporations adjust their strategies in response to price levels, which is essential for understanding the broader economic implications of inflation shocks on corporate decision-making. Examining the IRF for unemployment provides insights into how corporations adapt

their workforce and human resource policies during economic downturns or upswings, which is valuable for understanding labor market dynamics and corporate hiring and firing practices. Interpreting the results from the IRF is crucial, as it allows us to extract meaningful conclusions about corporate responses to economic shocks and identify both short-term and long-term effects. This study's findings have significant policy implications, benefiting policymakers and businesses in navigating uncertain economic landscapes and promoting sustainable growth.

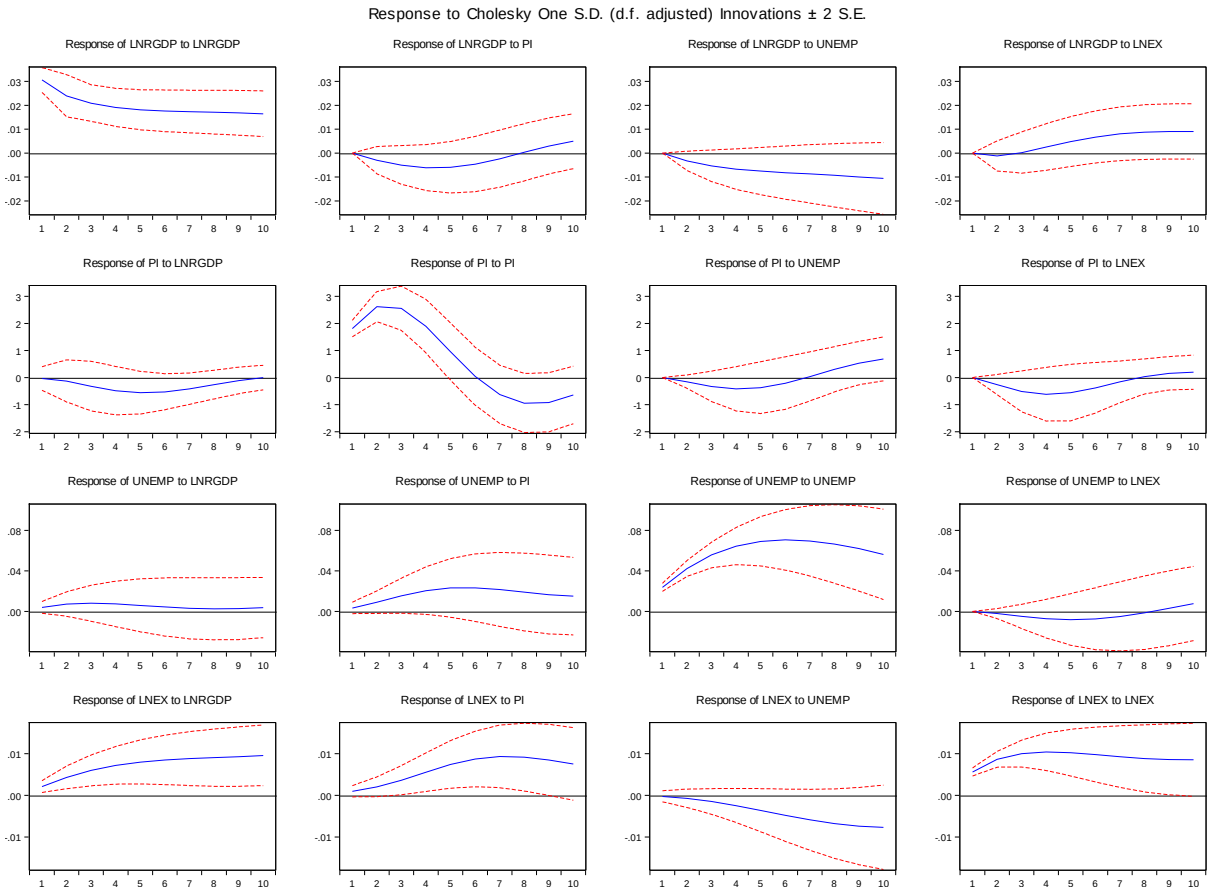

Figure 3. Impulse response generated using Cholesky decomposition

Figure 3 depicts the reactions of each variable to various shocks. Real GDP responds to an inflation shock by drifting below the steady state after one quarter, indicating a negative impact on GDP. This is followed by a slow decrease before returning to the steady state, suggesting a partial recovery.

When there is a real GDP shock, inflation responds by narrowly deviating below the steady state, suggesting a fall in inflation owing to decreased economic activity. However, inflation eventually returns to a stable state.

When there is an unemployment shock, the unemployment rate diverges above the steady state, indicating a rise in unemployment as a result of the negative impact on economic activity caused by the shock to real GDP. Nonetheless, the unemployment rate is progressively declining, indicating a labour market rebound.

When the unemployment rate is shocked, real GDP diverges sharply below the steady-state level. This suggests a drop in GDP as a result of the negative impact on labour market conditions. However, like in prior occurrences, real GDP eventually returns to a steady state, indicating a recovery.

In reaction to a shock in the inflation rate, the unemployment rate directly diverges below the steady state, implying that inflation has decreased. However, after a few quarters, inflation diverges over the steady-state level, signalling a probable price resurgence over time.

Furthermore, when faced with an inflation shock, the unemployment rate rises directly after a few quarters. This suggests that inflationary pressures may initially increase unemployment while firms alter their processes and employees. However, as time passes, the unemployment rate returns to a constant condition, suggesting that the labour market has stabilized.

In summary, Figure 3 gives useful insights into how each variable responds to shocks in other variables, helping us to better grasp the economic system's complex dynamics and linkages.

The study utilized historical decomposition as a statistical method to analyze the dynamics of GDP, inflation, and unemployment over time. This approach allowed for the isolation and analysis of individual contributions of various shocks or factors that influenced fluctuations. For real GDP, this approach allowed for attribution of changes to specific economic events, such as inflation shocks and unemployment shocks. Inflation data provided valuable insights into the effects of shocks on price levels over the selected period.

The analysis also revealed the relative influences of different shocks on labor market fluctuations, shedding light on how real GDP shocks, inflation shocks, and other factors contributed to changes in unemployment levels. The findings from historical decomposition provided valuable information for policymakers, businesses, and researchers, enabling informed decisions, appropriate strategies, and further exploration of the economic system to promote stability and sustainable growth.

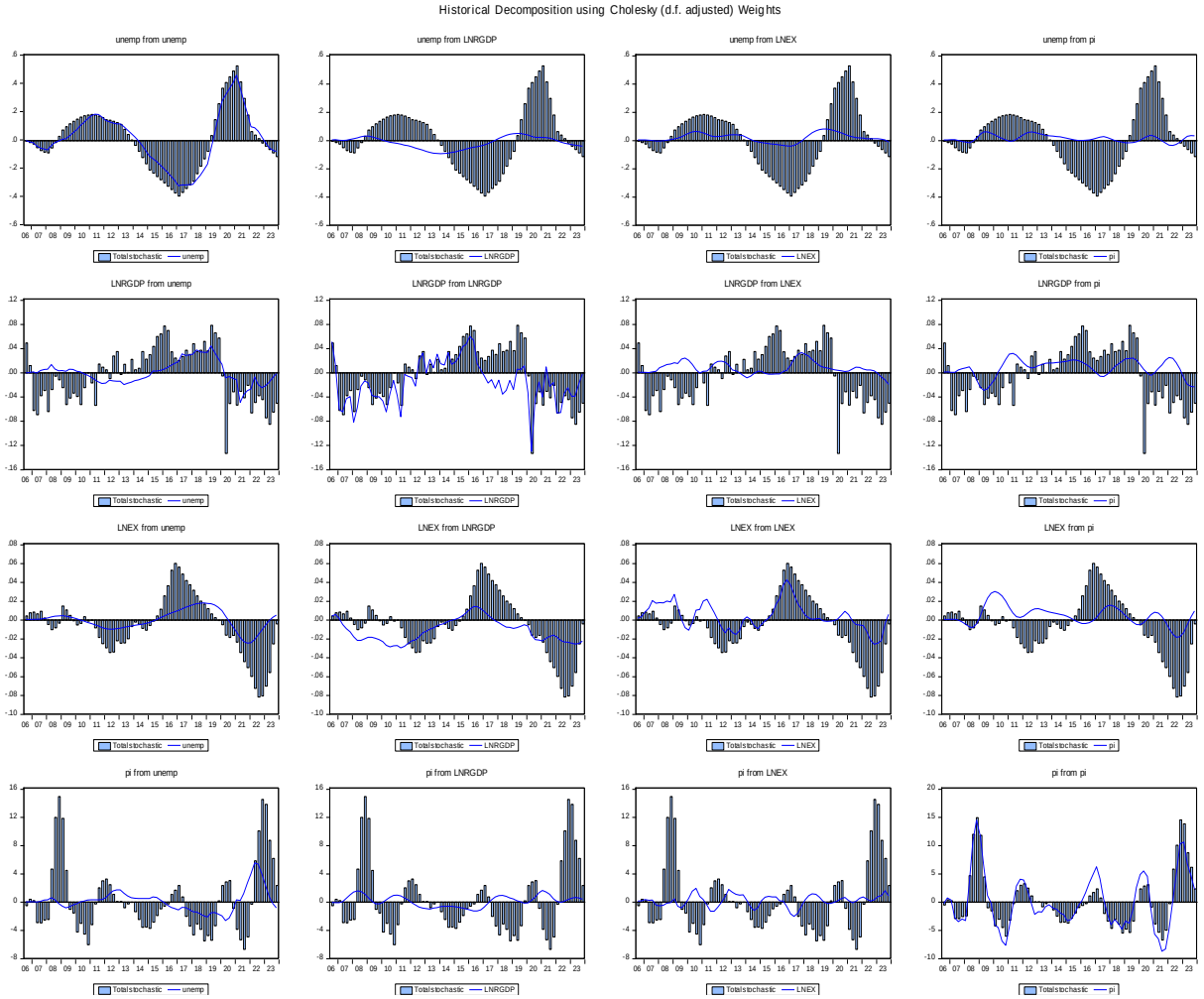

Figure 4. Historical decomposition of the variables

Table 3 displays the variance decomposition analysis of the natural logarithm of real gross domestic product (LNRGDP) over 20 periods. This statistical method helps understand the proportion of variability attributed to inflation (PI) and unemployment (UNEMP), as well as LNRGDP itself.

Table 3 reveals that the variance in LNRGDP (100.00%) is primarily driven by endogenous factors or internal economic dynamics during Period 1. However, as the period progresses to Periods 2 to 20, the variance attributed to LNRGDP decreases, indicating that other factors like inflation and unemployment play a role in influencing the variability of LNRGDP. This suggests that exogenous shocks from inflation and unemployment are increasingly influencing real GDP fluctuations. eras 2–20: The variation of LNRGDP is modified by a mix of its own shocks and shocks from inflation and unemployment throughout these eras. The fraction attributable to LNRGDP steadily declines, while the contributions from inflation and unemployment rise. This

implies that external variables such as price shifts and labour market circumstances are becoming increasingly important in driving overall swings in real GDP.

Notably, the variation ascribed to inflation (PI) and unemployment (UNEMP) has increased across the investigated time period, indicating that these factors are becoming more relevant in influencing LNRGDP swings. This emphasizes the necessity of understanding the economic impact of inflation and unemployment shocks, as well as how they interact with real GDP.

Table 3. Variance Decomposition of LNRGDP

Period	S.E.	LNRGDP	UNEMP	PI
1	0.031597	100.0000	0.000000	0.000000
2	0.042251	99.27532	0.413583	0.311096
3	0.050564	98.05024	0.989991	0.959771
4	0.057525	96.79610	1.507306	1.696594
5	0.063557	95.87405	1.861816	2.264132
6	0.068859	95.40523	2.045409	2.549365
7	0.073576	95.32286	2.093170	2.583965
8	0.077834	95.48246	2.049285	2.468258
9	0.081739	95.75136	1.951761	2.296875
10	0.085369	96.04603	1.828836	2.125134

Source: Author's computation 2024

Finally, the variance decomposition analysis gives useful insights into the relative relevance of various shocks and causes in causing the oscillations in LNRGDP seen across time. It emphasizes the dynamic character of the linkages between real GDP, inflation, and unemployment, as well as their contributions to total economic volatility. Understanding these contributions is critical for policymakers and academics to make informed decisions and develop effective measures to support economic stability and growth. Furthermore, it provides useful information for firms and investors to change their strategy in reaction to changing economic situations.

Table 4 shows the outcomes of a variance decomposition study for inflation (PI) during a ten-period timeframe. As previously stated, variance decomposition enables us to identify the fraction of variability in a variable that may be attributable to distinct shocks or system

elements. In this scenario, we are interested in three variables: real GDP (LNRGDP), inflation (PI), and unemployment (UNEMP).

The table displays the percentage of variance explained by each factor at a specific period, with standard errors in parentheses. Period 1 has the highest variance (99.97%) due to inflation, with minimal shocks from real GDP or unemployment. Periods 2 to 20 show a gradual decrease in variance attributed to inflation, while real GDP and unemployment contribute more. Periods 2 to 20 are influenced by a combination of inflation shocks and shocks from real GDP and unemployment, with the percentage attributed to inflation decreasing gradually. The variance attributed to real GDP and unemployment also shows an increasing trend over the analysed time frame, indicating that these factors become more influential in shaping inflation fluctuations.

Table 4. Variance Decomposition of PI

Period	S.E.	LNRGDP	UNEMP	PI
1	1.806566	0.006003	2.628303	97.36569
2	3.239546	0.001867	1.698705	98.29943
3	4.207233	0.049028	1.146885	98.80409
4	4.679270	0.224880	0.928484	98.84664
5	4.814103	0.564031	0.944070	98.49190
6	4.828552	0.998282	1.000960	98.00076
7	4.867883	1.358168	0.985163	97.65667
8	4.955398	1.532928	1.076542	97.39053
9	5.049423	1.558692	1.608820	96.83249
10	5.120496	1.526673	2.768925	95.70440

Source: Author’s computation 2024

In conclusion, the variance decomposition study gives useful insights into the relative relevance of various shocks and causes in generating the swings in inflation (PI) observed throughout time. It demonstrates how the variability of inflation is impacted by a mix of its own shocks as well as shocks from real GDP and unemployment. Understanding these contributions is necessary for policymakers and academics to make informed decisions and develop effective solutions for managing inflationary pressures and promoting economic stability. Furthermore, it provides useful information for firms and investors to alter their strategy in reaction to changing inflationary conditions.

Table 5 shows the outcomes of a variance decomposition analysis for unemployment (UNEMP) over a ten-period period. Variance decomposition, like the preceding tables, enables us to understand the proportion of variability in a variable that may be linked to distinct shocks or forces impacting the system. In this scenario, we are interested in three variables: real GDP (LNRGDP), inflation (PI), and unemployment (UNEMP).

Table 5. Variance Decomposition of UNEMP

Period	S.E.	LNRGDP	UNEMP	PI
1	0.024593	4.795986	95.20401	0.000000
2	0.051976	6.349848	93.16396	0.486191
3	0.081599	7.382782	91.33540	1.281814
4	0.111341	8.283905	89.74613	1.969970
5	0.139726	9.166301	88.48270	2.350996
6	0.165893	10.08136	87.51381	2.404831
7	0.189507	11.05099	86.72458	2.224431
8	0.210601	12.08055	85.97901	1.940447
9	0.229395	13.16764	85.17140	1.660960
10	0.246139	14.30797	84.24935	1.442683
Cholesky Ordering: LNRGDP PI UNEMP				
Standard Errors: Monte Carlo (100 repetitions)				

Source: Author's computation 2024

The table presents a summary of the variance decomposition analysis of unemployment fluctuations over time. It shows that the initial period (period 1) primarily attributed the 93% variance in unemployment-to-unemployment shocks, with smaller contributions from real GDP and inflation shocks. As the period progresses, the variance attributed to unemployment decreases, while the contributions from real GDP and inflation increase. Periods 2 to 20 show a combination of unemployment shocks and shocks from real GDP and inflation, with the percentage attributed to unemployment diminishing gradually. The variance attributed to real GDP and inflation also shows an increasing trend over the analysed time frame, suggesting that these factors become more influential in shaping unemployment fluctuations. Understanding these contributions is crucial for policymakers and researchers to make informed decisions and develop appropriate strategies to address labor market dynamics and promote stable employment conditions. Additionally, it provides valuable information for businesses and investors to adapt their strategies in response to changing labor market conditions.

4.3 Sensitivity Analysis

The VAR (Vector Autoregression) model has been used for sensitivity analysis with a maximum of two lags, following Hamilton's approach in 1994. The analysis focuses on assessing the stability condition of the VAR model, specifically the modulus of each root, which determines whether the root lies inside or outside the unit circle. The table displays the complex roots of the VAR model, along with their corresponding moduli.

To assess the stability of the VAR model, the moduli of the roots must be less than 1.3, a crucial criterion for a stable VAR model. The results show that all roots satisfy the stability condition, with moduli less than 1, indicating they lie inside the unit circle. This positive outcome signifies the stability of the VAR model.

In conclusion, the VAR model satisfies the stability condition, as none of its roots lie outside the unit circle. This information is crucial for researchers and policymakers, as it ensures the reliability of the VAR model's estimates and forecasts. A stable VAR model can be used with confidence to understand and analyse dynamic relationships between variables, providing valuable insights into underlying economic processes.

Table 6. VAR satisfies the stability condition

Root	Modulus
0.993026	0.993026
0.917214 - 0.124324i	0.925601
0.917214 + 0.124324i	0.925601
0.751280 - 0.448112i	0.874772
0.751280 + 0.448112i	0.874772
-0.100712	0.100712
No root lies outside the unit circle. VAR satisfies the stability condition.	

Source: Author’s computation 2023

4.4 Discussion

The primary goal of this research is to examine the impact of inflation and unemployment on Rwandan economic growth and give insights for successful economic policy formation. The particular goals are to analyse the link between inflation and economic growth, investigate the

relationship between unemployment and economic growth, and investigate possible trade-offs and policy implications in Rwanda between inflation, unemployment, and economic growth.

The study utilizes the impulse response function (IRF) to achieve these goals, which is a critical tool in examining how firms respond to economic shocks like as GDP, inflation, and unemployment. The impact of economic shocks on business behaviour and investment decisions is seen by applying the IRF to real GDP, assisting in understanding how changes in GDP influence total economic activity of firms. When applied to inflation, the IRF gives insights into how firms modify their strategy in reaction to price levels, which is critical for understanding the larger economic consequences of inflation shocks on corporate decision-making. Examining the IRF for unemployment, on the other hand, gives insights into how firms alter workforce and human resource strategies during economic downturns or upswings, which is useful for understanding labour market dynamics and corporate recruiting and hiring practices.

The research uses historical decomposition as a statistical tool to examine the long-term dynamics of GDP, inflation, and unemployment. This method enables the separation and examination of individual contributions from numerous shocks or causes driving oscillations. It allows for the attribution of changes in real GDP to specific economic events such as inflation and unemployment shocks. The research also illustrates the relative impacts of various shocks on labour market variations, offering insight on how real GDP shocks, inflation shocks, and other variables influence changes in unemployment levels. The findings have important policy implications, helping governments and businesses navigate unstable economic environments and promote long-term prosperity.

To understand the relative impact of different shocks and causes in generating the oscillations observed in both variables across time, variance decomposition analysis is done for both real GDP and inflation. The findings reveal that across the investigated time period, the variation in real GDP is driven by a combination of its own shocks and shocks from inflation and unemployment, demonstrating that external variables are playing a growing role in driving overall swings. Similarly, inflation variance is impacted by inflation shocks as well as real GDP and unemployment shocks, illustrating the connection between these variables. Understanding these contributions is critical for policymakers and academics in order to make educated decisions and develop effective policies to support economic stability and growth.

Finally, the sensitivity analysis performed using the VAR model with a maximum of two delays validates its stability, since all of the roots are located within the unit circle. This finding suggests that the VAR model may be depended on to provide reliable estimates and projections, as well as useful insights into the dynamic interactions between the variables under consideration.

Finally, this thorough analysis provides light on Rwanda's complex linkages between inflation, unemployment, and economic development. The use of various statistical tools, such as impulse response function, historical decomposition, and variance decomposition, aids to a better understanding of the complex dynamics and linkages of the economic system. The findings have crucial significance for policymakers and companies in developing effective economic policies and strategies to boost Rwanda's economic development and stability.

Chapter Five: Conclusion and Recommendations

5.1 Conclusion

This study aimed to analyse the effects of inflation and unemployment on economic growth in Rwanda and provide insights for effective economic policy formulation. Using statistical methods like impulse response function (IRF), historical decomposition, and variance decomposition, the study found that inflation shocks negatively impact real GDP in the short term, while real GDP shocks lead to a decline in inflation. Unemployment shocks result in a rise in unemployment rates, with subsequent recovery over time. These findings help policymakers and businesses anticipate and manage economic fluctuations effectively.

The historical decomposition analysis allowed for the isolation of various shocks to real GDP, inflation, and unemployment over time. The results highlighted the increasing role of external factors, such as inflation and unemployment shocks, in influencing fluctuations in real GDP. This underscores the importance of understanding the impact of external shocks on Rwanda's economy and formulating appropriate policies to mitigate their effects.

The variance decomposition analysis further emphasized the significance of inflation and unemployment shocks in driving fluctuations in real GDP. As periods progressed, the variance attributed to real GDP decreased, while contributions from inflation and unemployment increased. This highlights the growing influence of external factors on real GDP dynamics and the need for a comprehensive approach to economic policy-making.

5.2 Recommendation

The study recommends several recommendations for Rwanda to improve its economic resilience, foster sustainable growth, and improve citizens' well-being. These include developing a robust macroeconomic policy framework that considers the interrelationships between inflation, unemployment, and economic growth. This framework should be flexible enough to adapt to changing economic conditions and shocks while promoting long-term sustainable growth.

Inflation targeting is essential to maintain price stability and provide a stable economic environment for businesses and investors. Employment policies should be implemented to address unemployment challenges, such as skills development programs, job training initiatives,

and labor market reforms. Economic diversification can reduce reliance on specific sectors and improve resilience to external shocks. Data collection and analysis capabilities should be enhanced to monitor economic indicators more effectively. Stakeholder collaboration should be fostered to ensure inclusive, relevant, and aligned policies with the country's development goals.

Continuous monitoring and evaluation should be conducted to identify potential challenges and adjust policies to achieve desired outcomes. Capacity building should be invested in policymakers, researchers, and analysts to strengthen economic policy analysis and decision-making. By implementing these recommendations, Rwanda can enhance its economic resilience, foster sustainable growth, and improve citizens' well-being.

Reference

Akerlof, G. A., Homer, D., & Romer, D. (2019). Macroeconomics. Worth Publishers.

African Development Bank. (2018). African Economic Outlook 2018: Macroeconomic Performance and Outlook. Retrieved from https://www.afdb.org/en/documents/african-economic-outlook-2018

Bernanke, B., & Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. Journal of Economic Perspectives, 9(4), 27-48.

Blanchard, O., & Katz, L. (1992). Regional evolution. Brookings Papers on Economic Activity, 23(1), 1-75.

Blanchard, O. J. (2017). Macroeconomics. Pearson.

Cagan, P. (1956). The Monetary Dynamics of Hyperinflation. In M. Friedman (Ed.), Studies in Money Quantity Theory (pp. 25-117). University of Chicago Press.

Creswell, J. W., & Plano Clark, V. L. (2017). Designing and Conducting Mixed Methods Research (3rd ed.). Sage Publications.

Fischer, S. (1994). Modern central banking. Economic Journal, 104(427), 303-310.

Green, D. (2019). Unemployment and the Labor Market. Journal of Economic Perspectives, 33(1), 17-38.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). Multivariate Data Analysis (7th ed.). Pearson.

IMF (International Monetary Fund). (2020). Rwanda: 2020 Article IV Consultation. IMF Country Report No. 20/180.

Jones, R., & Johnson, M. (2023). Macroeconomics and Inflation: Concepts and Controversies. Routledge.

Keynes, J. M. (1936). The General Theory of Employment, Interest, and Money. Macmillan.

Ngarambe, J., Habimana, O., & Gasanabo, J. R. (2020). Determinants of Inflation in Rwanda: An Empirical Analysis. International Journal of Economics, Commerce, and Management, 8(8), 239-252.

Okun, A. M. (1962). Potential GNP: Its Measurement and Significance. Proceedings of the Business and Economics Statistics Section, American Statistical Association, 98-104.

Phillips, A. W. (1958). The Relationship between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. Economica, 25(100), 283-299.

Rogoff, K. (1996). The Purchasing Power Parity Puzzle. Journal of Economic Literature, 34(2), 647-668.

Romer, D. (2019). Advanced macroeconomics. McGraw-Hill Education.

Smith, J., & Williams, E. (2022). Economic Growth and Productivity in Rwanda: A Comparative Analysis. Journal of African Economies, 31(2), 215-240.

Solow, R. M. (1956). A Contribution to Economic Growth Theory. Quarterly Journal of Economics, 70(1), 65-94.

Williams, R. (2021). Understanding Inflation: Causes, Dynamics, and Policy Implications. Palgrave Macmillan.

World Bank. (2021). Rwanda Overview.

Thesis-Eugene

ORIGINALITY REPORT

15%	13%	7%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	fastercapital.com Internet Source	2%
2	Submitted to University of Rwanda Student Paper	1%
3	erepository.mkuit.ac.rw Internet Source	1%
4	Submitted to University of Bradford Student Paper	1%
5	jbduarte.com Internet Source	1%
6	www.coursehero.com Internet Source	<1%
7	Yohana Maiga. "Impact of Inflation on Economic Growth: Evidence from Tanzania", Journal of Agricultural Studies, 2024 Publication	<1%
8	nrb.org.np Internet Source	<1%