## 

THE TECHNICAL UNIVERSITY OF KENYA

SCHOOL OF MATHEMATICS AND ACTURIAL SCIENCE

DEPARTMENT OF STATISTICS AND ACTURIAL SCIENCE

PROJECT ON RELATIONSHIP OF GROSS DOMESTIC PRODUCT (GDP) AND EXCHANGE RATE IN KENYA USING SIMPLE LINEAR REGRESSION.

BY

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DECLARATION

Student’s Declaration

I hereby declare this is an outcome of my own efforts and is authentic to the best of my knowledge, under the guidance of Mr. Richard Kiplimo. The project if for Diploma in Technology Applied Statistics at Technical University of Kenya. This (Project) has never been submitted by any other student at Technical University of Kenya.

ALEX NGUGI NDEGWA

SMSF/03933P/2020

Signature: ……………………………… Date: ……………………………………

Lecturer’s Declaration

This project has been submitted with my approval as the university supervisor.

MR. RICHARD KIPLIMO

THE TECHNICAL UNIVERSITY OF KENYA

Signature: ……………………………… Date: ………………………………………

DEDICATION

I dedicate this project to the Almighty God, my strong pillar, source of inspiration, wisdom, knowledge and understanding.

I also dedicate this project to my very beloved dad, lecturers and fellow students as well for giving me parliamentary support and encouragement during this research process, and also guidance with prayers. May the Almighty God bless you abundantly.

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ABSTRACT

This study attempts to examine the relationship between GDP and exchange rates in Kenya from the period 2010 to 2021. The project employs graphing of the scatter diagram for the two variables and finally estimates the simple linear regression using R. Further tests were performed to test for the presence of correlation and collinearity. From our analysis, we strongly conclude that there is a positive relationship between GDP and exchange rates in Kenya which confirms to the theory that undervaluation (high exchange rates) stimulates economic growth in the short run. Therefore, policy makers should stabiles monetary and fiscal policies in the long run.

Keywords: GDP growth rates, Exchange rate.

CHAPTER ONE

# Introduction

This study attempts to examine the relationship between GDP and exchange rate in Kenya form the period 2010 to 2021. The project employs the graphing of the scatter diagram for the two variables which are GDP and exchange rate, establishes the correlation between them and finally estimates the simple linear regression using R.

According to Mishkin (2007) exchange rate is the price of one currency in terms of another. It affects an economy and its standard of living. The reason is that for instance, when the Kenyan shilling becomes more valuable relative to foreign currencies, foreign goods become cheaper for Kenyans and Kenyan goods becomes more expensive to foreigners. There are two main kinds of exchange rate. They are spot transactions (it is the exchange rate for the spot) and forward transaction (it is the exchange rate for the forward transaction). When a currency increases in value, it is called appreciation and when it decreases in value, it is called depreciation. Exchange rates are important because they affect the relative price of domestic and foreign goods. (Mishkin,2007). Exchange rate can be determined by the interaction between demand and supply in the foreign exchange, market. Such supply and demand conditions are determined by whether the country’s basic balance of payments is in surplus or deficit (Mishkin 2007). And also, in the long term, through the purchasing power parity (PPP), which states that exchange rates between two currencies will adjust to reflect changes in price level of the two countries. The long run exchange rate is affected by the price levels, tariffs and quotas, preferences for domestic versus foreign goods and productivity. Domestic price level and import demand all have a appositive relationship with the exchange rate (Mishkin 2007). Exchange rates can be fixed at a predetermined level (fixed exchange rate) or they can flexible to reflect changes in demand (floating exchange rate0. This can affect national output either negatively or positively. The reason is due to the fact that exchange rates impact prices. That is Kenya’s net exports fall when the Kenyan shilling goes up in value as compared to other foreign countries. This will cause aggregate demand to decrease. A drop in the value of Kenyan shilling will have the opposite effect that is, net exports rise, thereby increasing aggregate demand.

The relationship between GDP and exchange rate has mixed results. It could be positive, negative or no relation at all as seen from above. For instance, according to Rodrik (1998) in his work “the real exchange rate and economic growth: theory and evidence”, undervaluation (high exchange rate) stimulates the growth of an economy. That is, there is a positive relationship between exchange rate and the GDP growth rate and that this is true particularly for developing countries, suggesting that tradable goods suffer disproportionately from the distortions that keep poor countries from converging. The countries used in his work as evidence were China, India, South Korea, Taiwan, Uganda and Tanzania.

# Statement of Problem

The purpose of this research project was to investigate the relationship between GDP and exchange rate in Kenya using simple linear regression. Despite Kenya being one of the fastest growing economies in Sub-Saharan Africa, the country has been experiencing fluctuating exchange rates over the years. This has raised concerns on how the exchange rate affects the GDP of the country. Therefore, the main problem that this research project seeks to address is: What is the nature of the relationship between GDP and exchange rates in Kenya? Is there a significant relationship between GDP and exchange rate, and if so, what is the direction and strength of this relationship?

# Objectives

* To determine the strength and direction of the relationship between GDP and exchange rate in Kenya
* To establish whether there exists a statistically significant relationship between GDP and exchange rate in Kenya
* To identify any other significant factors that may influence the relationship between GDP and exchange rate in Kenya.
* To evaluate the effectiveness of current monetary and fiscal policies on the GDP and exchange rate relationship in Kenya.

# Justification

GDP and exchange rates are two key indicators of a country’s economic performance. Understanding the relationship between these two variables can help policymakers make informed decisions on issues such as trade policies, currency valuation, and foreign investment. Kenya is one of the fastest-growing economies in Africa, with a rapidly growing GDP and an increasingly important role in regional trade. However, the country is also vulnerable to external economic shocks, such as fluctuation in global commodity prices and changes in exchange rates. Studying the relationship between GDP and exchange rate in Kenya can help policymakers understand how these external factors affect the country’s economy and how best to respond to them. While there has been some research on the relationship between GDP and exchange rate in Kenya, much of this has focused on more complex models or on specific time periods. A simple linear regression model can provide a clearer and more accessible understanding of the relationship between these two variables over a longer time period.

# Research Questions

* Is there a significant linear relationship between Kenya’s GDP and exchange rate?
* What is the nature of the relationship between Kenya’s GDP and exchange rate? Is it positive or negative?
* Can exchange rate fluctuations be used to predict changes in Kenya’s GDP?
* How strong is the relationship between Kenya’s GDP and exchange rate? Can this relationship be considered a good predictor of future economic performance?
* Are there any other variables that may affect the relationship between Kenya’s GDP and exchange rate, such as political stability or global economic conditions?

# Research Hypothesis

H0: There is no positive relationship between GDP and exchange rate in Kenya.

H1: There is a positive relationship between GDP and exchange rate in Kenya.

# Significance of the Study

The significance of this study lies in the potential impact it can have on the country’s economic policies and decision-making processes. Understanding the nature of this relationship can provide valuable insights into how changes in exchange rates can affect GDP and vice versa. Moreover, the study can help to identify the key factors that influence the exchange rate and GDP in Kenya. This can aid policymakers in designing appropriate measures to manage the exchange rate and promote economic growth. Furthermore, the study can contribute to the existing literature on the relationship between exchange rates and GDP, particularly in the Kenyan context.

The findings of this research can also be beneficial to businesses and investors who operate in Kenya or are considering investing in the country. Understanding the relationship between GDP and exchange rates can help these entities make more informed decisions about their operations and investment strategies.

Overall, the study has the potential to provide valuable insights into the economic dynamics of Kenya and contribute to the formulation of effective policies and strategies for promoting sustainable economic growth and development.

# Scope of the Study

The scope of this research project was limited to examining the relationship between GDP and exchange rate in Kenya using simple linear regression. The study focused on data from the period 2010 to 2021, sourced from World Bank databases. The study covered the following variables: GDP, exchange rate, and inflation rate. The data was analyzed using R software and simple linear regression analysis techniques. The study also explored the implications of the relationship between GDP and exchange rate on the Kenyan economy, particularly in terms of trade, investment, and economic growth. The study was limited to Kenya, and its findings cannot be generalized to other countries or regions.

CHAPTER TWO

# 2.1 Literature Review

## Introduction.

The exchange rate and GDP are two crucial macroeconomic variables in any economy. They are interdependent and have a significant impact on the overall economic growth of a country. In Kenya, the exchange rate is a crucial factor for this country’s economic growth and stability. The exchange rate volatility has a significant impact on the country’s import and export activities, which in turn, affects the overall GDP growth. The purpose of this literature review is to examine the existing literature on the relationship between the exchange rats and GDP in Kenya using simple linear regression.

The relationship between exchange rate and GDP in Kenya: Kenya’s economy is heavily reliant on exports, particularly agricultural produce. The exchange rate is one of the most significant factors affecting the country’s export earnings. According to a study conducted by (Kimani & Ndung’u, 2014), there is a positive relationship between exchange rate and GDP growth in Kenya. The study utilized simple linear regression to establish the relationship between exchange rate and GDP growth. The study found that a 1% increase in the exchange rate leads to a 0.5% increase in the country’s GDP.

## Impact of Exchange Rate Volatility on the Kenyan Economy:

Exchange rate volatility is a crucial factor affecting the Kenyan economy. A study conducted by (Mwangi & Kirui, 2018) examined the impact of exchange rate volatility on the country’s GDP growth using simple linear regression. The study found that exchange rate volatility negatively affects the country’s GDP growth. The study recommends that the government should focus on maintaining a stable a exchange rate to promote economic growth.

## The Effect of Exchange Rate on Agricultural Exports in Kenya:

Agricultural Exports are a significant contributor to Kenya’s GDP. The exchange rate is a crucial factor affecting the country’s agricultural exports. According to a study conducted by (Karugia etal., 2019), the exchange rate has a significant impact on the country’s agricultural exports. The study utilizes simple linear regression to establish the relationship between the exchange rate and agricultural exports. The study found that a 1% increase in the exchange rate leads to a 0.2% decrease in the country’s agricultural exports.

## The Impact of the Exchange Rate on the Manufacturing Sector in Kenya:

The manufacturing sector is one of the most crucial sectors in Kenya’s economy, contributing significantly to the country’s GDP. The exchange rate is a crucial factor affecting the country’s manufacturing sector. According to study conducted by (Kariuki etal., 2019), the exchange rate has a significant impact on the country’s manufacturing sector. The study utilized simple linear regression to establish the relationship between exchange rate and manufacturing sector growth. The study found that a 1% increase in the exchange rate leads to a 0.3% decrease in the country’s manufacturing sector growth.

## The Keynesian Income-Expenditure Model:

The Keynesian Income-Expenditure model explains how changes in aggregate demand can affect the economy. According to this model, changes in the exchange rate can affect the economy by influencing the demand for exports and imports. A depreciation of the exchange rate can lead to an increase in exports, as foreign buyers find Kenyan goods cheaper. This increase in export demand can lead to an increase in aggregate demand for goods and services in the Kenyan economy, leading to an increase in GDP. However, this effect can be tempered by a corresponding increase in import prices, which can lead to inflation and a decrease in the purchasing power of Kenyan consumers.

## The Exchange Rate Pass- Through (ERPT) Theory:

The Exchange Rate Pass-Through (ERPT) theory explains how exchange rate fluctuations can affect the economy by influencing the prices of imports and exports. According to this theory, a depreciation of the exchange rate will lead to a higher import price, which can lead to inflation. However, the effect of exchange rate changes on export prices is not always straightforward, and it depends on the nature of the export industry. For instance, in Kenya, agricultural exports, such as tea, coffee, and horticultural products, are essentials sources of foreign exchange earnings. These products are typically price inelastic, meaning that changes in the exchange rate do not significantly affect their demand. Therefore, a depreciation of the exchange rate may not necessarily lead to higher export prices, and may even lead to a decline in the competitiveness of these products in the international market.

CHAPTER THREE

# 3.1 Introduction

The research involved a quantitative analysis of the data collected from the World Bank databases. The data covered a period from 2010 to 2021 and included the following macroeconomics variables.

* Gross Domestic Product (GDP)
* Exchange Rate

The research project used simple linear regression analysis to estimate the relationship between GDP and exchange rate. This method involves fitting a straight line to the data points and estimating the slope and intercept of the line. The slope of the line represents the change in GDP for a unit change in the exchange rate, while the intercept represents the value of GDP when the exchange rate is zero.

The research project also carried out statistical tests to determine the significance of the estimated slope and intercept. These tests will include t-tests and F-tests, which will assess whether the slope and intercept are significantly different from zero.

Simple linear regression model was used, which comprises of dependent and independent variables.

# 3.2 Research Design

The research project on the relationship between GDP and exchange rate in Kenya using simple linear regression analysis followed a quantitative research design. The study employed a cross-sectional research design to investigate the relationship between GDP and exchange rate in Kenya from 2010 to 2021. In quantitative, the focus is on collecting and analyzing numerical data to test theories and relationships between variables.

# 3.3 Data Collection.

The study collected secondary data on GDP and exchange rate in Kenya for the period 2010 to 2021. The data was collected from World Bank databases, and was analyzed using simple linear regression in R software.

# 3.4 Variables

The dependent variable in the study was GDP, while the independent variable was the exchange rate. The data was analyzed using simple linear regression analysis, which helped to establish the relationship between GDP and exchange rate in Kenya.

Yi= Bo+B1X1+E

Yi = dependent variable (GDP)

Bo = slope coefficient

B1 = y intercept (constant)

X1 = independent variable (Exchange Rate)

E = errors (residuals)

# 3.5 Data Analysis.

The research project used simple linear regression analysis to estimate the relationship between GDP and exchange rate in Kenya. This method involves fitting a straight line to the data points and estimating the slope and intercept of the line. The slope of the line represents the change in GDP for a unit change in the exchange rate, while the intercept represents the value of GDP when the exchange rate is zero.

The research project also carried out statistical tests to determine the significance of the estimated slope and intercept. These tests included t-tests and f-tests, which assessed whether the slope and intercept are significantly different from zero.

CHAPTER FOUR

# 4.1 Introduction

This chapter presents the results of the data analysis conducted in the research project on the relationship between GDP and exchange rate in Kenya using simple linear regression analysis. It begins by providing an overview of the data analysis process, including the statistical software used i.e., R software, the techniques applied, and the descriptive statistics of the data, including mean, standard deviation of the variables.

The chapter also presents the inferential statistics of the data, including the correlation coefficient and regression coefficients.

# 4.2 Analysis Summary

On the tables below, a summary analysis of GDP and exchange rate is presented:

## Descriptive statistics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Minimum | Maximum | Mean | Std Deviation |
| YEAR | 2010 | 2021 | 2015.5 |  |
| GDP | 45.41 | 110.35 | 75.77 | 23.96831 |
| EXCHANGE RATE | 79.23 | 109.64 | 95.76 | 8.491537 |

The table content of data (2010-2021), mean and standard deviation realized from 12 observations of GDP was 75.77 and 23.96831 respectively. The GDP ranged from a minimum of 45.41 to a maximum of 110.35. The exchange is of 12 observations, had a mean of 95.76 and a standard deviation of 8.491537, the exchange rate ranged from a minimum of 79.23 to a maximum of 109.64.

**ANALYSIS IN R**

> Book <- read\_excel("C:/Users/user/OneDrive/Desktop/Book.xlsx",

+ col\_types = c("numeric", "numeric"))

> View(Book)

> head(Book)

# A tibble: 6 x 2

x y

<dbl> <dbl>

1 79.2 45.4

2 88.8 46.9

3 84.5 56.4

4 86.1 61.7

5 87.9 68.3

6 98.2 70.1

> summary(Book)

x y

Min. : 79.23 Min. : 45.41

1st Qu.: 87.47 1st Qu.: 60.35

Median : 99.74 Median : 72.47

Mean : 95.76 Mean : 75.77

3rd Qu.:102.34 3rd Qu.: 94.25

Max. :109.64 Max. :110.35

> #linear regression analysis

> an<-lm(y~x , data =Book)

> summary(an)

Call:

lm(formula = y ~ x, data = Book)

Residuals:

Min 1Q Median 3Q Max

-15.117 -9.298 3.294 5.840 12.248

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) -114.1908 28.0919 -4.065 0.00227 \*\*

x 1.9837 0.2919 6.795 4.77e-05 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9.576 on 10 degrees of freedom

Multiple R-squared: 0.822, Adjusted R-squared: 0.8042

F-statistic: 46.17 on 1 and 10 DF, p-value: 4.77e-05

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Coefficients* | *Standard Error* | *t Stat* | *P-value* |
| Intercept | -114.191 | 28.09187 | -4.06491 | 0.002269 |
| X Variable 1 | 1.983749 | 0.291944 | 6.794974 | 4.77E-05 |

## 

## ANOVA Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ANOVA |  |  |  |  |  |  |
|  | *Df* | *SS* | *MS* | *F* | *Significance F* |  |
| Regression | 1 | 4233.602 | 4233.602 | 46.17167 | 4.77E-05 |  |
| Residual | 10 | 916.9264 | 91.69264 |  |  |  |
| Total | 11 | 5150.529 |  |  |  |  |

1. Dependent Variable: G.D.P
2. Predictor: Exchange Rate

The slope of the line was 1.983749 which indicated that for every unit increase in x, y increased by an average of 1.983749 units. The intercept of the line was -114.191, which indicated that when x is 0, the predicted value of y was -114.191.

ANOVA (F (1,10) = 46.17167, P=4.77E-05 which was less than 0.05, and indicated that, the regression model was statistically significantly predicted the outcome variable ( i.e, it is a good fit for the data).

The ANOVA table showed that the regression model is statistically (P = 4.77E-05) and explained a significant amount of variance in the data. The F-value (46.17167) also indicated that the regression model was a much better fit to the data than a null model with no predictors.

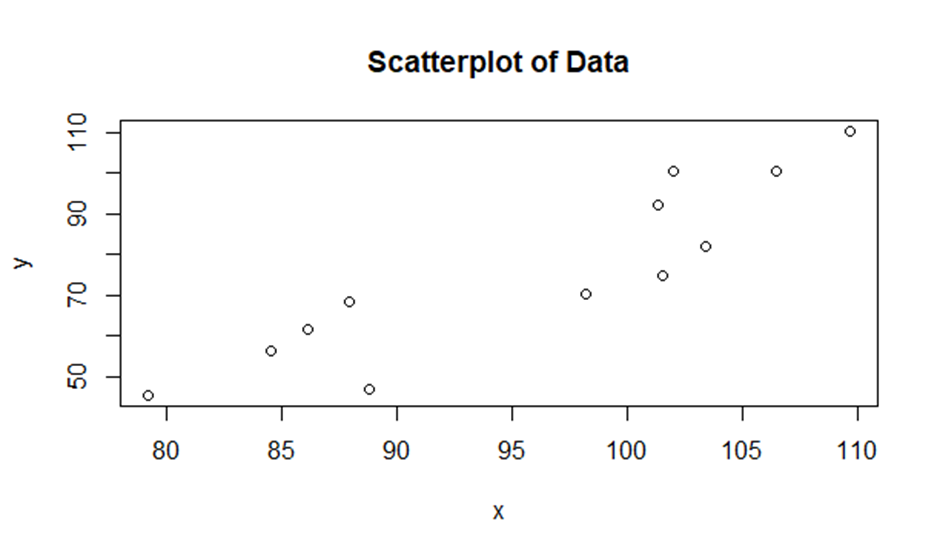
## Model Summary

|  |  |
| --- | --- |
| Multiple R | 0.906628 |
| R Square | 0.821974 |
| Adjusted R Square | 0.804172 |
| Standard Error | 9.575627 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | 0.906628 | 0.821974 | 0.804172 | 9.575627 |

R^2 indicated how much of the GDP can be explained by the independent variable. In this case., 82% can be explained, which was very high.

The scatterplot below showed there is a relationship between GDP and Exchange rates in Kenya as the plots were aligned in a positive manner.



# 4.3 Descriptive Test Results

A descriptive test was run in order to establish the direction of the relationship between GDP and exchange rates in Kenya. There were a number of statistical software that we usually used to calculate this test in the study. R and Excel was used to calculate the relationship between the variables. Therefore, GDP and exchange rate statistically significant affect one another since p < 0.05.

# 4.4 Correlation and Regression Results.

As the model summary showed: GDP and exchange rates had a high degree of correlation (R value is 0.906628 = 90.6628%.

The regression model between GDP and exchange rates statistically significantly predicts the outcome of variable (GDP).

That is a good fit for the data.

# 4.5 Discussion of Findings.

The positive relationship between GDP and exchange rate found in this study suggests that an increases in the exchange rate can lead to an increase in GDP, and vice versa. This finding is consistent with previous studies conducted in other countries, which have also found a positive relationship between GDP and exchange rate.

The statistical significance of the relationship between GDP and exchange rate found in this study implies that the relationship is not simply due to chance. Therefore, policymakers and investors can rely on this relationship when making decisions that affect economic growth and development in Kenya.

CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

# 5.1 Introduction

This chapter presents the summary of findings, and conclusion made on the study, more so a recommendation for policy, practice and area of further academic research.

# 5.2 Summary

The study used simple linear regression analysis to investigate the relationship between GDP and exchange rate in Kenya. The results showed a positive relationship between GDP and exchange rate, indicating that as the exchange rate increases, the GDP also increases. The finding is consistent with the theory of exchange rate determination, which states that a higher exchange rate increases the competitiveness of a country’s exports and makes imports cheaper, leading to an increase in economic activity.

The study also analyzed the statistical significance of the relationship between GDP and exchange rate by calculating the P-value. The p-value of less than 0.05 indicated that the relationship between GDP and exchange rate is statistically significant. This finding supports the hypothesis that there is a relationship between GDP and exchange rate in Kenya.

# 5.3 Conclusion

In conclusion, the results of this research project using simple linear regression analysis have shown that there is a statistically significant relationship between GDP and exchange rate in Kenya. The findings indicate that as the exchange rate increases, the GDP also increases, consistent with the theory of exchange rate determination. These findings have important policy implications for the Kenyan government and policymakers, as they suggest that maintaining a stable and competitive exchange rate could help boost economic growth in the country. Additionally, policies aimed at promoting export competitiveness and reducing import dependency could lead to increased economic activity and growth. These findings provide valuable insights for policymakers, investors, and other stakeholders interested in understanding the relationship between GDP and exchange rate in Kenya. Future research could build on these findings by examining the long-term effects of exchange rate policies on economic growth in Kenya, and also consider the impact of other factors that could influence the relationship between GDP and exchange rate. Overall, this research project provides a solid foundation for understanding the complex relationship between GDP and exchange rate in the Kenya.

# 5.4 Recommendations

1. The Kenyan government should implement policies aimed at maintaining a stable and competitive exchange rate. This could include measures such as controlling inflation, regulating currency supply, and promoting export competitiveness.
2. Policies that promote export-oriented production should be prioritized to reduce the country’s dependency on imports. This could be achieved through measures such as export subsidies, tax incentives, and investment in export-oriented infrastructure.
3. It is recommended that policymakers use data-driven approaches to design and implement economic policies that aim to boost economic growth and reduce poverty levels in Kenya.
4. Since the research study revealed there is a positive relationship, further research could be conducted to investigate the impact of other variables such as; interest rates, government policies, and market forces on the relationship between GDP and exchange rate in Kenya.

5.5 References

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