Analyzing the Relationship between Government Revenue and Economic Growth in Kenya from 2012-2022 using Multiple Linear Regression

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ABSTRACT

The relationship between government revenue and economic growth is a debate that has existed for a long time in the living history.Government revenue impacts economic growth differently within different regions. Some researchers argue that government revenue positively affects economic growth while others argue that the relationship is negative. However, minimal literature exists exploring the relationship between the two variables at country specific level. The objective of this study was to determine the relationship between Government revenue and economic growth in Kenya. The research adopted the correlational study design. The study used secondary data collected from the Central Bank of Kenya, KNBS, and Government records such as the finance Act. We collected data on different sources of Government Revenue such income tax, Value Added Tax (VAT), excise duty, import duty, Other tax income. The study also included data on non-tax revenue. The set of data under the study was from the financial years 2011/2012 to 2022/2023. The analysis has been done by the use of R software. To identify the level of association of the study variables such as GDP,Income tax,VAT,excise tax,import duty,other tax and non-tax revenue, he study employs multiple linear regression analysis. To check on the level of significance, we

tested at 5% significant levels. The p-value is 0.008462 which was less than 0.05 hence we reject the null hypothesis and conclude that there is significant positive relationship between Government Revenue and Economic growth in Kenya.

Mathematics Subject Classification: Primary 62J05; Secondary 62J12.
Keywords: Government revenue, economic growth, multiple linear regression analysis

1   Introduction

Government revenue or national revenue is money received by a government in form of taxes and non-tax sources to enable it to undertake public expenditure. Government needs to perform various functions in the field of political, social and economic activities to maximize social and economic welfare which requires large amount of revenue, Muriithi C. M[11].Taxes being the main source of government revenue, are referred to as charges enforced by governments on income and assets owned by persons or corporate.They are classified into two types tax and non-tax revenue, Illyas,M and Siddiqi,M.W[7]. Tax revenue is revenue collected from taxes on income and profit, social security contribution, taxes levied on goods and services, payroll taxes, taxes on the ownership and transfer of property, and other taxes. Non tax revenue are government revenue not generated from taxes. For example-bond issues and profits of state-owned companies.

Economic growth refers to the increase in the production of goods and services in an economy over a specific period,Thuo,V.W[19] or the increase in a country's national income over a period of years. Sustained growth of the economy can provide adequate income for workforce locally and ensure successful business undertaking.Economic growth can be measured using Gross Domestic Product(GDP),the Gross National Product (GNP),Gross National Income(GNI).GDP only focuses on output that is strictly derived from within the country,while GNP includes output derived from sources external to the country Thuo,V.W [19].GNI is the total amount of money and by nation's people and business and is used to measure and track a nation's wealth from year to year. It includes GDP and income received from overseas.GDP is the main measure of a country's Economic growth which is measured in countries around the world as the percentage alteration in GDP from one year to the next. It determines whether or not the output has increased or decreased, and by how much OECD[17].

Fiscal policy aligning government revenue and expenditure is of crucial importance in promoting price stability and sustainable growth in output, income and employment, which are important parameters of economic growth Ahmed,Q.M[1]. However, for sound fiscal policy, a good understanding of the relationship between government revenue and economic growth of a nation is important, for instance, in addressing government budgetary deficits, government collects tax revenues, provides goods and services not produced by private sector, engages in commercial-type activities that require the government to raise enough revenue to sustain its development agenda Muriithi, C. M.[11]

Taxation is used to stabilize the economy as part of fiscal policies. When the economy is developing too quickly, increasing taxes might restrict spending and cause economic stalling. Reduced taxes, on

the other hand, can help stimulate growth of economy by increasing the amount of money available for consumption and investment. However, when the government spends much than it gets from taxation, it is in deficit and will have to borrow money to keep running until taxes can be raised to bring the budget back to balance.

2 Literature Review

Nyamongo, C.B.(1987) studied government revenue and expenditures in Kenya with emphasis on trends and compositions. Nyamongo expresses his results in terms of proportions by analyzing the trends in percentage increase or decrease. The study found that the total government GDP ratio had increased over the years to reach 31.7% in 1980's. GNP ratio had also increased to 23.8%. He finally concludes that, in Kenya Government revenue has been increasing especially when you take into account that its share in GNP had increased from 15.1% the 1960s' to 22.7% in the 1980s.

Nyamongo doesn't give a relationship between revenue and Economic growth. He only indicated that revenue had a share in GNP which is a measure of economic growth. This doesn't explain whether it's positive or negative. Economic data has also increased and changed over time and therefore we can't compare a result that was generated 38 years ago to make conclusions about the economy.

Lutfunnahar, B.(2007),Identified the determinants of tax share and revenue performance for Bangladesh along with 10 other developing countries for the 15 years through a panel data analysis. The results obtained suggest international trade, broad money, external debt and population growth to be significant determinants of tax efforts. Industry share turns out to be insignificant and the sign of the coefficient of GDP per capita deviates from expectations; however, this variable is not highly significant.
Lutfunnahar concludes that GDP as a variable wasn't significant in his study. He only focuses on the determinant of taxation but not how taxation affects the economy.

Emmy, J. C.(2008), studied macroeconomic determinants of tax revenue share in Kenya. According to Jepkemboi, Kenya's fiscal structure reveals that government expenditure and revenue have maintained consistent growth patterns with expenditure always exceeding revenues. But after undertaking tax reforms the taxes have not been as productive as desired. Annual time series data for the period 1970-2005 were used. The study employed Ordinary Least Squares (OLS) method to estimate the long-run co-integrating equation and also the short run error correction model. The estimated long-run results indicates that tax revenue share in Kenya was determined by the level of per capita income, imports, agriculture, manufacturing, external debt and trade liberalization.
Jepkemboi only indicates that the level of per Capita income was a determinant of tax revenue but doesn't explain how their changes affect each other.

Gacanja, E. W.(2012),did an empirical case study of Kenya on tax revenue and economic growth. The objective in this study was thus to fill in the literature gap in country specific studies by exploring the relationship between economic growth and tax revenues in Kenya, and also determining causation between the variables. The first method involved a classical linear regression model based on the OLS estimation method. The second method used co integration test while the third method involved

performing a granger causality test on all the variables. The results of the study revealed a positive relationship between economic growth and tax revenues. All the tax variables; income tax, import duties, excise duties and sales tax/VAT showed a positive effect on GDP. The co-integration revealed that there is atmost one co integrating equation while the Granger Causality test indicated a bi-directional relationship between economic growth and excise duties; a unidirectional relationship between income tax and economic growth. However, there existed no causation between economic growth and import duties. These results suggest that the government should desist from concentrating on increasing tax revenues by increasing tax levels but instead employ a tax structure that enhances the tax base thus improving growth rate.

Gacanja only compared economic growth with tax revenue leaving out non tax revenue. Our study therefore analyzes this relationship including both tax and non-tax revenue.

Muriithi, C. M.(2013), studied the relationship between government revenue and economic growth in Kenya. The study used a case study research design since the unit of analysis was one country- Kenya. The study used secondary data. The findings of the study established that all the variables studied affected economic growth to 89.3% which is high. On individual variables, import duty and excise duty posted negative relationship with economic growth while income tax, VAT, and non-tax revenue had a positive relationship. Value added tax posted the highest positive relationship with economic growth.

Muriithi Cyrus Magu contradicts the research results from Gacanja done in the previous year therefore leaving us questioning the results from 2012 and 2013 concerning the relationship between government revenue and economic growth.

Islam, N. (2019),studied Relationship between tax revenues and economic growth in Bangladesh. His study sought to investigate whether any relationship exist between taxation and economic growth and further come up with fiscal policy recommendations. The study used a classical linear regression model based on the OLS estimation method to establish the nature and strength of relationship between taxation and economic growth. Second, a co-integration test was further employed to find out if there exist a long term relationship. The results of the study revealed a positive relationship between economic growth and tax revenues. The co-integration revealed that there is at most one co-integrating equation hence giving an indication that there exist a long term relationship between economic growth and taxation.

Nasrim's study was carried out in Bangladesh using a different set of data therefore the results cannot be used to analyze Kenya's Economy.

Taxes are not the only source of government revenue therefore this result may not be used to generalize the relationship that Government revenue has on Economic Growth. Tax reforms have also occurred especially with the new government and from 2020 due to the Covid-19 pandemic, a lot of sectors were affected.

our study fills the above research gaps by employing a multiple linear regression analysis technique and correlation to analyze the relationship. Our study has also included all sources of government revenue.

3   Research design

The study adopted a correlation research design which uses quantitative methods to investigate the relationship between variables. It allows one to collect quantitative data which can be analyzed quantitatively using inferential data analysis techniques such as regression and correlation. This design is selected because the researcher seeks to build a profile about the relationship between government revenue and economic growth in Kenya. The analysis was done using multiple linear regression analysis method to create a model that incorporate all the dependent and independent variable of the research.

4   Population of the study

A population is a well-defined set of people, services, elements, events, group of things or households that are being investigated. This study used a case study of one country since only Kenya is involved. Therefore, no sampling has been done.

5   Data analysis methods

The data on different sources of government revenue including import duty, excise duty, income tax, value added tax (VAT) and other revenues and Information on the dependent variable (economic growth) was obtained from the Kenya National Bureau of Statistics, World Bank and KRA. The study used fiscal years data starting 2011/2012-2022/2023. Data collected has been presented using tables and figures. The data has been analyzed using R software. In order to determine the relationship between government revenue and economic growth we conducted a regression analysis using the following regression model. The proposed model was;

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \epsilon \tag{5.1}$$

where:

Y= Economic growth

X_1= Income tax

X_2= Value added tax

X_3= Excise duty

X_4= Import duty

X_5= Other tax income

X_6= Nontaxable income tax

ϵ= Error term

6   Findings and Data Analysis

6.1   Data Presentation

At first, the data was fed into the MS Excel and save as Comma Delimited file and thereafter it was imported to R software using the read.csv function. After getting the data, we extract the variables in form of Y and X's(X1,X2,X3,X4,X5,X6) by the following code and then creating the data frame using data.frame function as shown in figure 1.

```
   Fiscal_Year        Y       X1       X2        X3        X4       X5        X6 Total_Revenue
1    2011/2012  3990412 312463.0 183386.0  78884.00  51712.00     0.00  64287.00      626445.0
2    2012/2013  4506152 370600.0 216000.0  91810.07  61484.24     0.00  82772.64      739894.3
3    2013/2014  5021646 449590.1 232630.3 102029.10  67554.64     0.00 117358.03      851804.1
4    2014/2015  5831528 508580.9 259685.2 115871.72  74047.72 39039.89  85936.47      997225.4
5    2015/2016  6709671 564475.2 289213.5 139540.34  79187.93 39567.66 110030.12     1111984.6
6    2016/2017  8081061 625050.0 339034.0 165474.00  89943.00 33961.29 143637.53     1253462.7
7    2017/2018  8922320 640593.3 356855.9 162483.84  99214.64 52544.53 175534.78     1311692.3
8    2018/2019  9745599 685389.3 413186.1 196588.32 107701.80 37347.15 204460.59     1440212.7
9    2019/2020 10620841 706936.3 383713.2 195269.83  98022.24 43565.99 306123.54     1427507.6
10   2020/2021 11370323 694052.5 410758.4 216324.92 108375.20 55248.68 253624.94     1484759.7
11   2021/2022 12752164 876707.2 523097.6 252094.38 118280.20 67041.76 362586.60     1837221.2
12   2022/2023 13483003 941575.8 550439.8 264508.63 130122.60 73782.51 400080.49     1960429.2
```

Figure 1: Revenue and GDP data

6.2   Economic Growth

The study sought to establish the trend of Economic Growth in Kenya over the study period. The data findings are presented in the Figure below:
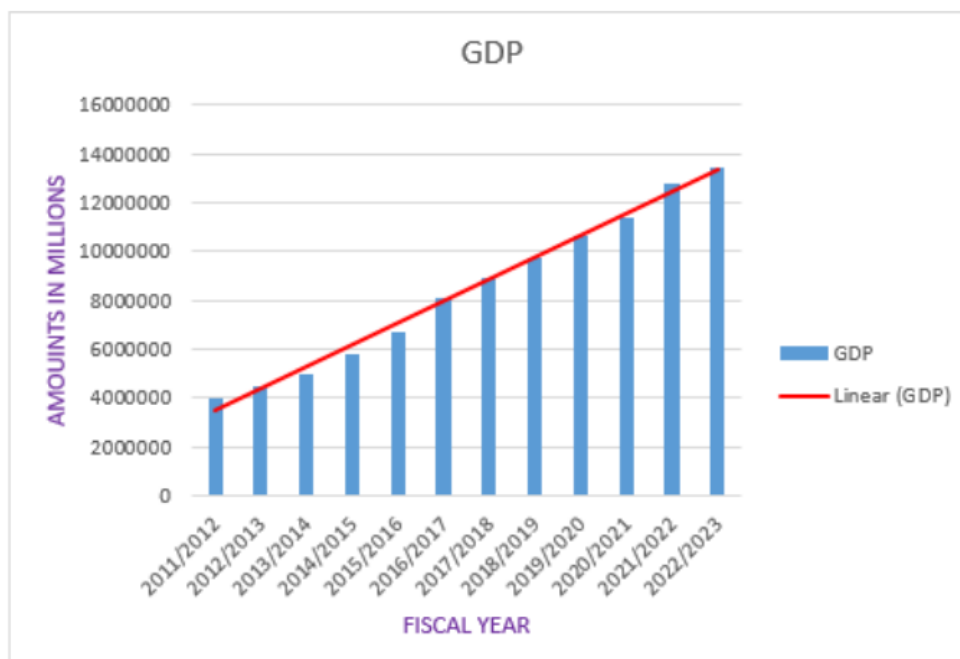

Figure 2: Economic growth

From the findings presented above, the study established that Economic Growth had been on continuous increase over the study period as in figure 2.

6.3   Government revenue

The study sought to establish the trend in government revenue in Kenya over the study period. The data findings are presented in the Figure below:

The graph above is a presentation of all the independent variables of our proposed model. From the findings presented above, the study established that there has been different levels of growth on the different sources of government revenue. from the graph,income tax has been leading all through the years followed by VAT then excise duty. There was a slight reduction in the growth of income tax,excise duty and non-tax revenue due which could be due to covid-19 pandemic that affected most sectors in the country.
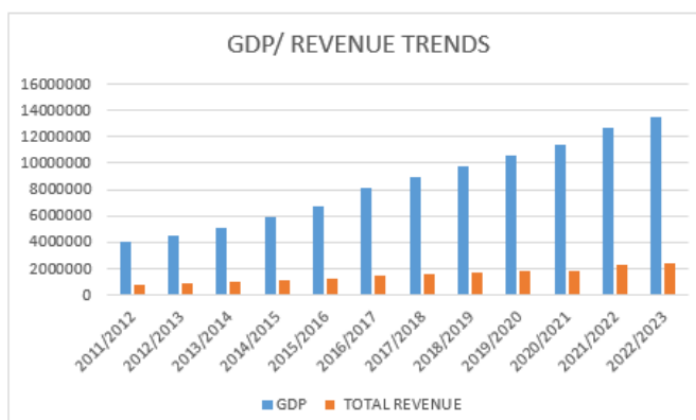
Figure 3: GVT revenue and GDP

6.4 Government revenue and economic growth

The study sought to establish the trend in government revenue in comparison to economic growth in Kenya over the study period. The data findings are presented in the Figure below:

```
> mydata=rnorm(100)
> qqnorm(mydata)
> qqline(mydata)
```

Figure 4: R-QQ Command

7 Normality testing

Before doing our statistical analysis, we first checked for the normality of our data using a QQ plot. We input the code below in R:
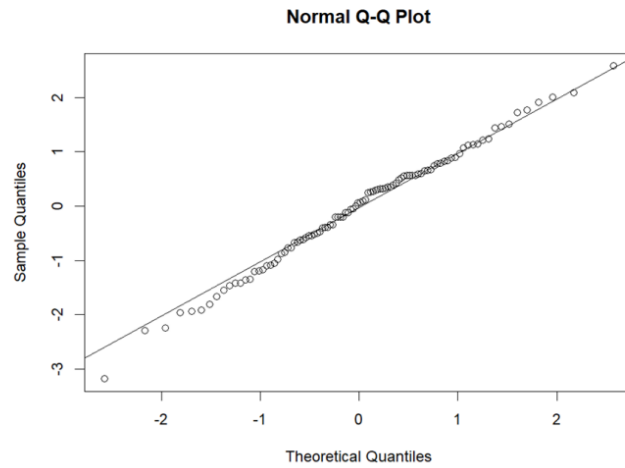
Normal Q-Q Plot

Figure 5: QQ PLOT

8 Correlation

our first objective was to determine the correlation between variables and therefore, to show the relationship between government revenue and economic growth, we did the correlation analysis by the use of cor.test() function to test a single correlation coefficient. We showed the relationship between economic growth and each independent variable.

8.1 Economic growth and income tax

The correlation between Y=Economic growth (GDP) and Income tax.

```
> cor.test(Y,X1,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X1
t = 13.849, df = 10, p-value = 7.51e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9103473 0.9931443
sample estimates:
      cor
0.9749083
```

Figure 6:

From the output, we see that the sample correlation estimate is 0.9749083. This implies that income tax is strongly related with the economic growth. Implying that income tax can be used to predict economic growth.

8.1.1 Economic growth and VAT

The correlation between Y=Economic growth (GDP) and VAT.

```
> cor.test(Y,X2,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X2
t = 16.931, df = 10, p-value = 1.086e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9386159 0.9953692
sample estimates:
      cor
0.9830012
```

Figure 7: COR GDP and VAT

We can observe that the sample correlation is 0.9830012 which implies a strong relation between VAT and the Economic Growth. Hence the VAT can be a good predictor variable for Economic growth.

8.1.2 Economic growth and Excise tax

The correlation between Y=Economic growth (GDP) and Excise tax.

```
> cor.test(Y,X3,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X3
t = 29.388, df = 10, p-value = 4.859e-11
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9789618 0.9984429
sample estimates:
      cor
0.9942604
```

Figure 8: COR GDP and Excise tax

From the output, we see that the sample correlation estimate is 0.9942604. This implies that excise duty is strongly related with the economic growth. Implying that excise duty can be used to predict economic growth.

8.1.3 Economic growth and import duty

The correlation between Y=Economic growth (GDP) and import duty .

```
> cor.test(Y,X4,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X4
t = 15.752, df = 10, p-value = 2.183e-08
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9295967 0.9946659
sample estimates:
      cor
0.9804377
```

Figure 9: COR GDP and import duty

From the output, we see that the sample correlation estimate is 0.9804377. This implies that import duty is strongly related with the economic growth. Implying that import duty can be used to predict economic growth.

8.1.4 Economic growth and other tax income

The correlation between Y=Economic growth (GDP) and other tax Income.

```
> cor.test(Y,X5,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X5
t = 3.9064, df = 7, p-value = 0.005851
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.3640007 0.9627185
sample estimates:
      cor
0.8279686
```

Figure 10: COR GDP and Other tax

From the output, we see that the sample correlation estimate is 0.8279686. This implies that other tax income is strongly related with the economic growth. Implying that other tax income can also be used to predict economic growth.

8.1.5 Economic growth and Non-tax income

The correlation between Y=Economic growth (GDP) and Non-tax income.

```
> cor.test(Y,X6,method = "pearson")

        Pearson's product-moment correlation

data:  Y and X6
t = 10.447, df = 10, p-value = 1.063e-06
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8502473 0.9882057
sample estimates:
      cor
0.9571161
```

Figure 11: COR GDP and Nontax

From the output, we see that the sample correlation estimate is 0.9571161. This implies that Non-taxable income is strongly related with the economic growth. Implying that Non-taxable income can be used to predict Economic growth.

9   Model formulation

Here, we analyze our data and predict that changes that may occur to our dependent variable Y when the values of the independent variable change.
To meet our second specific objective we formulated the model below:

```
> model= lm(Y~X1+X2+X3+X4+X5+X6,data= mydata)
> model

Call:
lm(formula = Y ~ X1 + X2 + X3 + X4 + X5 + X6, data = mydata)

Coefficients:
(Intercept)           X1           X2           X3           X4
  1.256e+06    -6.575e+00    -7.630e+00     3.636e+01     5.824e+01
         X5           X6
  1.304e+01     1.155e+01
```

Figure 12: Regression model

From the result of our analysis and the estimation of our coefficients, our regression model is as below:

$$Y = 12560000 - 6.575X_1 - 7.630X_2 + 36.36X_3 + 58.25X_4 + 13.04X_5 + 11.55X_6$$

Interpretation:

β_0: The intercept term represents the predicted value of the dependent variable (Y) when all predictor variables $(X_1, X_2, X_3, X_4, X_5, and X_6)$ are zero. In this case, the predicted value of Y is approximately 1256000 indicating that in normal circumstances, Economic Growth in Kenya would be 1256000 million shillings

β_1= -6.575: this implies that For every unit increase in X_1, the predicted value of Y decreases by approximately 6.575 units.

β_2= -7.630: this implies that For every unit increase in X_2, the predicted value of Y decreases by approximately 7.630 units.

β_3=36.36: which indicates that For every unit increase in X_3, the predicted value of Y increases by approximately 36.36 units.
β_4=58.25: this implies that For every unit increase in X_4, the predicted value of Y increases by approximately 58.24 units.

β_5=13.04: implies that For every unit increase in X_5, the predicted value of Y increases by approximately 13.04 units.

β_6=11.55: implying that For every unit increase in X_6, the predicted value of Y increases by approximately 11.55 units.

As per the regression equation established above, there was a direct relationship between excise duty, import duty, other tax income and non-taxable income. However, there was an inverse regression relationship between income tax and VAT.
On income tax:

The inverse relationship between GDP (Gross Domestic Product) and income tax can be understood through several economic mechanisms:

Incentive Effect: Higher income tax rates can reduce the incentive to work, save, and invest. When individuals and businesses face higher taxes on their income, they may be less inclined to engage in productive economic activities. This can lead to a decrease in labor supply, entrepreneurship, and investment, which can in turn lower GDP growth.

Consumption Effect: Income tax directly reduces disposable income, which can lower consumer spending. When individuals have less money to spend due to higher income taxes, overall consumption may decrease. Since consumption is a significant component of GDP, a reduction in consumer spending can lead to lower GDP.

Investment Effect: Income tax also affects investment decisions. Higher income tax rates can reduce the after-tax return on investment, discouraging businesses and individuals from investing in capital goods, innovation, and other productive activities. This can lead to lower capital formation and slower economic growth.

Global Mobility of Capital and Talent: In a globalized economy, high income tax rates can encourage capital flight and brain drain, where businesses and skilled individuals relocate to jurisdictions with lower tax burdens. This can result in a loss of productive resources, innovation, and economic activity, ultimately impacting GDP growth negatively.

On VAT:
The inverse relationship between VAT (Value Added Tax) and GDP (Gross Domestic Product) can occur due to several factors:

Consumption Effect: A higher VAT rate tends to decrease consumption as it increases the prices of goods and services. Reduced consumption can lead to lower economic activity and thus a decrease in GDP.

Investment Effect: Higher VAT rates can also impact investment decisions. If businesses face higher costs due to VAT, they may reduce investment, which can slow down economic growth and hence GDP.

Income Effect: VAT can affect disposable income. When VAT rates are high, consumers have less money to spend on goods and services, which can dampen overall economic activity and GDP growth.

International Competitiveness: High VAT rates can make domestically produced goods and services less competitive compared to imports, leading to a decrease in exports and hence GDP.

on import duty:

The positive relationship between import duty and GDP can be explained by several interrelated factors:

Government Revenue Generation: Import duties contribute to government revenue. As GDP grows, the overall economic activity increases, leading to higher imports and subsequently more revenue from import duties. Governments often rely on this revenue to fund public expenditure, such as infrastructure development, education, and healthcare, which can further stimulate economic growth.

Trade Protectionism: During periods of economic growth, countries may seek to protect domestic industries from foreign competition by imposing higher import duties. This protectionist measure aims to safeguard local jobs and industries, which in turn supports GDP growth by maintaining employment levels and fostering industrial development.

Generally a positive relationship between tax and GDP typically suggests that higher tax revenues are associated with a stronger economy. This correlation can indicate that increased government spending, funded by tax revenue, stimulates economic activity and contributes to GDP growth. Additionally, higher tax revenues may signal a more robust economy with higher incomes and consumption levels, leading to increased tax receipts. However, the nature of this relationship can vary depending on factors such as tax policies, government spending priorities, and overall economic conditions.

10   Testing for statistical significance

Hypothesis
To test for statistical significance of our model we conducted a hypothesis test on effect of government revenue on economic growth.

```
> summary(model)

Call:
lm(formula = Y ~ X1 + X2 + X3 + X4 + X5 + X6, data = mydata)

Residuals:
      4       5       6       7       8       9      10      11
-126578 -100866  164437  201804 -120953   27129  -16135  133665
     12
-162504

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.256e+06  2.122e+06   0.592    0.614
X1          -6.575e+00  7.207e+00  -0.912    0.458
X2          -7.630e+00  1.425e+01  -0.535    0.646
X3           3.636e+01  1.506e+01   2.414    0.137
X4           5.823e+01  3.111e+01   1.872    0.202
X5           1.304e+01  1.428e+01   0.913    0.458
X6           1.155e+01  4.243e+00   2.723    0.113

Residual standard error: 277400 on 2 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.9972,    Adjusted R-squared:  0.9887
F-statistic: 117.5 on 6 and 2 DF,  p-value: 0.008462
```

Figure 13: Summary of the Model

H_0: The effect of government revenue on economic growth in Kenya is not statistically significant.
H_1: The effect of government revenue on economic growth in Kenya is statistically significant.

We tested the overall model and obtain the data below:

From the results above,we reject the null hypothesis since our P-value is 0.008462 which is less than 0.05 therefore we accept the alternative and conclude that the relationship between government revenue and Economic growth is statistically significant.

11 Conclusion

This study sought to determine the relationship between Government revenue and economic growth in Kenya. Government revenue impacts economic growth through meeting the various governmental needs. The study used a case study research design since the unit of analysis was one country-Kenya. The study used secondary data collected from the Central Bank of Kenya and KNBS. The exact information collected included statistics on import duty, excise duty, income tax, Value Added Tax (VAT) and other tax revenue which comprised the tax revenue and the non-tax revenue. In order to establish the relationship between the variables, the researcher conducted a regression analysis with economic development as the dependent variable. The findings of the study established that all the variables studied affected economic growth to 99.72% which is high. On individual variables, income tax and VAT posted negative relationship with economic development while excise duty, import tax, other

tax and non-tax revenue had a positive relationship.Excise duty posted the highest positive relationship with economic growth followed by VAT then import duty.

12 Policy Recommendation

Based on the study findings presented and discussed above, the following policy recommendations emanate that should be adopted by the government to enhance its fiscal policy decisions hence boost the economic growth.

First,the government can utilize the positive relationship that exists between tax and economic growth to try and efficiently use the taxes it collects to spar growth. This boost per capita incomes hence increasing disposable income that would in turn increase demand and eventually increasing tax levels on sales/VAT and excise duties.

Second, the findings give an implication that the government can change the long-run economic growth levels by generating more revenue from excise duty,import tax,other tax revenue and non-tax revenue without raising tax rates or creating new taxes. This can be achieved through improving the tax collection system, eliminating fraud,evasion and corruption.

13 Acknowledgment

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