

Effect of tax revenue growth on economic growth in Rwanda period of 2003 to 2023

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ABSTRACT

Economic growth is anticipated to be stimulated by higher tax revenues, which will fund social services, infrastructure, and economic diversification. But even though tax revenue has increased significantly during the past 20 years, Rwanda's economic growth has stagnated. In order to determine how tax income growth affected Rwanda's economic growth between 2003 and 2023, this study was conducted. In particular, from 2003 to 2023, the study looked at Rwanda's tax revenue trends and the connection between tax revenue increase and economic expansion. Null hypotheses were rejected during the assessment. The study used software (E-Views 10) for econometric analysis using time series data from Rwanda Revenue Authority and National Institute of Statistics of Rwanda reports. The study employed the Multiple Linear Regression Model and the Ordinary Least Squares (OLS) method to evaluate the long-term effects of various tax components on GDP by estimating the impact of independent variables on the dependent variable and determining the direction and strength of these relationships. The empirical findings revealed a statistically significant positive relationship between total tax revenue and economic growth in the long run, with customs duties (coefficient 31.56118) and PAYE (23.63706) contributing more strongly to GDP than other tax revenues (coefficient -13.22934), which has a significant decrease in GDP. It is observed that R-squared is 0.908230, showing that 91% of the variations in the growth of GDP in Rwanda are explained by independent variables (profit taxes, excise tax, customs duties, PAYE, and other tax revenues), confirming the robustness of the analysis. Thus, the study comes to the conclusion that sustained economic development can be supported by an effective tax structure, especially one that improves customs duties and PAYE collection. Recommendations for policy include examining various tax tools, adjusting tax laws to better suit the objectives of economic development, and, lastly, enacting moderate tax rates to stimulate the economy.

Keywords: Economic Growth, Fiscal Policy, Government Expenditure, Tax Revenue Growth, Tax Reforms, Sustainable Development

I. INTRODUCTION

The governments of the world's poorest nations express a strong commitment to promoting and directing their countries' economic and social progress. This ambition is clearly reflected in the numerous development plans that have emerged from government presses across underdeveloped regions over the past three decades. The tax system is often identified as one of the most powerful levers available to these governments to move their economies from their present to achieve their future development plans (Kazman, 2014).

Tax revenue growth is often seen as the lifeblood of economic development, serving as a primary source of funding for public services and development initiatives. According to Stiglitz and Rosengard (2015) tax revenue is "the compulsory payments made by individuals and corporations to the government, which serve as a primary instrument for resource allocation, income redistribution, and economic stabilization". The government mostly depends on taxes to fund its operations. In order to pay for its essential expenses, the government typically imposes taxes on individuals and businesses. Ensuring effective revenue collection is the main goal of the East African Community's (EAC) revenue authorities. For every authority, assessing the performance of various revenue streams is an essential performance metric. This evaluation includes calculating tax income as a percentage of the country's GDP, comparing actual revenue received with predetermined targets, and examining increase in collections year over year. During the fiscal year 2022-2023, the East African Revenue Authorities (EARAs) had varying revenue results. Three revenue authorities surpassed their targets: SSRA (South Sudan Revenue Authority) at 163.9%, RRA (Rwanda Revenue Authority) at 103.6%, and URA (Uganda Revenue Authority) at 100.2%. On the other hand, TRA (Tanzania Revenue Authority), KRA (Kenyan Revenue Authority), and OBR (Office Burundais des Recettes) fell short by 2.5%, 4.7%, and 5.7%, respectively. In comparison, South Africa's SARS (South Africa Revenue Service) also missed its target by 0.3%, achieving 99.7%, which was lower than the EARAs' average of 109.1% (RRA Report, 2023).

Economic growth is the increase in a country's overall output of products or services (Toye, 1978). Economic growth is conventionally characterized by increases in GDP or real GDP per capita that occur over the long-term (Ojong et al., 2016). Among the top ten fastest-growing economies in 2019 were six African nations: Rwanda (8.7%), Ethiopia (7.4%), Côte d'Ivoire (7.4%), Ghana (7.1%), Tanzania (6.8%), and Benin (6.7%). However, real GDP growth in East Africa (EA) decreased from 4.7% in 2021 to 4.4% in 2022. During the 2022/23 fiscal year, Rwanda experienced a mixed macroeconomic performance. Inflation saw a sharp rise, increasing from 7.1% to 17.9%, while the Rwandan Franc (RwF) weakened against the US dollar, depreciating from 1,008.0 RwF per USD to 1,075.0 RwF per USD. Despite these economic pressures, the country demonstrated resilience by achieving robust real economic growth, which accelerated from 5.8% in the 2021/22 fiscal year to 8.1% in 2022/23, Rwanda's economy grew by 8.2% in 2023, which was higher than the expected 6.2%. The growth was even stronger in the last part of the year, reaching 10%, Rwanda successfully balanced inflation control, managed external deficits, and ensured fiscal prudence, showcasing a resilient financial sector (RRA, 2023)

In order for the government to finance infrastructure and other critical public services, which in turn stimulate economic activity, tax revenue growth is key to Rwanda's economic development. Increases in direct taxes and taxes on products and services have a major positive impact on Rwanda's GDP, according to research by Nzabirinda (2023) that looks at data from 2006 to 2021. In particular, the GDP increases by 0.19% for every 1% increase in direct taxes and 0.58% for every 1% increase in goods and services taxes. In addition, tax revenue increased by 12.3% in the 2023–2024 fiscal year over the prior period, according to the Rwanda Revenue Authority. This growth was mainly attributed to economic expansion, the automation of tax-related services, and a greater use of electronic invoicing systems (Nzabirinda, 2023). A revenue authority's main objective is to collect taxes that are due in line with the law and to do so in a way that maintains public trust in the tax system and its management. A strategy document that identifies the most important compliance issues in a tax system and describes the revenue agency's approach to addressing them is called a tax compliance improvement plan. By creating such a plan, the agency may create and execute successful compliance initiatives while systematically evaluating and ranking risks. In order to handle the most pressing tax compliance issues, a defined procedure like this guarantees that resources are distributed across various functions in an economical manner designed to improve taxpayer compliance with regard to registration, tax return completion, tax payment, and correct reporting (RRA, 2023).

1.1 Statement of the Problem

In the 21st-century economy, tax revenue is crucial in funding government spending, powering infrastructure growth, and stimulating economic growth with the development of economies, the capacity of a nation to mobilize and use tax revenue effectively determines the level of sustainable development. According to the International Monetary Fund (IMF, 2023), efficient taxation and tax collection contribute significantly towards economic growth as they fund government investment. While tax revenue growth is generally seen as positive indicator of a government's ability to mobilize domestic resources, its actual impact on economic growth remains uncertain, particularly in developing countries like Rwanda. Despite rising tax collections, many such economies continue to face stagnant growth, raising concerns about how effectively tax revenue are being utilized to stimulate productive investment, reduce inequality, improve public sector management but don't promote as well economic growth, this paradox highlights a critical challenge.

Researchers have investigated the interface between tax and economic growth under various contexts (Etienne, 2023; Mureka, 2021; Nzabirinda, 2023) the studies intend to investigate the relationship between tax revenue expansion on economic growth by using Ordinary Least Squares (OLS) method and Vector Error Correction Model. While a large majority of these studies address the contribution of taxation to overall economic performance, the majority stress tax collection effectiveness or its effect on government receipts without directly examining the direct impact on economic growth. In Rwanda, studies mostly address reforms in taxation, tax compliance, and revenue mobilization (Etienne, 2023) but do not comprehensively capture the effect growth in tax revenue has had on GDP, investments, employment, and economic performance as a whole. The specific gap in the literature is the limited understanding of the direct impact of tax revenue growth on Rwanda's economic growth.

This study aims to address the problem through the analysis of the effect growth in revenues from taxation has had on economic growth in Rwanda over a 21-year period from 2003 to 2023 is a timely research project, as need to delve deeper into the relationship between Profit taxes, PAYE, Excise tax, Customs duties and other tax revenues on Rwanda's economic growth. It aims to test the extent to which increased taxation revenue has been responsible for stimulating economic growth. The overall goal is to offer empirical evidence to guide policymakers on developing tax approaches that improve the economic sustainability of revenues and ensuring efficient use of revenues to attain Rwanda's optimal development potential.

1.2 Research Objectives

- i. To analyze the trend of tax revenue growth in Rwanda.
- ii. To assess the relationship between tax revenue growth and economic growth in Rwanda during the study period.

1.3 Research Hypotheses

H_{01} : There has no a significant increase in tax revenue in Rwanda.

H_{02} : There is no positive significant relationship between tax revenue growth and economic growth in Rwanda during the study period.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Theoretical Model on Taxation

A number of theoretical perspectives have been established to explain the origins and intent of taxes, and one of them provides a particularly pertinent framework for understanding the ways in which tax systems support the growth of inclusive and equitable societies. Important insights into how taxes impact economic development and public policy can be gained from the socio-political theory, benefit theory, and cost of services theory. Service charges According to theory, taxes are payments associated with pricing in a market economy, and people should be responsible for paying for the specific government services they use (Ojong et al., 2016). This argument holds that a person shouldn't have to pay taxes if they don't use public services. Despite emphasizing equity through usage-based contributions, this strategy has drawn significant criticism. Government services are subject to some limitations imposed by the cost of service principle. The government wants to assist those who are less fortunate. Should the theory be put into practice, it would limit the government's ability to provide essential social services and public goods, such infrastructure, healthcare, and education, to those who would not be able to afford them. Furthermore, the theory is less useful for implementing policies, especially in developing nations, due to the challenge of precisely estimating the cost per person for numerous public services.

The Benefit Theory was created in response to these limitations. According to this viewpoint, taxpayers ought to make contributions to the public finances according to the advantages they derive from products and services supplied by the government (Solow, 1956). According to this perspective, taxes are paid by citizens in exchange for the direct and indirect benefits of governmental spending. Although this theory supports taxation by citing personal responsibility and benefit, it has flaws, especially when it comes to estimating the true benefits that each citizen receives from public goods, many of which, like environmental preservation, law enforcement, and national defense, are indispensable and benefit society as a whole. More comprehensively, the socio-political theory of taxation highlights that tax structures ought to be created with the intention of accomplishing more general social goals, like advancing economic development that is inclusive, lowering poverty, and promoting equity (Bird & Zolt, 2005). Taxation is viewed as a policy tool for society change from the socio-political perspective, in contrast to the other two theories that concentrate on the individual's relationship to public service consumption or benefit. In addition to being fair in its allocation, it promotes a tax structure that is sensitive to the historical background and structural requirements of a community.

The socio-political theory offers a useful perspective for comprehending Rwanda's post-1994 fiscal reforms. Rwanda established a tax system after the genocide with the goals of fostering social cohesion, lowering reliance on outside assistance, and guaranteeing fair access to public services in addition to restoring governmental capacity and raising money. An intentional attempt to generate domestic resources while coordinating taxation with national development aspirations is seen in the creation of the Rwanda Revenue Authority and the ensuing tax policy modifications. According to (Fjeldstad & Heggstad, 2012). Rwanda's revenue mobilization strategy shows a purposeful use of taxes to achieve both fiscal recovery and more general socio-political goals like equity and national unity. Thus, the socio-political framework effectively captures the multidimensional role of taxation in Rwanda's economic recovery and long-term growth strategy.

2.1.2 Ability-to-Pay Principle

A key idea in tax fairness is the ability-to-pay, which states that people should make contributions to the public coffers in accordance with their financial capability, which is commonly determined by their income, wealth, or consumption. This theory supports progressive tax systems higher earners pay a greater share to reduce inequality, promote social justice, preventing tax avoidance and managing administrative complexities. It was notably advanced by Arthur Cecil Pigou in 1928, who emphasized that equitable taxation requires taxing individuals in proportion to their financial strength (Bejakovic, 2020). Economists like Thomas Piketty argue in favor of stronger application of this principle to address inequality through more progressive taxation (Piketty, 2021). In the context of Rwanda, this principle informs the design of the tax code by ensuring that wealthier individuals and profitable businesses contribute more to public revenue, thereby promoting equity while supporting sustainable economic development.

2.1.3 Solow's Theory of Economic Growth

Economic growth, as described in Solow (1956) model, relies on the accumulation of various forms of capital (both human and physical) while accounting for diminishing returns to these inputs over time. The production capacity of an economy is shaped by the quantity and productivity of its capital (denoted as y) and labor force. To illustrate connection between taxation and economic expansion/decline, utilize the succeeding growth model in which changes in real GDP is determined by changes in both human and physical capital, and some error terms.

Using this theoretical framework, we observed that a country's tax policies have indirect yet significant effects on variables, which ultimately influence GDP growth. A high tax on corporate and individual incomes may disincentive investment in physical capital (k). Similarly, elevated tax burdens can negatively affect labor market participation (m) by discouraging individuals from entering the workforce, reducing working hours, or dissuading them from acquiring new skills or pursuing certain careers. Moreover, tax policy can obstruct productivity growth by limiting the availability of venture capital for innovative, technology-driven businesses and by reducing investment in research development. Since research and development often generates positive spillover effects that enhance labor productivity and per capita output, any reduction in such activities may restrain economic progress (Kairanya, 2016)

2.1.4 Keynesian Theory

According to traditional Keynesian economics, fiscal policies that influence disposable income and expected returns play a significant role in shaping consumer behavior, particularly in terms of spending and saving. A reduction in taxes increases disposable income, which typically leads to higher private consumption (Kairanya, 2016). However, the Ricardian equivalence theory offers a contrasting view: it suggests that consumers may anticipate future tax increases to offset current tax cuts, leading them to save rather than spend the additional income, thereby neutralizing any stimulative effect on consumption. Furthermore, an increase in government spending financed through higher taxation can contribute to inflationary pressures. This creates uncertainty regarding the future value of savings and the relative pricing of future goods, both of which are crucial factors in investment decision-making. When inflation rises, real interest rates tend to fall, reducing the incentive to save and discouraging capital accumulation. At the same time, expectations of higher inflation can prompt investors to shift their portfolios away from cash holdings toward tangible assets or productive capital in an attempt to preserve value and enhance. This portfolio adjustment mechanism is described by the Tobin Mundell effect, which highlights how inflation expectations can redirect financial resources toward real investments, potentially spurring economic growth (Ali et al., 2018).

2.1.5 Endogenous Growth Model

Romer and Lucas formulated the endogenous growth theory (Romer, 1994), under which nation's economic progress is primarily due to internal factors such as innovation, building of human capital, and policy decisions instead of the influence of exogenous factors. Romer's argument is that investment in Research and idea building gives rise to rising returns to scale as it increases the productivity of each input. He categorizes ideas as rival-free resources that can be exploited by many people without being used up and underscores the importance of knowledge spillovers in monopolistically competitive environment. Intellectual property rights, such as patents, induce innovation in this environment. Lucas adds to this by focusing on human capital, stressing that education and training not only improve individual productivity (internal effects) but also raise the productivity of others through external effects. He argues that long-term growth relies on sustained investment in people, as these investments increase efficiency and productivity

Second, the endogenous model identifies the role of policies by the government, primarily fiscal policies like taxation, on deciding economic performance. Fiscal policies, in this regard, can be used to generate funds for infrastructure and technological development, both of which are crucial in promoting growth. Therefore, in investigating how taxation impacts economic growth in Rwanda, the endogenous model gives insights by connecting fiscal policy and productivity, innovation, as well as long-run economic growth.

2.1.6 Exogenous Growth Model

The exogenous growth model, specially know through the Solow-Swan model (Solow, 1956), is the neoclassical economic Theory. According to the neoclassical economic theory, technological advancement drives economic growth independently of other economic forces. Long-term economic growth is explained by capital accumulation, population (labor) increase, and technological advancement. The exogenous growth model uses technological variables, savings rates, production, and declining returns of capital to predict economic growth. By rapidly growing a nation's capital, foreign direct investment (FDI) can support economic growth. However, according to the Solow growth model from 1956, this effect does not last forever. As more capital is added, its impact starts to decline due to diminishing returns. Eventually, the economy reaches a point where adding more capital does not lead to further growth. While investment is important early on, lasting economic growth in this model relies on ongoing improvements in technology, which the model assumes happen from outside the system.

2.1.7 Laffer Curve Theory

In 1974, economist Arthur Laffer introduced the concept known as the Laffer curve, illustrating the theoretical link between tax rates and the government’s revenue from taxation. The curve highlights how adjustments in tax rates can influence revenue in two main ways: the arithmetic and the economic effect. This framework suggests that altering tax rates impacts total revenue not only through direct changes in the amount collected but also through its influence on overall economic activity (Trabandt & Uhlig, 2011). Simply put, the arithmetic effect of lowering tax rates is that the quantity of tax revenues (per dollar of tax base) will reduce by the rate decrease. When tax rates rise, the opposite is true. However, the economic effect acknowledges that lower tax rates will have favorable influence on activities, employment, and production. Raising tax rates discourages participation in the activities that are subject to the tax, which has the opposite economic effect. The arithmetic effect always works in the opposition from the economic effect (Kazman, 2014).

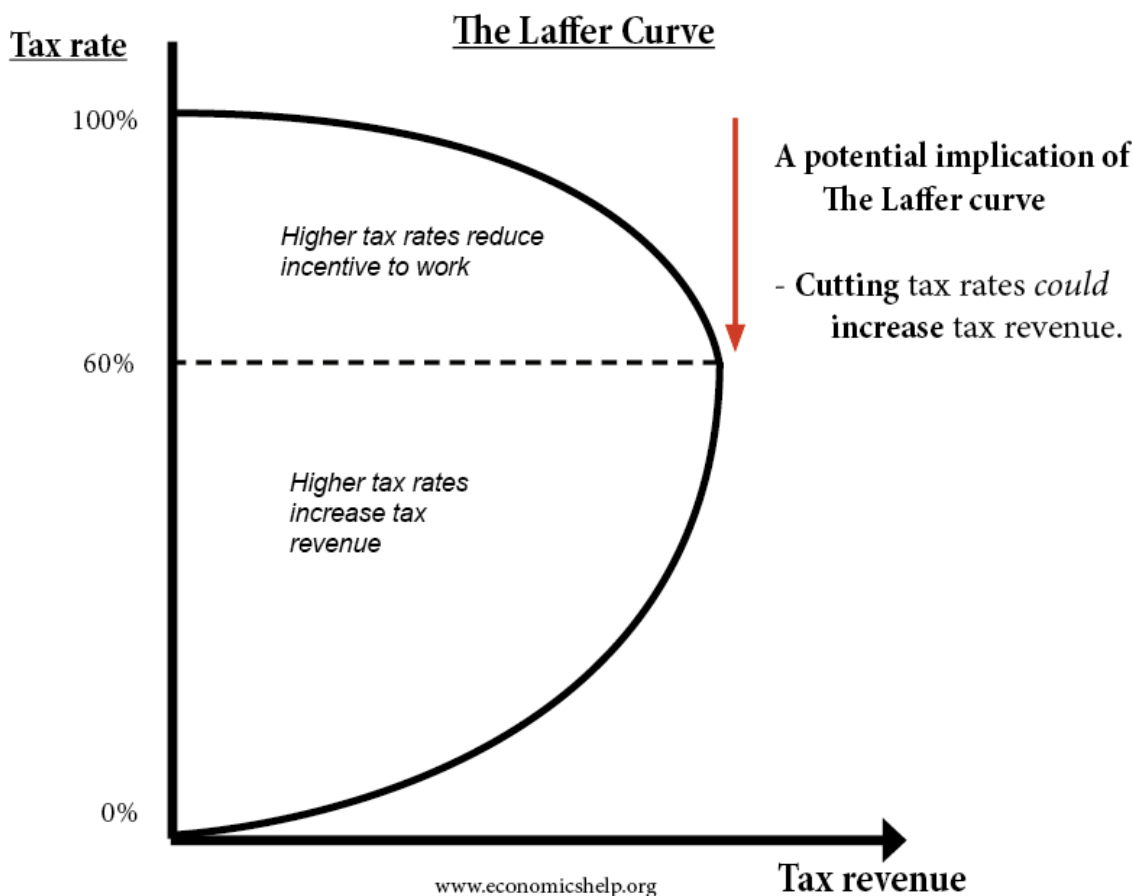


Figure 1

Laffer Curve

Source: Tejvan Pettinger (2018)

2.2 Empirical Review

Numerous empirical studies have investigated the link between tax revenue and economic growth, both in Rwanda and internationally. These studies employed various econometric techniques and focus on different components of taxations as (Umutoni, 2017) provided valuable insights into the relationship between tax revenue growth and economic growth in Kenya, the study utilized a 33-year time series data from 1990 to 2022, analysis have be done through the Vector Error Correction Model (VECM) to analyzed the long-run relationship between those variables and the findings are that tax revenue growth, interest rate, inflation, net FDI to GDP ratio and net exports to GDP ratio have a favorable effect on economic growth.

In a study published in 2022, (Adefolake and Omodero, 2022) evaluated the impact of tax income on Nigeria’s economic expansion using time series data from 2000 to 2021, the ADF is used to assess and test the acquired data for unit root. At first difference, the study variables which include GDP, PPT, CIT, and VAT are determined to be stationary. As a result, a long-term association is shown by Johansen co-integration test. In order to assess the impact of PPT, CIT, and VAT on GDP, the study makes use of the vector error correction model (VECM), the results show that VAT and PPT have significant and positive effects on GDP, but CIT has a considerable and negative influence on GDP.

Nantob (2014) provided an evidence from developing countries by assessing the effect of taxes increase on economic growth of 47 developing countries from 2000 to 2012 by using a dynamic panel data method, found that taxes on income, profits, and international trade have a non-linear impact on economic growth. In contrast, indirect taxes such as VAT and excise duties were found to consistently support economic expansion, suggesting they may be more growth-friendly in developing economies.

According to a regional fact with East Africa Revenue Authorities (2024) who investigated how fiscal factors influence economic growth within the EAC, focusing on Kenya, Uganda, Tanzania, Rwanda, and Burundi over the period 2005-2020. Using the Hausman and Lagrange Multiplier (LM) tests, the researchers determined that the pooled OLS regression model was the most appropriate for parameter estimation and statistical analysis. Their findings revealed that taxation exerted a negative yet statistically significant effect on GDP, with p-value of 0.000 at 5% significance level and a coefficient of 0.438. This study further concluded that public debt negatively affects the EAC's economic performance, whereas gross domestic investment contributes positively.

Babatunde et al. (2017) examined how taxes affected economic growth in Africa between 2004 and 2013. The study used a number of preliminary tests, such as descriptive statistics and stationary tests utilizing the Im, Pesaran, Shin W-statistic, Levin et al., and Augmented Dickey Fuller (ADF) tests. The researchers applied the Hausman test to evaluate the suitability of the model by comparing fixed and random effects approaches. The results indicated a statistically significant positive relationship between tax revenue and GDP, suggesting that increases in tax revenue are associated with growth in economic output. According to Ibn Khaldun's theory of taxation, which supports the beneficial effects of reduced tax rates on labor, output, and economic performance, both high and low taxation levels are therefore conducive to economic growth.

Nizeyimana (2024) examined the impact of tax collection on Rwanda's economic growth using a regression research design and a qualitative methodology, taken Musanze district as a case study (2019-2023). The study's sample size was 56 employees that work in the Musanze District, and SPSS was used to analyze the data. The findings showed that VAT and income taxes had a favorable impact on economic growth. However, customs duties have a less significant effect. The study suggested the improvement of tax system in Musanze district.

Umutoni (2017) examined the effect of government fiscal actions, specifically expansionary policy on Rwanda's economic growth over the 23-year period. The research finds a strong positive relationship between government expenditure, tax revenue, and economic growth. With an R-squared valued of 0.98, the results indicate that 98% of the variation in economic growth can be explained by fiscal variables, suggesting a significant influence of government fiscal interventions. Using empirical methods including stationarity and co-integration tests, the study shows that government spending, tax revenue, and GDP are co-integrated in the long run, meaning they move together over time and share a stable long-term relationship. This implies that fiscal policies have lasting impacts on the economic trajectory of the country.

Nzabirinda (2023) analyzed how different categories of tax revenue have influenced Rwanda's economic growth over 15-year period. Using quarterly data from the RRA and NISR, Direct tax (DT), the tax on goods and services (TGS), and other three primary tax components were the subject of the investigation. Additionally, GDP is used as a stand-in for economic growth in the Tax on international Trade (TIT). Econometric software (E-Views 8.0) was used for the analysis, and the results showed a long-term correlation between GDP and tax receipts, which was validated by Johansen co-integration tests. However, no short-run causality was found among the variables. In terms of individual impact, a 1% increase in DT leads to a 0.19% rise in GDP, while a 1% increase in Tax on Goods and Services results in a 0.58% increase in GDP. Both these components show a positive and significant effect on GDP, indicating its limited role in driving economic performance. The regression model used in the analysis is highly robust, with an adjusted R-squared value of 0.994407, meaning that 99.44% of the variation in GDP is explained by the included tax variables. Based on these results, the study recommended that Rwandan fiscal policy should focus on strengthening domestic tax mobilization particularly Direct Taxes and Taxes on Goods and Services due to their strong positive contribution to economic growth.

A review of the existing literature reveals that most studies examining the relationship between tax revenue growth and economic growth report a strong positive correlation, suggesting that increased tax collection contributes to economic expansion. However, despite consistent growth in tax revenue over the years, Rwanda's economic performance has remained unpredictable, raising important concerns about the actual impact of tax policy on long-term economic outcomes. This inconsistency points to a potential gap in understanding the deeper dynamics of how tax revenues influence growth. Many of the existing studies focus mainly on broad correlations using aggregate data, without adequately investigating the causal mechanisms, the role of different types of taxes, or sector-specific impacts. These overlooked aspects suggest a need for more comprehensive and nuanced empirical research that not only measures the relationship between tax revenue and economic growth but also explores the underlying channels and conditions that shape this relationship in the Rwanda context.

III. METHODOLOGY

This study adopted a quantitative research approach, supported by econometric modelling technique, specially a multiple linear Regression model. A correlational research design was used to determine the statistical relationship between two or more variables without manipulating them, making it appropriate for this study’s aim of examining the association between tax revenue growth and economic growth in Rwanda. Within this framework, the research will use time-series data analysis, a branch of quantitative research that deals with data collected at successive points over time. Time-series analysis is particularly useful for identifying trends, patterns and causal relationships over a historical period, in this case from 2003 to 2023. The study relied exclusively on secondary data obtained from official sources, namely from Rwanda Revenue Authority (RRA) and the National Institute of Statistics of Rwanda (NISR), including their statistical bulletins and annual reports. The dependent variable in this analysis is Gross Domestic Product (GDP), which serves as the primary indicator of economic growth. The independent variables consist of several categories of tax revenue: Profit taxes (CIT, PIT), PAYE (Pay-As-You-Earn), Excise tax, Customs duties and Other tax revenues (including Fuel Levy, road Toll, Royalty tax on Mining, Strategic Reserve Levy Motor vehicle tax, other customs, interests and penalties). The relationship between these variables will be analyzed using E-Views 10 (Econometric Views) software, which allows for advanced econometric test.

IV. FINDINGS & DISCUSSION

4.1 Trend of Variables

To observe the direction and stance of the tax revenue growth in Rwanda.

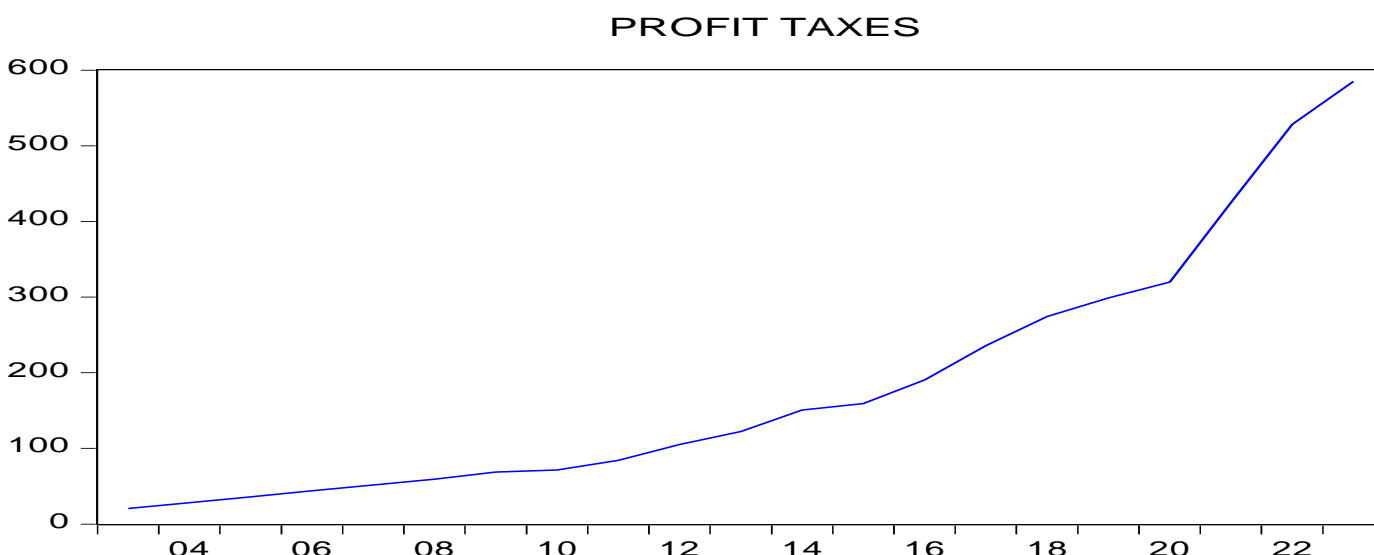


Figure 2
Level of Profit Taxes in Rwanda

The line graph illustrates the trend of Profit Tax revenue in Rwanda from 2003 to 2023, measured in Rwanda francs (RWF) billions. Overall, the graph shows a steady upward trajectory, highlighting continuous growth in tax collections over the two decades. From 2003 to around 2010, the increase was gradual, with revenue rising from below RWF 50 billion to just under RWF 100 billion. Between 2010 and 2019, the growth became more moderate, reaching approximately RWF 300 billion. A brief plateau is noticeable around 2020 to 2021, likely due to the economic impacts of the COVID-19 pandemic. However, from 2022 onwards, there is sharp surge in profit tax revenue, climbing rapidly to nearly RWF 600 billion by 2023.

PAYE

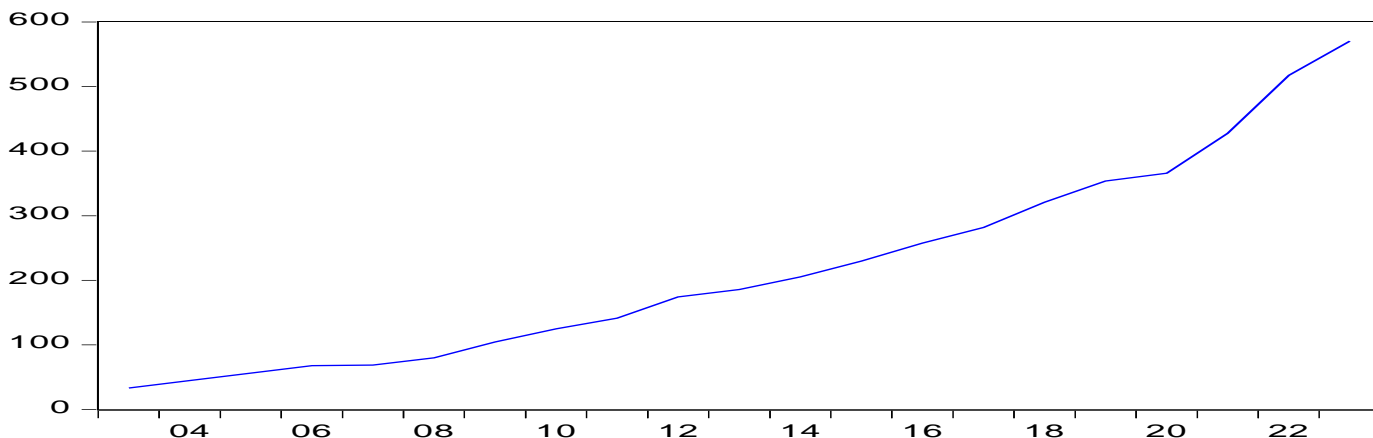


Figure 3
The Extent of PAYE (Pay-As-You-Earn) in Rwanda

The figure illustrates the trend of PAYE (Pay-As-You-Earn) tax revenue in Rwanda from 2003 to 2024, showing a consistent upward trajectory, reflecting sustained growth in formal employment and improved tax collections mechanisms. From modest levels in 2003, PAYE revenue has increased sharply, particularly from around 2017 onward, where the slope of the curve becomes steeper indicating an acceleration in revenue growth. By 2023, PAYE collections approached RWF 600 billion, marking a significant rise compared to earlier years. This steady increase enhances the growing contribution of PAYE to Rwanda’s domestic revenue base and likely reflects positive developments in wage growth, labor force formalization, and tax compliance.

EXCISE TAX

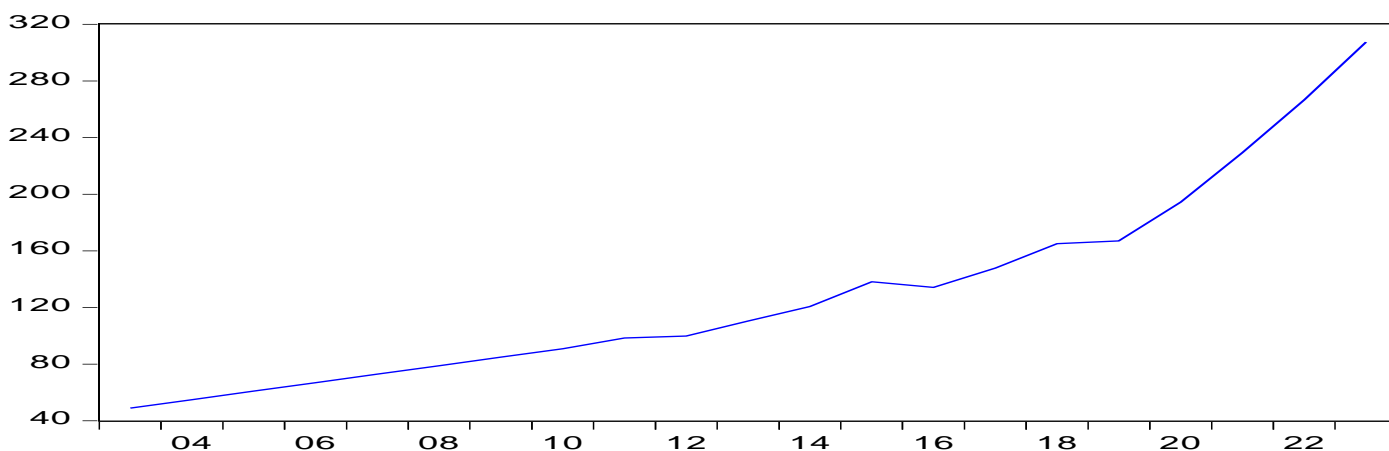


Figure 4
The Extent of Excise Tax in Rwanda

The curve indicates a slow but steady increase in Rwanda’s excise tax revenue from 2003 to 2023 in billions, with a gradual rise from 2003 to around 2013, followed by a more pronounced upward trend, especially after 2020. This indicates that the government likely implemented higher excise tax rates or experienced increased in consumption of excisable goods. A slight plateau or slower growth is visible between 2016 and 2018, possibly reflecting temporary policy adjustments.

CUSTOMS DUTIES

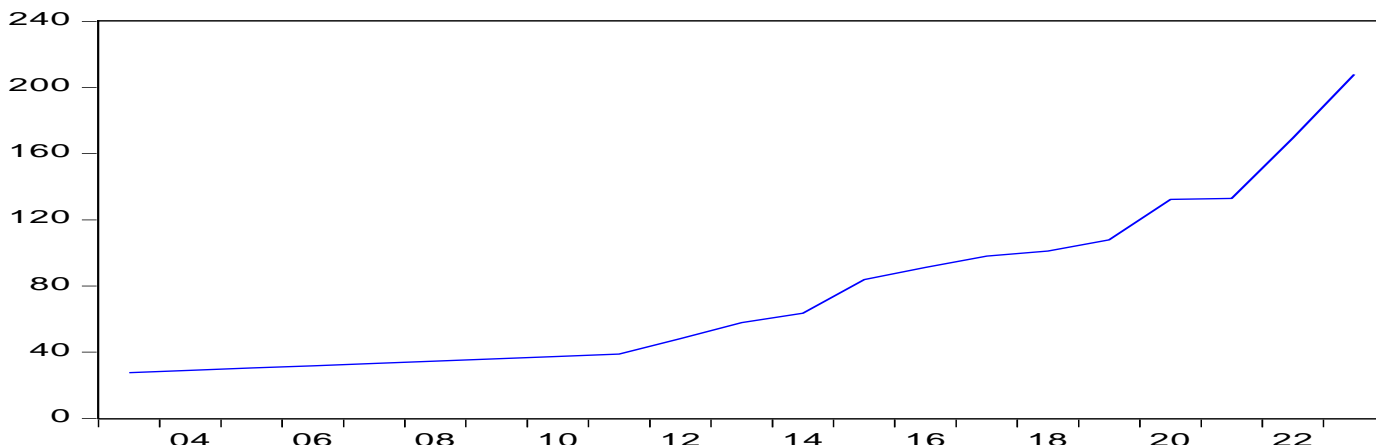


Figure 5
The extent of Customs duties in Rwanda

The figure displays the trend of Customs Duties revenue in Rwanda from 2003 to 2023, measured in Rwandan Francs (RWF) billions. From 2003 to 2023, Rwanda’s customs duties increased significantly from RWF 27.6 billion to RWF 207.9 billion, showing a steady upward trend with notable acceleration in certain periods. Between 2003 and 2011, growth was gradual, reflecting stable trade and tax systems, while the period from 2012 to 2015, saw a sharp rise, likely due to improved customs enforcement, increased imports, and regional trade integration. After moderate growth from 2016 to 2019, customs revenue surged again from 2020 to 2023, nearly doubling, possibly driven by post-COVID trade recovery. Overall, the trend illustrates Rwanda’s strengthening capacity in revenue collection and expanding international trade.

OTHERS TAX REVENUES

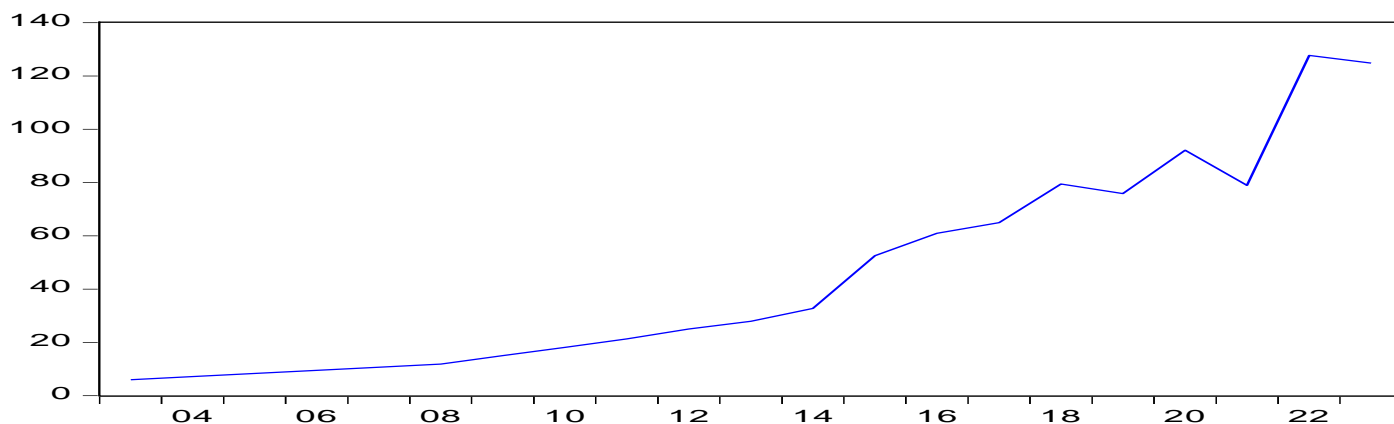


Figure 6
The Extent of Others Tax Revenues

The line graph shows the trend of Other Tax Revenues in Rwanda from 2003 to 2023, measured in billions of Rwanda francs. A significant upward trend showing a growth from RWF 6.0 billion in 2003 to RWF124.8 billion in 2023 indicating a strong improvement in tax collection. The revenue rose steadily between 2003 and 2008, followed by accelerated growth from 2009 to 2014, where it nearly tripled. From 2015 to 2019, the trend continued upward with slight fluctuations, including a dip in 2018. Despite global economic disruptions during the pandemic period, the revenues rebounded sharply by 2021 and remained high through 2023, with only minor declines. Overall, the figure reflects a generally upward trend with periods of fluctuation, indicating growing but volatile performance in non-VAT, non-income taxes revenues over the years.

4.2 Descriptive Analysis

This part is showing the descriptive statistics of data used in this research.

Table 1*Descriptive Statistics of Variables as Individual Samples*

	GDP	CUSTOMS_DUTIES	EXCISE_TAX	OTHERS_TAX_REVENUES	PAYE	PROFIT_TAXES
Mean	5980.286	75.88571	130.3825	45.25238	219.5893	183.7667
Median	4929.000	57.90000	110.4000	27.90000	185.9000	122.2000
Maximum	16355.00	207.9000	307.4000	127.7000	570.4000	585.0000
Minimum	1146.000	27.60000	48.86667	5.966667	33.27500	20.53333
Std. Dev.	4189.159	51.42160	70.70353	38.91670	157.9549	166.3370
Skewness	0.910667	1.059103	1.056584	0.796806	0.736012	1.129891
Kurtosis	3.095548	3.268975	3.332313	2.459841	2.560512	3.236714
Jarque-Bera	2.910591	3.989248	4.003924	2.477451	2.065005	4.517314
Probability	0.233331	0.136065	0.135070	0.289753	0.356115	0.104491
Sum	125586.0	1593.600	2738.033	950.3000	4611.375	3859.100
Sum Sq. Dev.	3.51E+08	52883.63	99979.78	30290.19	498995.3	553359.8
Observations	21	21	21	21	21	21

Table 1 shows measures of central tendency (mean, median), measures of dispersion (standard deviation), and measures of normality (kurtosis, skewness) and illustrates the Jarque-Bera, which measured the difference between skewness and kurtosis of the series. Based on the probabilities of Jarque-Bera, which are all greater than 0.05, all variables are normally distributed.

In conformity with these results, the GDP of Rwanda from 2003 to 2023 was RWF 5980.286 billion on average, with a standard deviation of RWF 4189.159 billion. From 2003 to 2023, Customs duties were 75.88571 billion on average with a standard deviation of RWF 51.42160 billion. Excise tax was RWF 130.3825 billion on average with a standard deviation of RWF 70.70353 billion. Other tax revenues were RWF 45.25238 billion on average with a standard deviation of RWF 38.91670 billion. Average and standard of PAYE were RWF 219.5893 and 157.9549 billion respectively. Profit taxes were RWF 183.7667 billion on average and RWF 166.3370 billion on standard deviation.

4.3. Preliminary test

Before interpreting the results of a regression analysis, it is essential to conduct preliminary tests to ensure the validity and reliability of the model.

4.3.1. Stationarity Test (Unit Root Test)

Table 2*Augmented Dickey Fuller (ADF) Test*

Null Hypothesis: has a unit root							
Exogenous: Constant							
Lag Length: 0 (Automatic - based on SIC,maxlag=2)							
Variable	Level/First difference	ADF Test Statistic	1% Critical Value	5% critical Value	10% critical Value	P-value	Stationary?
GDP	First difference	-4.33026	-3.857386	-3.04039	-2.66055	0.0038	Yes (5%)
PAYE	First difference	-6.41126	-3.886751	-3.05216	-2.66659	0.0001	Yes (5%)
EXT	First difference	-6.48140	-3.857386	-3.04039	-2.66055	0.0001	Yes (5%)
CUSD	First difference	-7.66407	-3.857386	-3.04039	-2.660551	0.0000	Yes (5%)
OTR	First difference	-7.16006	-3.831511	-3.02997	-2.655194	0.0000	Yes (5%)
PFT	First difference	-5.34877	-3.886751	-3.05216	-2.666593	0.0006	Yes (5%)

4.3.2. Test for Co-Integration

Since all variables were found to be non-stationary at their level forms but became stationary after first differencing, a Johansen cointegration test was conducted to access the existence of any long-run equilibrium relationships among them. This approach was based on Unit root tests applied to the residuals from regression model. The results of Johansen test, presented in Table 3, indicated whether cointegration exists among the variables under study.

Table 3*Unrestricted Cointegration Rank Test (Trace)*

Sample (adjusted): 2003 2023				
Included observations: 20 after adjustments				
Trend assumption: Linear deterministic trend (restricted)				
Series: GDP CUSTOMS_DUTIES EXCISE_TAX OTHERS_TAX_REVENUES PAYE PROFIT_TAXES				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.999339	331.4127	117.7082	0.0000
At most 1 *	0.982827	184.9632	88.80380	0.0000
At most 2 *	0.934951	103.6749	63.87610	0.0000
At most 3 *	0.642326	49.02273	42.91525	0.0109
At most 4 *	0.579439	28.46007	25.87211	0.0233
At most 5	0.426982	11.13677	12.51798	0.0841

The results of the Johansen cointegration trace test indicate the presence of long-run equilibrium relationships among the variables GDP, Customs Duties, Excise Tax, Other Tax Revenues, PAYE, and Profit Taxes over the period 2003 to 2023. The test rejects the null hypothesis of no cointegration up to five cointegrating equations, as the trace statistics for "None" through "At most 4" are all greater than their corresponding critical values at the 5% significance level, with p-values below 0.05. Only at "At most 5" is the null not rejected, with a p-value of 0.0841, indicating that no more than five cointegrating relationships exist. This suggests that although the individual series may be non-stationary, they share a stable, long-run relationship (Boadway & Wildasin, 1994).

4.4 Modelling

Regression analysis was used to see if there was a link between tax revenue growth and economic growth (GDP). To compute regressions for the study, the researcher used econometric software (E-Views 10).

Table 4*Regression analysis*

Dependent Variable: D(GDP,1)				
Method: Least Squares				
Sample (adjusted): 2004 2023				
Included observations: 20 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-47.42997	102.9294	-0.460801	0.6520
D(CUSTOMS_DUTIES,1)	36.55464	9.485078	3.853910	0.0018
D(EXCISE_TAX,1)	-7.380042	9.862855	-0.748266	0.4667
D(OTHERS_TAX_REVENUES,1)	-13.71629	6.155281	-2.228377	0.0428
D(PAYE,1)	20.47961	7.523209	2.722191	0.0165
D(PROFIT_TAXES,1)	3.728520	5.760843	0.647218	0.5280
R-squared	0.912147	Mean dependent var		760.4500
Adjusted R-squared	0.880771	S.D. dependent var		725.6327
S.E. of regression	250.5577	Akaike info criterion		14.12858
Sum squared resid	878908.6	Schwarz criterion		14.42730
Log likelihood	-135.2858	Hannan-Quinn criter.		14.18689
F-statistic	29.07143	Durbin-Watson stat		2.365991
Prob(F-statistic)	0.000001			

As shown in this table 5, Excise tax, Profit taxes are statistically insignificant, since their p-value=0.4667, 0.5280 >0.05 do not impact GDP, we eliminate in the model. Therefore, we consider Customs duties, others tax revenues, PAYE.

Then we run the OLS regression on those four variables, and we got the following results.

Table 5*Regression Analysis between GDP, Customs Duties, Others Tax Revenues and PAYE*

Dependent Variable: D(GDP,1)				
Method: Least Squares				
Sample (adjusted): 2004 2023				
Included observations: 20 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-80.27257	88.61488	-0.905859	0.3785
D(CUSTOMS_DUTIES,1)	31.56118	6.512794	4.846028	0.0002
D(OTHERS_TAX_REVENUES,1)	-13.22934	5.572771	-2.373926	0.0305
D(PAYE,1)	23.63706	3.250277	7.272323	0.0000
R-squared	0.908230	Mean dependent var		760.4500
Adjusted R-squared	0.891023	S.D. dependent var		725.6327
S.E. of regression	239.5437	Akaike info criterion		13.97221
Sum squared resid	918098.9	Schwarz criterion		14.17135
Log likelihood	-135.7221	Hannan-Quinn criter.		14.01108
F-statistic	52.78278	Durbin-Watson stat		2.569780
Prob(F-statistic)	0.000000			

The regression results indicate a strong and statistically significant relationship between changes in GDP and changes in the selected tax revenue components over the period 2004 to 2023. The model which explains approximately 91% of the variation in GDP growth (R-squared= 0.9082), shows that a one-unit increase in the change of CUSTOMS_DUTIES leads to a significant increase in GDP growth by about 31.56 units (p-value=0.0002). Whereas our study reported that customs duties (which is part of TIT) exert a positive effect on GDP in Rwanda, Nzabirinda (2023) in his study where analyzing different categories of tax revenue have influenced Rwanda's economic growth over 15-year period in Rwanda found no significant relationship between Tax on international Trade (TIT) and GDP.

A one-unit increase in PAYE (Paye-As-You-Earn) results in a GDP growth increase of approximately 23.64 units (p-value=0.0000). These findings highlight the positive economic influence of trade-related revenues and formal sector income taxes. Similarly, Nizeyimana (2024) in assessing the impact of tax collection on Rwanda's economic growth using a regression research design and a qualitative methodology, found that income taxes had a favorable impact on economic performance.

This result provides a new insight by showing that while customs duties and PAYE contribute positively to Rwanda's GDP, other tax revenues have a negative and significant impact. A one-unit increase in the change of OTHERS_TAX_REVENUES is associated with a significant decrease in GDP growth by approximately 13.23 units (p-value= 0.0305), indicating that not all tax revenue sources contribute positively to economic expansion. The negative coefficient suggests these other taxes may be distortionary or less efficiently collected, potentially dampening economic activity. The constant term is (-80.27) is statistically insignificant (p-value=0.3785), implying it does not meaningfully explain variations in GDP growth within the model.

The overall regression is highly significant, with an F-statistic of 52.78 and an associated p-value of 0.000000, confirming that the model's explanatory variables jointly have a strong effect on GDP growth. The adjusted R-squared value of 0.8910 reinforces the model's robustness, confirming the strong relationship between tax revenue and GDP which agree with Umutooni (2017), adjusting for the number of predictors included. Additionally, the Durbin-Watson statistic 2.57 indicates the absence of significant autocorrelation in the residuals, supporting the reliability of the estimated coefficients.

Thus:

$$GDP = -80.27257 + 31.56118CUD + 23.63706PAYE - 13.22934OTR$$

4.5 Diagnostic Test (Post-Test)

This section includes tests typically used to assess model specification include tests for autocorrelation, Heteroskedasticity, normality of residuals, and functional form.

4.5.1 Normality Test

This normality test was used to check whether the residuals (errors) of a model follow a normal distribution.

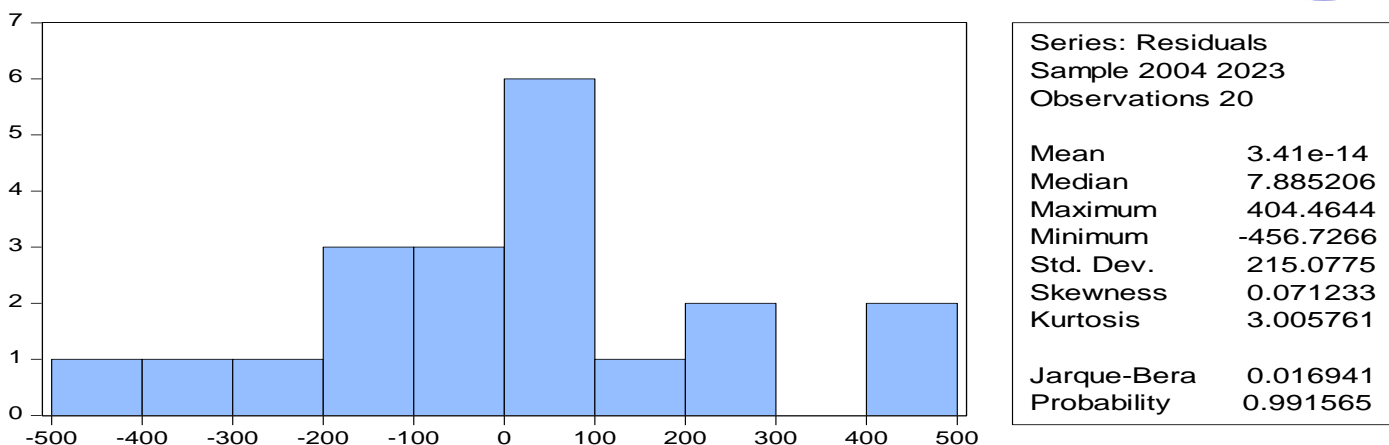


Figure 7
Normality Distribution

The histogram of residuals appears approximately symmetric, and the summary statistics support this visual impression. The Jarque-Bera test statistic is 0.016941 with a P-value of 0.991565, which is much greater than the 0.05 significance level. Therefore, we fail to reject the null hypothesis that the residuals are normally distributed. Additionally, the Skewness (0.071233) is very close to 0, and Kurtosis (3.005761) is very close to the normal value of 3 both further supporting normality. These results indicate that the residuals of the model follow a normal distribution, satisfying one of the key OLS assumptions and validating the reliability of inferential statistics.

4.5.2. Multi-collinearity Test Analysis and Discussions

To ensure the reliability of the regression results by using the Variance Inflation Factors to check for the Multicollinearity. A VIF value below 10 suggests that a variable is not afflicted by multi-collinearity.

Table 7
Multi collinearity Test

Variance Inflation Factors			
Sample: 2003 2023			
Included observations: 20			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	10594.45	3.375148	NA
D(CUSTOMS_DUTIES,1)	89.96670	6.030499	3.701187
D(EXCISE_TAX,1)	97.27591	9.850733	4.672367
D(OTHERS_TAX_REVENUES,1)	37.88749	2.180833	1.754718
D(PAYE,1)	56.59867	4.573012	7.567984
D(PROFIT_TAXES,1)	33.18732	7.290971	5.869206

The centered Variance Inflation Factor (VIF) values indicate that multicollinearity is present but not severe in most of the model’s independent variables. D(OTHERS_TAX_REVENUES), D(CUSTOMS_DUTIES), and D(EXCISE_TAX) show low to moderate VIFs of 1.75, 3.70, and 4.67, respectively, which are within acceptable limits and suggest low multicollinearity. However, D(PAYE), and D(PROFIT_TAXES) exhibit higher VIF values of 7.57 and 5.87, indicating moderate multicollinearity. While these values are below the conventional threshold of 10, they suggest some correlation between these regressors and others in the model, which could inflate standard errors and reduce the precision of individual coefficient estimates. Overall, multicollinearity is not at a critical level, but attention may be warranted if interpretation of individual tax components is a primary concern.

4.5.3 Heteroskedasticity

To determine whether the variance of the errors terms in a regression model is constant (homoskedastic) or changing (heteroskedastic) across observations.

Table 8
Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.149965	Prob. F(5,14)	0.3805
Obs*R-squared	5.822658	Prob. Chi-Square(5)	0.3239
Scaled explained SS	2.861320	Prob. Chi-Square(5)	0.7214

The results of the Breusch-Pagan-Godfrey test show that all p-values (F-statistic: 0.3805, Obs*R-squared: 0.3239, Scaled explained SS: 0.7214) are greater than the 0.05 significance level, indicating that we fail to reject the null hypothesis of homoskedasticity. This suggests there is no evidence of heteroskedasticity in the residuals of the model. Therefore, the Ordinary Least Squares (OLS) estimators remain BLUE (Best Linear Unbiased Estimators), and the standard errors, confidence intervals, and hypothesis tests can be considered reliable. However, while the absence of heteroskedasticity supports the validity of OLS.

4.5.4. Correlogram

To check whether the residuals are independently distributed whether there's any serial correlation (autocorrelation) remaining at various lags.










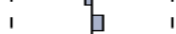










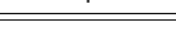
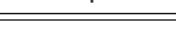
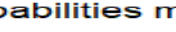
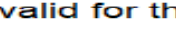
Table 9
Correlogram Test

Date: 07/16/25 Time: 15:33

Sample: 2003 2023

Included observations: 20

Q-statistic probabilities adjusted for 5 dynamic regressors

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob*
		1 0.281	0.281	1.8297	0.176
		2 -0.147	-0.245	2.3562	0.308
		3 -0.017	0.120	2.3634	0.500
		4 -0.082	-0.178	2.5488	0.636
		5 -0.136	-0.038	3.0897	0.686
		6 0.035	0.061	3.1273	0.793
		7 -0.081	-0.186	3.3475	0.851
		8 0.010	0.169	3.3513	0.910
		9 0.044	-0.131	3.4285	0.945
		10 -0.107	-0.057	3.9279	0.951
		11 -0.097	-0.037	4.3842	0.957
		12 -0.169	-0.281	5.9492	0.919

*Probabilities may not be valid for this equation specification.

The Ljung-Box Q-statistics test results indicate that there is no significant autocorrelation in the residuals of the model up to lag 12. All the p-values associated with the Q-statistics at each lag are well above the 0.05 significance level (0.176 at lag1, 0.793 at lag6, and 0.919 at lag12), meaning we fail to reject the null hypothesis of no autocorrelation. This suggests that the residuals are independently distributed, satisfying one of the key assumptions of a well-specified time series model. Therefore, the model does not suffer from autocorrelation issues.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study attempted to answer the central question of: What is the effect of tax revenue growth on economic growth in Rwanda during the period of 2003 to 2023? To answer this question, the researcher employed a time series analysis and a quantitative research design. Using a multiple linear regression model, the study evaluated the individual impacts of various components of tax revenue growth including customs duties, Pay-As-You-Earn (PAYE), excise tax, profit taxes, and other tax revenues on Gross Domestic Product (GDP). Analyzing the trend of these components of tax revenue growth changed throughout time and their level fluctuated irregularly according to economic activity. In agreement with the empirical findings, the multiple linear regression analysis revealed that customs duties and PAYE have a positive and statistically significant effect on economic growth, indicating that these tax instruments contribute effectively to Rwanda's GDP growth. In contrast, other tax revenues exhibit a significant negative effect on GDP, suggesting inefficiencies economic implications associated with these sources of revenue. Additionally, excise tax and profit taxes were found to be insignificant, implying a minimal or negligible influence on GDP within the study period.

Overall, the study's objectives were fully achieved, providing insights that are crucial for policymakers aiming to optimize tax policy as a tool for sustainable economic growth.

5.2 Recommendations

Based on the results of the study on the effect of tax revenue growth on economic growth in Rwanda from 2003 to 2023, the following recommendations are proposed to inform fiscal policy and optimize economic growth. These recommendations aim to provide actionable information to policymakers, the Rwanda Revenue Authority to improve tax policy and administration, thereby contributing to sustainable economic growth and development in Rwanda.

The following is to: Strengthen customs duties and PAYE collection: given their positive impact on economic growth, the RRA should focus on improving customs duties and PAYE collection mechanisms, ensuring efficient tax administration and minimizing tax evasion. Optimize other tax revenues and review excise tax and profit taxes: the negative effect of other tax revenues on GDP suggests inefficiencies in tax collection. Due to their insignificance, the government should review and reform these tax instruments to ensure they contribute positively to economic growth.

Implement moderate tax rates: A balanced tax rate can stimulate economic growth. Policymakers should aim for moderate tax rates that encourage investment, entrepreneurship, and job creation while generating sufficient revenue for public expenditures. Tax policy reforms: The government should regularly review and reform tax policies to ensure that they align with economic development goals. Researchers should further research on topics such as effectiveness of revenue collection, impact of tax evasion, tax burdens, tax policy and investment, on Rwanda's economic growth is crucial, these areas can provide valuable insights and promote economic growth in Rwanda.

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