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## **Dynamic Effects of Fiscal Policy on Output in Rwanda**

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# Dynamic Effects of Fiscal Policy on Output in Rwanda

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## Abstract

This paper aimed to analyze the dynamic effect of various components of fiscal policy on output in Rwandan economy from 1990 to 2022. Differently several researchers argue that fiscal policy affect positively and negatively the output, in long run and in short run, the growth in the economy. These theories have used in this study Keynesian Theory, suggests that fiscal policy can have a significant effect on output, especially during economic downturns, Ricardian Equivalence theory argues that individuals have rational expectations about future taxes and government spending and New Keynesian theory emphasizes the importance of price and wage rigidities in shaping the effects of fiscal policy on output. The estimation technique employed is the ARDL together with ECM. This study used secondary data collected from world bank database, these data were time series data as the study used annual data. Using Eviews 13, the econometrics technique of ADF Test was used to test the stationarity. The stationarity test was done so as to ensure whether to conduct the co integration test or not. Having purely results of unit root test at first different allowed the researcher to adopt ARDL bound test of co integration. The results of ARDL bound test indicated the existence of a long run relationship among the series of the study. The findings from ARDL ECM indicated that there is a significant short run relationship among the variables of the study. With R-square of 0.84, it is evident that all variables together Cause variation of 84% to the dependent variable GDP in short run, other factors remaining constant and the negative coefficient of -0.036 implies that as long as the time will go the error will be correct. This study reveals that the activities in the fiscal policy can affect positively on output. The results of post estimation tests show that there is no multi collinearity, no heteroscedasticity, the model are specified by using Ramsey resort test, data are stable and errors are normally distributed which mean that we don't have spurious regression and we have good forecast in this work. This study reveals that the activities in the fiscal policy can impact positively on the economic growth. Some recommendation has been given to the regulatory Authority and government of Rwanda that should initiate the policies that would encourage more investors to come to invest in the country in order to access the more tax and also be more proactive in their surveillance of collecting tax which will facilitate in long run the entry of new business in Rwandan market in order to increase GDP of country.

## 1. Introduction

Fiscal policy is based on the theories of British economist John Maynard Keynes. Also known as Keynesian Economist. This theory basically states that governments can increase or decrease macroeconomic productivity levels by also increasing or decreasing tax levels and public spending. This influences the increase of employment and maintains a healthy value of money. Fiscal policy is very important to the economy (Grossman, 1990).

Developed country like US government has used fiscal policy in several circumstances. In the early 1960s it cut taxes to increase sluggish economic growth. In 1970 it places a 10% surcharge (a tax on top of existing taxes) on both corporate and personal income taxes to reduce aggregate demand and curb inflation. In the early 1980 it cut person income taxes by 25% over three years to increase work incentives and encourage economic growth. In the early years 1990 it increases taxes to reduce large federal budget deficit, which were thought to be causing high real interest, lower level of investment, and slow economic growth. Other nations, too, have used fiscal policy to help cope with recession or inflation. For example, in recent years Japan launched a series of government spending programs designed to increase aggregate demand and extract its economy from major recession (Corbo & Hernandez, 1994).

For sub-saharan africa, the theory is applied in countries where households cannot smooth their consumption due to liquidity constraints. In such situation business cycles reinforce the already high volatitliy of private final expenditures(Ozbilgin,2010). Furthermore, shrinking deficits lead the private sector to reduce its estimates of current and future tax liabilities, providing a further boost to investment and consumption and reduction of unemployment. Finally, higher investment can also ease supply constraints on growth.

Developing country like South Africa has gone through the program tax reforms and administration capacity improvements were carried out fiscal policy. For instance, debt as a percentage of GDP has increased marginally over the past four decades after falling from 1960s to 1980s it started climbing up in the first years of the 1990s. The post 1994 period returned fiscal management to 1960s debt levels. Similarly, the deficit level that peaked at 5.4% as a proportion of GDP between 1990 and1993 was halved by the 1994 up to 2004 sub-period, a level comparable to average deficit to GDP ratio in the 1960s Expenditure as a share of GDP has generally increased over the years from low of 18.4% in the 19960s to 26.4% in the first decade after 1994 (Folster & Henrekson, 1999).

The Gross Domestic Product (GDP) in Rwanda was worth 13.31 billion US dollars in 2022, according to official data from the World Bank. The GDP value of Rwanda represents 0.01 percent of the world economy. The rwanda GDP increased every year according to three sector of economy.

In Rwanda, fiscal policy is aimed at strengthening and consolidating macroeconomic stability while providing adequate resources to the productive and social sectors in line with the objectives of the EDPRS. Moderate growth during the past few years coupled with an improved performance of the Rwanda Revenue Authority brought total domestic revenue to 28% of GDP in 2007. Further increases are expected to be derived primarily from payers and consumption taxes. Domestic revenues are expected to stabilize as a share of GDP at about their current levels in 2018 and 2019. This is because there is little scope for further improvement in tax collection, and there is likely to be some erosion of import duties because of trade liberalization and changing composition of imports. The budget for 2019, provides for a nominal increase of 18 per cent compared with the 2018 budget (Bubakare, 2014).

Rwanda 's expansionary fiscal policy coordination focuses on different areas that are looked at the level of supply shocks, Treasury management and investment. Policy maker are nowadays trying to attain the desired optimal mix of macroeconomic objectives of growth and price stability for the needs for mutual complementarity of the mentioned policies. In fact, the interaction between monetary and fiscal policies relates that both types of policies have an impact on key macroeconomic policy framework in which all policies are steered toward the same objectives, (RRA,2015).

### **1.1 Problem statement**

Fiscal policy can play an important role in promoting economic growth, reducing unemployment, and managing inflation. However, there are several challenges that can affect the effectiveness of fiscal policy in achieving these goals in Rwanda.

The serious problem in Rwanda we have high taxes and low labor demand caused by a low growth of productive yet labor-intensive activities especially in the formal private sector; under-developed entrepreneurship; non-organized labor supply; unequal access to education; low quality of education, which refers to the constraints on the government's ability to spend or borrow due to high debt levels, limited revenue sources, and other fiscal pressures. This can limit the government's ability to implement expansionary fiscal policies that can boost output and reduce unemployment.

Rwanda, like many developing countries, faces constraints in terms of available resources and revenues. This can limit the government's ability to implement expansionary fiscal policies, such as increasing spending or reducing taxes, which could potentially boost output. Another challenge is the dependency on external aid. Rwanda heavily relies on foreign aid, which can have implications for its fiscal policy. The government needs to carefully balance the use of aid money to ensure it effectively stimulates output without creating dependency or distorting incentives.

Additionally, there might be issues with fiscal discipline and efficiency. Ensuring that fiscal policies are implemented effectively and that public funds are used efficiently is crucial for maximizing the impact on output. Transparency, accountability, and effective governance play important roles in addressing these challenges.

Fiscal policy refers to the government's decisions regarding taxation, spending, and borrowing. In terms of output, fiscal policy can stimulate economic growth by increasing government spending, which can boost demand for goods and services. However, this can also lead to inflation if there is not enough supply to meet demand.

When it comes to unemployment, fiscal policy can play a role in creating jobs through government spending on infrastructure projects and other initiatives. However, this can also lead to higher government debt and may not always result in sustainable job creation.

Overall, fiscal policy can have both positive and negative effects on the economy, and policymakers need to carefully consider the trade-offs involved in their decisions.

### **1.2 Objectives of the study**

In general, the main objective of this work is to conduct an empirical study on the dynamic effects of fiscal policy on output in Rwanda.



**This study pursues the following specific objectives:**

To analyze the effect of government expenditure on output (GDP) in Rwanda.

To analyze the effect of tax revenue on output (GDP) in Rwanda.

To elaborate the effects of public investment on output in Rwanda.

**2. Literature review**

Popiel (2020) investigated Fiscal policy and US output using a standard structural vector autoregression (SVAR) model. The results revealed that there is a systematic relationship between fiscal policy and output. Moreover, Popiel (2020) shows that, a time-varying parameter version of the model showed that, the lack of consistency across specifications is not driven by changes in the transmission of uncertainty shocks over time.

Guloba (2018) investigated Uganda's Fiscal Policy for the period 2000-2016 and its implications for Public Investment Management in Uganda. The paper carries out project absorptive capacity and overall fiscal trend analysis to ascertain whether budgeted projects translated into intended outturns. It was found that weak Public Investment capacity led to less than budgeted public investment outturn which reduced the intended fiscal policy impact.

Churchill, Ugur and Yew (2019) investigated the nexus between public spending and output growth, the result upheld the conventional belief that large government size is detrimental to growth. The studies by Gupta (2018) and Diyoke, Yusuf and Demirbas (2020) revealed a strong positive correlation between government spending and economic growth.

In another study by Dudzeviciūtė, Smeltė and Liušvaitienė (2018) using data for eight European Union member countries found a strong positive association between public spending and economic growth. Idris and Bakar (2018) and Ihugba and Njoku (2018) found positive impact of government expenditure on output growth. Barlas (2020) found that current expenditures on education and infrastructure have positive impact on economic growth as opposed to security expenditure, which negatively affects economic growth in Afghanistan.

In contrast, Phiri (2019) in his analysis of the effect of military expenditure on economic growth found that the current level of defence expenditure are too high and does not support growth and development. Similarly, d'Agostino, Dunne and Pieroni (2019) using large sample data for 109 middle and low income countries found that defense expenditure has negative impact on economic growth.

Elizabeth (2020) examined fiscal deficit and macroeconomic aggregates in Nigeria for the period 1980 to 2010. The study employed the Ordinary Least Square in estimating the equation and the co-integration test using the Engle Granger procedure. The empirical findings showed that fiscal deficits did not significantly affect macroeconomic output. The result also shows a bilateral causality relationship between government deficit and output.

Chimobi (2019) investigated national income and government expenditure nexus in Nigeria and found that there is stable long run relationship between the fiscal variable and economic growth.

**3. Research methodology**

This chapter discusses the overall methodology that will be adopted in conducting the study and it is divided into the following sections: Research Design, Data collection procedure, data processing, Data analysis approach and Econometrics Model Specification.

### 3.1 Research Design

A research design stipulates the procedures of collecting, analyzing, interpreting as well as reporting data in a research study (Creswell & Plano, 2007).

This study used quasi-experimental research design which is a type of quantitative research design and attempted to find out cause, effect and relationships among the variables of interest.

### 3.2 Study Population

The study population is the entire group that you want to draw conclusions about such as people, objects and events. The population of this study is a times series data on government expenditure, tax revenue, Public investment and Gross Domestic Product (Output). This research will cover thirty two years from 1990 to 2022.

### 3.3. Data Collection Procedure

The study used a published time series secondary data from 1905 till 2022. The data set will be collected from the world bank. The time series data that will be used in this study are government expenditure, tax revenue, Public investment and Gross Domestic Product (Output).

### 3.4. Data Processing

In evaluating the effect of fiscal policy on output and to find out the answers to research questions, this study adopt the approach as used by model used by (Nursechafia, 2014) and (Badar, 2013). The two studies employed time series econometric techniques such as unit root, co-integration, Granger causality, impulse response function and forecast error variance decompositions within the vector autoregression (VAR) framework. The process is outlined in the next subsection. The data processed using E-views software.

### 3.5 Data Analysis approach

The process of establishing order, structure, and meaning within a large quantity of previously collected data is referred to as data analysis. It is a process that is chaotic, unclear, time-consuming, creative, and fascinating all at the same time. It does not progress in a linear fashion, nor is it neat in any way. According to Marshall and Rossman (1990:111), qualitative data analysis is the process of looking for general statements that can be made about relationships between different categories of data. The E-Views software used to perform the analysis on all of the data and estimation test such as OLS, which utilized in order to verify the consistency and robustness of the results obtained from the ARDL bounds testing.

#### Test for a unit root

It is essential to determine the stationarity properties of the macroeconomic variables in question before attempting to estimate the relationship that exists between them. As a result, in order to validate the stationarity of the variables that are being used in this investigation, In this study the ADF and PP statistics was utilized. Since series are a combination of  $I(0)$  and  $I(1)$ , the ARDL bounds testing method for co integration) was used to estimate the relationship between the variables. This method was developed by Pesaran and Shin and was used to estimate the relationship between the variables.

#### Post-Estimation Tests

The results of estimation technique were backed and subjected to the post estimation technique which is presenting the major statistical assumption of ARDL model analysis.

**Normality Test:** Assuming that the residuals or error terms are normally distributed. This assumption was checked using histogram.

**Stability Test:** Considering the fact that this study used time series data to ascertain whether our coefficient in the model are stable, the model stability was primarily investigated by

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cumulative sum of recursive residual(CUSUM) test used to check whether the model has omitted a variable or not, implying that the model has not omitted a variable.

**Heteroscedasticity test:** refer when a linear regression errors have non constant variance. This can be test through white test which evaluates whether model independent variables explain its errors variance. If model independent variables explain its errors, then model errors are assumed heteroskedastic or non-constant variance (Gujarati and Porter,2010). In this study I used white test for testing the problem of Heteroscedasticity.

**Multi collinearity Test:** One the key assumption for a regression based model is that the independent or explanatory variables should not be correlated amongst themselves. The classical linear regression model(CLRM) assumes that there is no exact linear relationship among the explanatory variables. If they are one or more such relationship among the explanatory, we call it multi-collinearity or collinearity. If two variables are highly collinear it is very difficult to isolate the impact of each variable separately on the explained variable (Gujarati and Porter,2010). In this study, this was assessed by Variance Inflation Factor(VIF) value.

### Serial Correlation Test

When future periods are affected by error terms from previous periods, there is a serial correlation. Even though the estimators of OLS regression are linear and statistically significant, and there is a serial correlation, those estimators are not BLUE. The serial correlation test which aims at describing the relationship between observations of the same variable over specific periods performed using Breusch-Godfrey serial correlation LM test also known as the Lagrange multiplier test. The null hypothesis of this test is that there is no serial correlation up to lag order p. If Probability Chi-Square is greater than the critical p-value at 5% the null hypothesis is rejected, which means that there is no serial correlation.

### 3.5.2 Testing for co-integration

There are various methods of testing for co-integration. This study used **ARDL Bounds test** for testing the presence of long-run relationship between the variables.

#### ARDL Bounds Testing for Co integration

Regardless of the order of integration in the series, the ARDL bounds testing method is used to investigate co integration relationships between variables. Beard, Jackson, Kaserman, and Kim (2010) state that OLS estimation is conducted using the CCR method. This is achieved by transforming variables using the error terms' long-run covariance matrix. This guarantees the OLS estimator's asymptotic efficiency.

### 3.6 Model specification

The analysis of the economic phenomenon is based on same underlying logical structure known as a model. The model is a simplified version of the reality; the model describes the behavior of the variable in the system and it the basic frame work of the analysis. The model is in the form of equations, composed by dependent variables and independent variables which are related (Ramathan, 1985).

In regression analysis and related fields such as econometrics, specification is the process of converting a theory into a regression model. This process consists of selecting an appropriate functional form for the model and choosing which variables to include. Model specification is one step in regression analysis. If an estimated is mis specified, it was biased and inconsistent.

The model of this study state the Dynamic effects of fiscal policy on output and unemployment in Rwanda from 1995 to 2022, in doing these we adopt Olawunmi and Tjudeen (2007) where:

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$GDP = f(GGTEXP, PUBINV, TAX)$

GDP: Gross Domestic Product

GGTEXP: Gross Government Total Expenditure

PUBINV: Public investment at period t

TAX: Tax revenue

$\beta_0$ : Intercept

$\beta_1, \beta_2$  and  $\beta_3$ : The coefficient of the model of regression

$\mu_t$ : Error term at period t.

And model is formulating and presented as follows:

$GDP_t = \beta_0 + \beta_1 GGTEXP_t + \beta_2 PUBINV_t + \beta_3 TAX_t + \mu_t$

$\ln GDP_t = \beta_0 + \beta_1 \ln GGTEXP_t + \beta_2 \ln PUBINV_t + \beta_3 \ln TAX_t + \mu_t$

### 3.7 Research hypothesis

A hypothesis can be defined as a statement of association between variables. A hypothesis is a tentative proposition which is subject to verification through subsequent investigation. Its prediction regarding the possible outcomes of the study in terms of the variable that are being investigated (Grawith; 2001).

It is proposed of what the research that revealed:

The following hypotheses revealed in this research.

Null hypothesis ( $H_0: \beta_0 = 0$ ) Fiscal policy variables have no significance effect on output in Rwanda.

Alternative hypothesis ( $H_1: \beta_0 > 0$ ) Fiscal policy variables have significance effects on output in Rwanda.

### 3.8 Source of Data

It is one of materials a researcher uses for collecting information during investing. Source of data is secondary data. This study employed secondary data obtained from the world bank data base. The time series data cover the period 1990-2022, in an attempting the dynamic effects of fiscal policy on output in Rwanda.

## 4. Research findings

This chapter adopts an econometric approach in its dynamic effects of fiscal policy on output in Rwanda. This is the application of statistical and mathematical theories in economics for the purpose of testing hypothesis and forecasting future trends. Econometric takes economic models and tests them through statistical trials. The data used in this study are basically secondary data collected mainly from the central bank of Rwanda.

### 4.1 Empirical analysis

#### Stationary Test

Since the study deals with time series data, the test of stationarity is a necessary condition. The existence of a unit root indicates that a time series is under consideration of non-stationary while the absence of it shows that a time series is stationary. Therefore, the Augmented Dickey-Fuller (ADF) test was used in this study to check for a unit root in each variable and thereby determine the order of integration.



**Table 1: Stationary test of the series in level I(0)**

HO: Series has Unit Root						
Variables	Test statistic (ADF)	1% Critical value	5% Critical Value	10% Critical Value	P-value	Decision
LNGDP	-1.916	-4.339	-3.587	-3.229	0.618	Not stationary
LNGGEXP	-3.704	-4.440	-3.632	-3.814	0.436	Not stationary
LNPUBINV	-0.034	-4.339	-3.587	-3.229	0.993	Not stationary
LNTax	-2.600	-4.467	-3.644	-3.261	0.237	Not Stationary

**Source: Researcher compilation, (2023)**

For the ADF test, the null hypothesis (HO= Unit root) is that there is a unit root in the series against the alternative hypothesis (H1= No Unit root) which indicates that the series is stationary. Above table show that all t-statistics are less than t-critical for all variables and P-values are greater than 5% significant level except tax which is stationary.

**Table 2: Stationary test of the series in the first difference, I(1)**

Variables	Test statistic (ADF)	1% Critical value	5% Critical Value	10% Critical Value	P-value	Decision
LNGDP	-3.671	-4.285	-3.5562	-3.215	0.039	stationary
LNGGEXP	-4.225	-4.323	-3.580	-3.225	0.012	Stationary
LNPUBINV	-5.602	-4.284	-3.562	-3.215	0.0004	Stationary
LNTAX	-9.721	-4.284	-3.562	-3.215	0.0000	Stationary

**Source: Researcher compilation, (2023)**

Referring to the results above, it is obvious that, LNGGTEXP, LNPUBINV, LNGDP and LNTAX become stationary at first difference because its t-statistics (ADF) values are greater than its t-critical value (5%) in all variables and its probability are less than 5% significant level, then researcher can run the econometric model by using Ordinary Least Squares (OLS).

### Estimation of the model

After analyzing the stationary by using the ADF unit root test, Researcher going to estimate the model by taking into the consideration the model of the variables that are stationary.

$LNGDP_t = -2.520878 + 0.129208 LNGGTEXP_t + 0.004341LNPUBINV_t - 0.076463 LNTAX_t$   
 The regression model shows that there is relationship between variables either positive or negative. According to Olawunmi and Tjudeen said that fiscal policy has conventionally been associated with the use of taxation and public expenditure to influence the level of economic activities to be boosted in long run. The results show that independent variable like GGTEXP and PUBINV have positive impact on GDP except TAX has a negative impact on GDP. And  $R^2$  of 0.98 which show the high goodness of fit of this model.

### Lag selection Order

ARDL analysis approach gives the advantage of selecting the optimal lag length that is suitable for each of the variables. The optimal lag length can be selected using Akaike information criterion(AIC), Schwarz Bayesian criterion(SBC) or the Hannah-Quin criterion (HQC) estimation (Raza, shabaz, and nguyen,2015). The results obtained using AIC are shown below:

**Table 3: Results of Lag selection**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-333.1033	NA	32767.05	21.74860	21.93363	21.80891
1	-226.4613	178.8833*	95.63952*	15.90073*	16.82588*	16.20230*
2	-214.4132	17.10054	130.7056	16.15569	17.82096	16.69853

**Source: Researcher compilation, (2023)**

The Akaike information criterion (AIC) results show that the appropriate lag length to include in this model is the lag 2 which is highlighted by the criteria for all variables.

**ARDL Bound test for Co-integration**

The stationarity test confirmed that the variables are integrated of different orders whereby some are I (0) while others are I (1). Therefore, performing a bound F-test is necessary to establish whether the long run relationship exist or not.

Null hypothesis (H0): There is no co-integration

Alternative hypothesis (H1): there is Co-integration

If the calculated F statistic is greater than the critical value for the upper bound I (1), then we conclude that there is co integration. This show the long run relationship then we reject the null hypothesis.

**Table 4: The results of bound F-test**

F- statistic	Critical values					
	1% U-bound	1% L-bound	5% U-bound	5% L-bound	10% U-bound	10% L-bound
7.5260	2.370	3.200	2.790	2.790	3.650	4.660

**Source: Researcher compilation, (2023)**

The above results show that the F statistic of 7.52 is greater than the critical value for the lower and upper bound at 1%, 5% and 10% level of significance, then researcher fail to reject the alternative hypothesis which indicate the presence of Co integration, in other word this shows the long run relationship between the variables. Then let estimate the long run model which is the error correction model.

**ARDL Long run and ARDL Short run**

After bound test’s results confirmed that there is long run co-integration relationship between independent variable (GDP) and its determinants gross government total expenditure, public investment and tax revenue with the optimal lag structure of the variables (1,1,1,2). And The error correction model is applied to check the short run effect of independent variables like government expenditure, public investment and tax on dependent output. The co-integrating term is known as the error correction term(ECT).

The following table showed the results for ARDL long run and ARDL Short run.

**Table 5: Results of ARDL Long run and ARDL Short run**

<b>Results of ARDL long run coefficient estimation</b>				
<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Probability</b>
LNGGTEXP(-1)	31.06875	96.05801	0.323437	0.0491
LNPUBINV(-1)	0.034374	0.148120	0.232067	0.0184
LNTAX(-1)	-57.21526	174.2184	-0.328411	0.0453
<b>Results of ARDL Short run with Error correction model</b>				
<b>Variables</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
COINTEQ	-0.036031	0.005468	6.589354	0.0000
LNGDP(-1)	0.036031	0.081133	0.444096	0.0306
LNGGTEXP	0.129208	0.116328	1.110721	0.0269
LNPUBINV(-1)	0.000256	0.001225	0.208797	0.0362
LNTAX	-0.076463	0.145331	-0.526129	0.0048
R-squared	0.849542			

**Source: Researcher compilation, (2023)**

**Long run effect**

The above table estimate the coefficients for the long run model. In this study, the ARDL model was chosen by AIC. The results show that probabilities is less than 5% significant level which indicate that the rate of gross government total expenditure one-time point in the past (LNGGTEXP (-1)) increase the rate of output in Rwanda. The results pointed out also that public investment have positive effect on output in Rwanda. The coefficient indicated that 1% increase in gross government total expenditure leads to 31.06% increases in output. The coefficient indicated that 1% increase in public investment leads to 3.43% increases in output. The coefficient indicated that 1% increase in tax leads to 57.2% decrease in output.

**The short run effect**

The above results show that the coefficient of the error correction term (CointEQ) is significant (P-value=0.0000) and it has a negative sign. This confirm there is a co integration relationship between the variables. And the negative coefficient of -0.036 implies that as long as the time will go the error will be correct. This mean that there is a statistical significance of one percent disequilibria from the previous year’s shock converge back to the long run equilibrium in the current year. This implies that all independent variables (GGTEXP, PUBINV AND TAX) have a significant effect on Rwandan output in the short run. With R-Square of 0.849, it is evident that all independent variables together cause variation of 84.9% to the dependent variable (GDP) in short run.

The result suggests that 1 percent increase in gross government total expenditure (GGTEXP) will increase gross domestic product (GDP) by 0.129%. This has confirmed by the study of Gukat and Ogboru (2019) and Ihugba and Njoku (2018) whose findings show positive impact of government expenditure on output growth.

The results indicate that 1 percent increase in public investment influence positively increase of 0.00025% of GDP, holding GGTEXP and TAX constant, this has confirmed by the study of Furceri, and Topalova (2019) found a short- and long-term positive and significant effect of public investment on output for advanced economies. For low-income developing countries, Furceri and Li (2017) found a positive effect of public investment on output in the short and medium terms.

The results indicate that 1 percent increase in tax influence negatively decrease of -0.076% of GDP, holding GGTEXP and PUBINV constant Gunter et al. (2019) use a data set of 51 countries from 1970-2014 to examine the impacts of value-added taxes on economic growth. They find that the effect of taxes on growth are highly non-linear: At low rates with small changes, the effects are essentially zero, but the economic damage grows with a higher initial tax rate and larger rate changes. For this reason, increases in the VAT in countries with high VAT rates, such as much of industrialized Europe, will have more significant impacts on GDP than increases in countries with low VAT rates.

**Post-Estimation Tests**

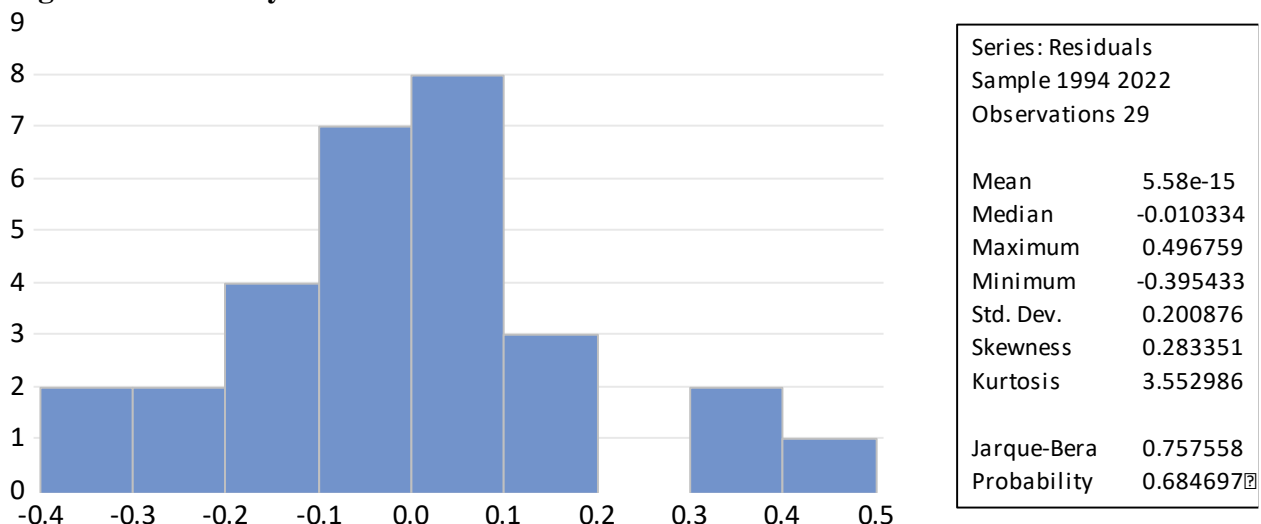
**1. Normality test**

As we other parametric in statistics, the collected data must be normally distributed around a zero mean and constant variance. For the OLS regression model normality of residuals must be test. Abuse of this assumption implies that even though OLS estimators exhibit BLUE (Best Linear Unbiased Estimators) properties, their statistical reliability cannot be easily determined by statistical significance tests (Gujarati, 2003). Therefore, the study employed the histogram normality test.

HO: Residuals are normally distributed

H1: Residuals are not normally distributed

**Figure 1: Normality test**



**Source: Author’s calculation**

The normality test of the above result showed that we fail to reject the null hypothesis (HO) means that residuals are normally distributed mean that the p value from JARQUE-BERA test is greater than critical probability of 5%. This confirm that the normality of residual implies that the estimated liner regression model has realistic predictive powers and valid predictions.

**2. Multi-collinearity test**

One the key assumption for a regression based model is that the independent or explanatory variables should not be correlated amongst themselves. Now let’s to understand why this assumption was made in the first place. The key purpose of a regression equation is to tell us the individual impact of each of the explanatory variables dependent or explained variable and that is captured by the regression coefficient.

So, a regression coefficient captures the average change in the dependent variable for 1 unit change in the explanatory variable, keeping all others explanatory variables constant. Hence, if the explanatory variables are correlated it will not be possible to measure their individual effects on the dependent variable. This problem is known as multi collinearity.

Multi collinearity can be detected if the centered variance inflation factors is above 10. Which can lead to skewed or misleading results when a researcher attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical model. In general, multi-collinearity can lead to wider confidence interval that produce less probabilities in terms of the effect of independent variables in a model.

**Table 6: Variance Inflation Factors**

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.018320	92.01185	NA
LNGGTEXP	0.000774	165.0079	4.457328
LNPUBINV	2.78E-08	19.97120	3.954491
LNTAX	1.85E-11	2.717167	1.906035

**Source: Researcher compilation, (2023)**

The table above shows that there is no multi collinearity in the model because the results of Variance Inflation Factors(VIF) is less than 10.

### 3. Heteroscedasticity test

A good regression model should be characterized by data points that have similar dissension from their standard line. This is the one assumption of the classical linear regression model that series must be homoscedastic. The null hypothesis here is that the error variance is homoscedastic. We used Heteroskedasticity test called white test to test heteroskedasticity in our variables. We can reject the null hypothesis of homoscedasticity, if the computed Chi-Square statistic is less than 5% of significance level. The hypothesis is stated as followed:

HO: There is no heteroscedasticity (Homoscedastic)

H1: There is heteroscedasticity

If Chi-Square probability is greater than the critical p-value. We fail to reject the null hypothesis; this indicate the absence of heteroscedasticity. Otherwise there is homoscedastic

**Table 7: Results of Heteroscedasticity using Breusch-Pagan-Godfrey test**

HO: The error Variance is Homoscedastic			
<b>Heteroscedasticity test:</b>			
F-statistic	1.335152	Prob. F	0.9374
Obs*R-squared	11.20916	Prob. Chi-Square	0.8152
Scaled explained SS	8.467579	Prob. Chi-Square	1.000

**Source: Researcher compilation, (2023)**

The results above show that we fail to reject the null hypothesis(HO) because the Chi-Square probability obtained is greater than critical p-value of 5%, This indicate that there is no heteroscedasticity in the model. This represent the homoscedastic of the model.

### 4. Serial Correlation Test

Serial correlation LM was conducted to check respectively if there is a relationship between errors and if the variance of errors is constant. In this study I performed using Breusch-Godfrey serial correlation LM test also known as the Lagrange multiplier test.

The null hypothesis state that there is no serial correlation between the errors.



The alternative hypothesis state that there is serial correlation between errors.

If the probability Chi square is greater than 5% we fail to reject HO.

**Table 8: Breusch-Godfrey Serial Correlation LM Test**

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.915091	Prob. F(2,25)	0.7750
Obs*R-squared	2.182833	Prob. Chi-Square(2)	0.7144

**Source: Researcher compilation (2023)**

The above results show that there is no serial correction in the model, researcher fail to reject the null hypothesis because the probability chi square is greater than 5% of significant level.

### 5. Ramsey Reset Test Result

Then we are collecting the data, some necessary data can be omitted or in formulation of the model, the wrong functional model can be used. This may cause the wrong parameters and the unwanted results. Then the model has to be specified in order to have the reliability results.

Null Hypothesis (HO): The model is not correctly specified

Alternative Hypothesis (H1): The model is correctly specified

We reject the Null hypothesis if the F-statistics probability is less than 5% significance level.

**Table 9: Ramsey Test Results**

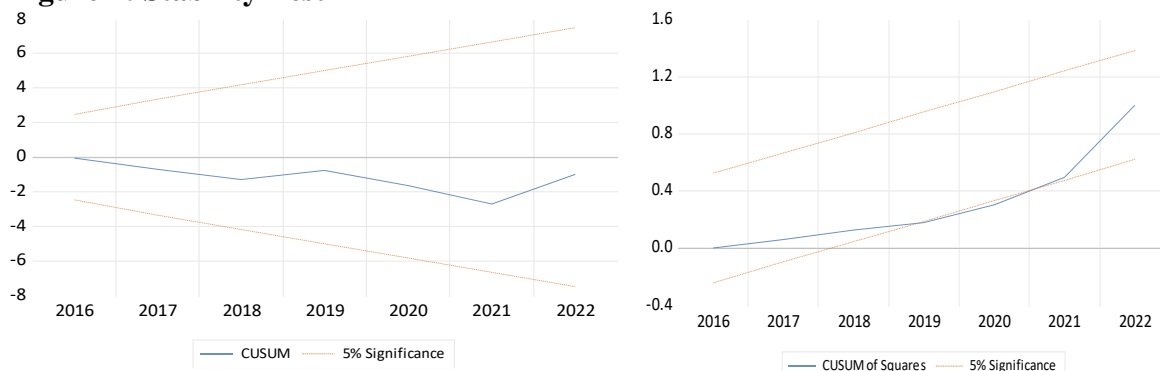
	Value	Df	Probability
t-statistic	0.682312	25	0.5013
F-statistic	0.465550	(1, 25)	0.5013
Likelihood ratio	0.590424	1	0.4423

**Source: Researcher compilation (2023)**

The above results show that probability value of 0.501 is greater than the critical value of 5%. Researcher fail to reject the alternative hypothesis This shows that there is no apparent non linearity in the regression model and it would be concluded that the linear model is appropriately specified.

### 6. Stability Test

**Figure 2: Stability Test**



**Source: Researcher compilation, (2023)**

The cumulative Sum of Recursive (CUSUM) used to confirm the stability of the coefficients with the null hypothesis that the coefficients are stable against the alternative hypothesis that coefficient are not stable. The plots show that the coefficient are stable as the recursive residuals are significant at 5% significance level. Thus, the null hypothesis was not rejected, suggesting that the estimated coefficient was stable and consistent, However, CUSUM of squares statistics exceed the 5% critical bounds of parameter stability, thus indicates a slight instability of coefficient.

## 5. Conclusion

After testing and regressing the model of this study I find that manipulating the independent variables like using expansionary fiscal policies has dynamic effects like increased government spending or tax cuts, can stimulate economic activity and potentially lead to higher output levels. On the other hand, contractionary fiscal policies, like reduced government spending or tax hikes, might have the opposite effect, potentially dampening output.

However, it's important to note that the impact of fiscal policy on output is not always straightforward. The effectiveness of fiscal policy can be influenced by factors such as the overall health of the economy, the timing of policy implementation, and the structure of the fiscal measures. Additionally, the dynamic effects of fiscal policy on output can also depend on people's expectations and confidence in the economy. If individuals and businesses have positive expectations about the future, they may respond more favorably to fiscal policy, leading to greater output.

Shortly, while expansionary fiscal policies generally aim to stimulate output and economic growth, the actual outcome can be influenced by a range of factors, making it a complex and dynamic process.

## 6. Recommendations

The government should continue to invest in public investment (means increase capital expenditure) because it motives public investors as they played a great role in economy.

The government should put in place all policies to improve level of income of Rwandan people because it contributes in the level of tax revenue and in the economic growth.

RRA should encourage local private limited liability companies and informal sector operators to processing tax systems and keep create advanced software's for tax collection or taxation as technology increased to make country boost economically.

The government should more expand of integration which means of easy to invest in country and free movement of people with non-tariff barriers.

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