EFFECT OF EXCHANGE RATE CHANGES ON LABOUR PRODUCTIVITY GROWTH IN KENYA (1985-2018)

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DECLARATION

This project is my original work and has not been presented for award of any degree in any other University.

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SUPERVISOR'S DECLARATION

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

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DEDICATION

This project is dedicated to God Almighty, my creator, my strong pillar, my source of inspiration, wisdom and knowledge. He has been the source of my strength throughout this project. I also dedicate this to my loving wife: Delvin Moraa, who has given me encouragement and made sure that I give it all it takes, to accomplish. To my daughter Beverly (Maama) who has been affected in every way by this quest. Thank you and may God bless you all.

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All others who may have contributed in one way or another in this journey, I say thank you and God bless you.

ABSTRACT

The main purpose of this study was to establish the effect of exchange rate changes on labour productivity growth in Kenya (1985-2018). Specifically, the study tested the granger causality between exchange rate and labour productivity growth in Kenya; examined the influence of intervening variables public capital, private capital and terms of trade on labour productivity growth in Kenya and recommended on suitable policy considerations in enhancement of labour productivity growth in Kenya. The study employed secondary data where the information gathered covered period of 1980 to 2018. The study employed a time series data. From the analysis of the findings, it was concluded that exchange rate had a positive but insignificant effect on labour productivity in the short run. Also, it was concluded that public and private capital influenced labour productivity. Both private and public capitals had significant effect on labour productivity. It was also established that labour productivity in Kenya was not significantly influenced by the exchange rate. Moreover, it was concluded that the statistically insignificant relationship between exchange rate changes and labor productivity was as a result of low levels of adoption of technology and human capacity development among Kenyan firms compared to multinational corporations, as technology increases the productivity of goods destined for export. Thus, it was recommended that the government of Kenya should implement monetary policies that put exchange rate on a competitive edge. It was equally recommended that the government should stimulate the economy through investment on public capital formation. This will go a long way in improving exchange rate and consequently improve terms of trade and boost labour productivity.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADF Augmented Dickey-Fuller

AIC Akaike Information Criterion

ARCH Autoregressive Conditional Heteroscedasticity

ARDL Autoregressive-Distributed Lag

BLS Bureau of Labor Statistics

EERC Equilibrium Exchange Rate Changes

ERC Exchange Rate Changes

GDP Gross Domestic Product

IFS International Foundation for Science

ILO International Labour Organization

IMF International Monetary Fund

KIPPRA Kenya Institute for Public Policy Research and Analysis

KNBS Kenya National Bureau of Statistics

LM Lagrange Multiplier

LR Likelihood Ratio

OLS Ordinary Least Square

R&D Research and Development

RESET Regression Equation Specification Error Test

SIC Schwarz Information Criterion

UN United Nations

US United States

VAR Vector Autoregressive Model

VECM Vector Error Correction Model

CHAPTER ONE: INTRODUCTION

1.1Background to the study

Kenya is a country which is in great need of a sustainable economic growth and has the capability of promoting development which will lead to the reduction of poverty levels. Despite the fact that the economy grew at an average growth rate of 5.4% in 2014, it was expected that it would grow at increased rate of 6% in the following year of 2015. The growth rate in the economy was expected to continue rising to a rate of 6.6% in the year 2016 and a rate of 6.5% in the following year of 2017 (World Bank, 2017). As per the World Bank report, Kenya is poised to be a growth powerhouse and it is expected to become one of the economies that is growing at a higher rate within East Africa. This has been attributed to the low costs of energy, growth of industries, growth in the infrastructure, growth of Agriculture as well as growth in the Manufacturing sector. Kenya has been listed as Third fastest growing economy ahead of Africa emerging markets (Standard Digital 2015).

Domestic policies have been seen to have a defining role in determining and explaining the growth of economy. In addition, the government of Kenya has put a number of macroeconomic policies which are aimed at achieving labour growth in large firms as well as small enterprises. One of the macroeconomic policies, is the management of shilling and rate of exchange. Management of shilling exchange rate is based on the fact that economic policies have an influence of the price incentives which come into play on the exchange rate. This has a significant role especially on the real wages and the employee income. The exchange rate significance is based on both the macroeconomic and microeconomic perceptions. For example, the macroeconomic perspectives

mainly focus on the stability of the finance, in that the exchange rate is domestic price stability credible anchor.

Empirical studies done have revealed through their findings that a strong relationship exists between economic performance and changes in behaviour of the exchange rate particularly in Asian, African, and Latin America countries. Domac and Shabsign (1999) stated that despite changes in exchange rate leading to expansion of the economies of the East Asian especially on labour productivity, their continued misalignment have been found to have distorted the economic growth of most of the African countries. Changes in the exchange rate have been found to be significant in determining economic growth and thus the policy formulators should always make reference to the Equilibrium Exchange Rate Change (EERC). Equilibrium Exchange Rate Changes refers to the changes in the exchange rates which happen in absence of price rigidities, short run factors and frictions in the economy (Anigbogu, et al., 2014).

The exchange rate is important particularly for the domestic firms which either import or export goods in that it determines the outcome in terms of profits from their various businesses. Globalization has been seen to have an effect on various firm performance aspects. Globalization has been seen to give firms a platform where they can look for markets where they can exchange their goods as well as sourcing for inputs which they can use for their business development. This has an advantage as it lessens the burden of looking for domestic markets as well as local inputs for their firms. It provides firms with a greater scope where they can increase the production performance. Further globalization has given firms exposure to the external international environment where they devise ways through which they can deal with changes in external competition which may have an effect on firm performance (Aliyu, 2011).

Firm operations do not have either the long run gains or loss in that any change in the exchange rate which might be expected is covered in the contract during the initial pricing. Basing on the various years a change in the normal operating profit which is brought about by short run changes in the exchange rate may be cancelled by a loss or gain mostly on the hedge contract. This is aimed at reducing the variation in the operating earning which are connected to the exchange rate changes. Further the provisions of the termination give a room to the company which helps it retain a strategic flexibility in the operations hedge as opposed to the case where there is a structural hedge (Anigbogu, et al., 2014).Despite there being emerging literature with regard to exchange rate change influence on firm profits and prices, only a few studies have an empirical evidence on the impact of exchange rate on labour productivity.

1.2. Statement of the problem

There exist various channels in the international arena where changes in the international competition has an effect on the productivity of the firm. For example, changes in the international pressure of competition may make the firms to either leave the market or adopt techniques which are efficient in the production process (Melitz and Ottaviano, 2008). Another example is that the increase in competition which may be brought about by exchange rate may lead to the lowering of production as the firm total sales get reduced (Fung, 2008).

Other researchers are of the opinion that real appreciation of the foreign inputs which are of quality and are affordable, may lead to firms being encouraged to adopt technology innovation. Similarly, a real appreciation may lead to reduction in the external profitability which may result into firms not adopting the appropriate technology which may lead to production of quality product (Bustos, 2011). More empirical studies need to be done considering the much significance attached to exchange rate effect on firm productivity.

The empirical evidence available on the influence of exchange rate on labour productivity is scanty and the ones which are available are not comprehensive enough, to give clear findings which may establish the relationship. The current study aims at using the available data from the manufacturing firm to actually establish whether exchange rate has an influence on the labour productivity of the firms. In addition, the current study will find out the possible sources of exchange rate which may be induced by effects of productivity growth. This study thus aims at answering the question: what is the effect of exchange rate on labour productivity growth in Kenya (1985-2018)?

1.3 Research objectives

The main objective of this study is to find out the effect of exchange rate on labour productivity growth in Kenya.

1.3.1 Specific objectives

Specifically, the objectives of this study are:

1) To test granger causality between exchange rate and labour productivity growth in Kenya.
2) To examine the influence of intervening variables public capital, private capital and terms of trade on labour productivity growth in Kenya
3) To recommend policy considerations in enhancement of labour productivity growth in Kenya.

1.4 Significance of the study

The findings of this study will be of benefit to current and potential investors as they will be able to recognize on how well to mitigate on the risks of the exchange rates fluctuations. The findings of this study are of paramount importance in assisting the policy makers to enable them come up

with the necessary regulations to guide the central Bank of Kenya in drafting a foreign exchange rate changes document. This will also help the lawmakers to legislate appropriate laws and regulations which protect the economy specifically those companies that either export or import goods. Finally, the findings of the study will be significant to future researchers who may have interest to further the research on the subject of the study. This will form the basis for more studies and analysis of the relationship of exchange rate and labour productivity growth and how they are related to other economic variables.

The findings of this study will be important to policy makers for they will be able to formulate policies in regards to foreign exchange rate on labour productivity.

1.5 Scope of the study

The main objective of this study was to establish the effect of exchange rate changes on labour productivity growth in Kenya**.** Specifically, the study tested granger causality between exchange rate and labour productivity growth in Kenya; examined the influence of intervening variables public capital, private capital and terms of trade on labour productivity growth in Kenya. The study also recommended policy considerations in enhancement of labour productivity growth in Kenya. The study covered period from 1985 to 2018. This study used data from international sources for harmonization purposes.

CHAPTER TWO

2.0 LITERATURE REVIEW

This section consists of both theoretical and empirical literature review. The theoretical literature explains the theories in which the study is anchored while the empirical review provides the research done in relation to the subject of the study.

2.1 Labour productivity

Labour productivity is termed as the relationship between the workers input and production process output (Mahmood, 2006). For a country to achieve economic growth, a growth in its labour productivity should be positive and increasing. Economic growth is also achieved through increasing the output of goods and services and not in increasing the labour time of production. It does this by ensuring that it adopts efficient production techniques. The US economy has improved because of undertaking this concept (BLS, 2008). Most of the developing Nations are deficient of human capital which has been seen as an important aspect of growth of the economy.

In view of this, economists worldwide appreciate the role played by foreign firms in developing human capital within developing economies. When they invest in the developing economies, they end up channeling developmental resources in the form of capital and assets (Aitken and Harrison 1999). This leads to increase in the worker's productivity due to the trainings they undergo and the work experience they get while working for the multinational corporations. As the workers later on move away from the multinational corporations so as to work in the domestic firms, they carry along with them good skills which they have gotten from foreign enterprises (Cuyvers *et al,* 2008).

In the developing economies, most of the domestic industries are not competitive in terms of prices and quality when it comes to the international market. The quality of their goods is below par and therefore this result in them fetching lower prices or rejection at the foreign markets. The manufacturing industries in the developing economies at times contribute much less than the agricultural industry economy (Mahmood, 2008).

2.2Theoretical Literature

2.2.1 The purchasing power parity theory

This theory was advanced by Cassel (1918) and states that changes in the exchange rates in the long run to ensure that the goods from various countries have a similar cost when they are denominated by a similar currency (Fisher, 2000). According to Cassel (1923) a currency's exchange rate against a second one achieves a state of equilibrium once the purchasing power of both currencies is equal in the two countries under comparison. In other words, the PPP is an association between the exchange rate of a country and volatility of is national price compared to that of another country.

Usually, the nominal exchange rate between one currency and another is the same as the collective price level ratio between the countries under comparison. This supposition is held by the PPP theory and aims at ascertaining that the power of a currency maintains its purchasing power across borders. It is necessary for one unit of a local currency to purchase the same amount of goods in a foreign country as those that it purchases locally. Thus, the idea behind Purchasing Power Parity is to allow the purchasing power of a currency to remain the same across two countries (Holmes, 1967).

The changes in the exchange rate will have an effect on multinational profitabilities and will expose them to other enterprises as well as financial institutions. The theory has been a subject to both support from various scholars as well as criticism on areas of weaknesses. When the exchange rate is stable the firms will be in a position to do an evaluation of the investment performance, as well as financing which will lead to the decrease in operational costs (Kandil, 2005; Rahman and Hossain, 2003). Changes in exchange rate may be significant to the macroeconomics such as the wages, level of input, prices as well as inputs. This may lead to disequilibrium in the macroeconomics which may call for changes in the exchange rate to ensure the equilibrium balances (Parikh and Williams, 1998). Economists have criticized this by arguing that it does not consider transaction cost, transport cost and other trade barriers.

2.2.2 The balance of payments theory

The theory states that the supply of foreign exchange is the main determinant of the exchange rate of a country currency. This implies that when the demand of foreign exchange exceeds the supply the country currency price will go up and vice versa (Kanamori and Zhao, 2006). The demand and the supply of foreign exchange results from the balance of payments items which includes the debit and credit items. Demand of foreign exchange emanates from the balance of payment debit side. The debit side contains the goods and services which are imported and the investment and loans which are made abroad (Kanamori and Zhao, 2006).

The balance of payments and the credit, results to the need of supply of foreign exchange. This is made up of things like receipts of capita, exporting goods and services etc. There is a decline in the foreign rates if a country cannot afford the balance of payments. If the country is able to afford the balance of payment, then there would be an increase in the exchange rate. More foreign amounts can be purchased or bought by the domestic currency (Kanamori and Zhao, 2006). If a

country's equilibrium falls below an affordable balance, there would be an intense balance payment. There is an increase in the export and hence an elimination in the intense balance of payment thus restoring the equilibrium rate. If balance of payment of a particular nation is okay, it results to a rise above the equilibrium by the exchange rate, hence a reduction in exports.

2.2.3 Flow oriented model

The model makes an assumption that the country trade performance balance and the current account are the main determinants of the exchange rate. The model further states that when there is change in the exchange rate the competitiveness as well as trade balance are affected. This will have an overall effect on the economic variables that will include the real output and the income (Dornbusch et al., 1980). The stock prices will tend to change in relation to the right economic perspectives. This model presents a relationship which is negative between the exchange rate and the stock prices where the causation running direction happens from the exchange rate to the stock prices. The causation running occurs when there is depreciation in the domestic currency which results increased competitiveness of the local firms which in turn leads to cheaper exports especially in the international market. When the exports are high the income will tend to be high which will lead to firm stock prices increase.

2.3. Empirical literature review

Firm heterogeneity is important in any economy and has gone to the extent of determining the production and productivity of any given organisation. The main findings of models and theories in earlier economies is that some of the many big organisations may tend to give pressure in mixed markets in that the larger markets may opt to reduce its productivity in order to sustain itself in the market, while there are some smaller markets that are active, which are eventually forced out of the markets (Melitz, 2003; Melitz and Ottaviano, 2008). Theories and models that have been

introduced to the markets more recently help to understand the effect that liberation has on the markets' productivity. They help in this by merging the innovation and the technologies that have been brought to the market as the main drivers for firms' productivity. These findings conclude that any increase in exchange rates and a decrease in profit exports may at times or always bring about a lower production rate in the markets. This is found so, in that it discourages any market to adopt to the new technologies and innovations introduced to the markets (Yeaple, 2005; Bustos, 2011).

Fung (2008), brought together the rate in variable and exchange to the competition theory or model monopoly done by Krugman (1979). In the model the domestic producers cost is increased by the relative cost and this is compared to foreign investors, this is guided by the responses of two different firms that they share an opposing effect sharing same reduction in the competition brought about by the exchange rates reduction which will also bring about the reduction of the firm's sales both the domestic and foreign. In the long run this will eventually lead to the exit of some markets that are domestic hence give the remaining firms a much larger market for production. There might also be a decline in the remaining firms' sales if its rates are low or there is no increase in foreign firms' sale. If the remaining firms scale exhibit an increase in returns, there will be a reduction on productivity due to the reduced sales.

According to Boler et al. (2012), another way in which the ways of exchange rates may affect production of a firm is through the lack of affordable high-quality inputs of the intermediates and this can also bring about the adoption of technology and innovations. Moreover, Boler et al. (2012) came up with a global model for international markets with mixed firms. The model explained that the reducing cost of import inputs levelled down the production margin cost and increased the profits of a firm which also increased the fixed R&D costs that is incurring.

Ekholm et al. (2012) makes an estimate in a company in Norway on how the exchange rates movement affects productivity. To examine it at all, the sharp appreciation in the Norwegian Krone in years 2000-2005 contained a greater impact on the firm's productivity which had large net trade exposures initially. They studied the effect of the offset increased import commodities. They found that there was a positive effect on the threat gain to profitability coming from exchange rate increase. They further found out that tech and innovation had played a bigger part in the production of the firms.

Tomlin and Fung (2010) did an investigation to find out if there were any distributional effects on a level of industry exchange rate production. They adopted a quantile regression type of analysis as Canadian plant level data reveals, and they discovered that there was a positive effect on the appreciation of the industry-level trade to the plant production at the smaller end of distribution.

Fernandes and Paunov (2009) discovered that there was a positive effect and was significant in the competition on imports on upgrading of the plant level production quality. They used a data from Chile from the period between 1997 and 2003. The data was based on the manufactured goods. Their investigation was based on effects of imported good, competition which was presented by the logistics costs and the upgrading of goods quality. Kugler and Verhoogen (2008) shows that there will be an encouragement to the firms to use technology and innovation if at all there is an increase in productivity of the exported goods. They also found out that there was no effect on the exiting of a firm and the decision to enter the market, but the market for export intensity was highly influenced.

2.4. Overview of the literature

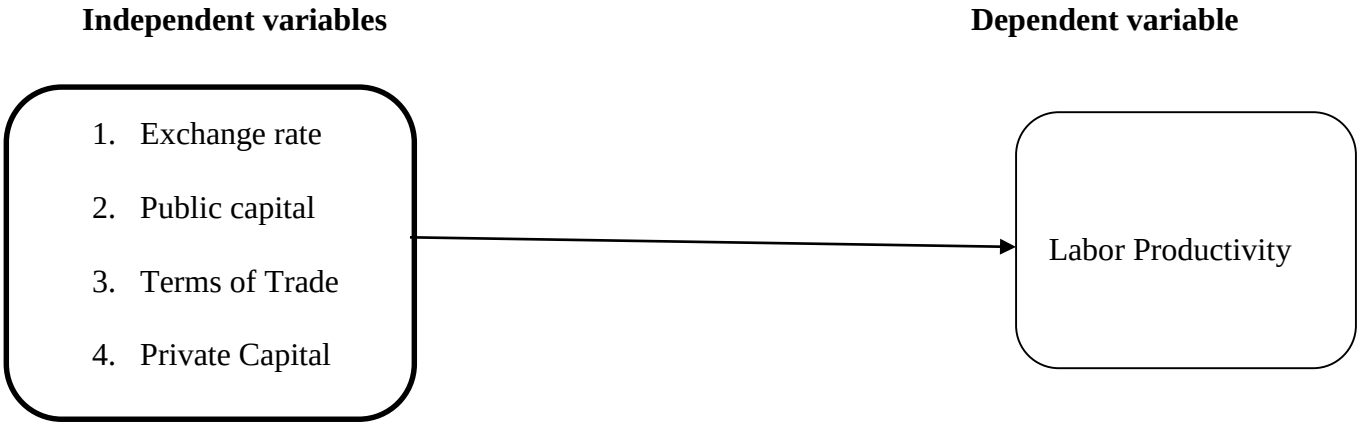
There is ambiguity in the sense that, there is or might be a relationship between the competitive pressure internationally with productivity. Depending with the channels or ways used for exchange rate, there will always be a difference. There are issues that have come up from the empirical literature above. First there is no any accounted literature that provide a clear channel or way at which exchange rate happens as it is identified by Campa and Goldberg (1999). The main reason for this is that there is no data that would account for that information. The second issue is that many studies done, only depend on the variation of an organisation at an industry level, on the exchange rate measure to investigate the effects found on performance measures, and scholars like Fung, 2008; Tomlin and Fung, 2010 are a good example.

CHAPTER THREE

3.0 Methodology

3.1 Conceptual framework

The conceptual framework aims at depicting the variables used in the study. Labour productivity is affected by a number of factors. In this study, labour productivity will be the dependent variable. On the other hand, independent variables to be used include labour force, quantity of private capital stock in the economy, amount exchanged in the economy, quantity of stock of public capital and changes in the terms of trade. The factors are shown in the diagram below.



Source: Author, 2019

Figure 1: Conceptual frameworks on the model variables

Campa and Goldberg (1999) identified three channels of exposure through which a change in the real exchange rate affects the international competitive pressure that firms face. Real exchange rate exposure can occur from (i) the sale of output in foreign markets, (ii) purchases of imported inputs and (iii) import competition in the domestic market. The potential effect of real exchange rate on the first two channels can have opposing effects on the international competitive pressure faced by firms. For example, a real appreciation increases the price of exports in foreign currency

and other things equal, should lead to a decrease in firm profits. The larger a firm's share of exports in total sales is, the larger the impact of a change in the real exchange rate on profitability will be. However, a real appreciation also decreases the price of imported inputs in the domestic currency and should lead to a reduction in costs and consequently an increase in firm profits. The opposite effects are true in the event of a real exchange rate depreciation. Therefore, the overall effect of real exchange rate movements on the profitability through the first two channels depends on the firm's net trade exposure to foreign markets. For example, a real exchange rate appreciation will lead to increased international competitive pressure for a firm whose exports exceed imported inputs. A real exchange rate depreciation will lead to a decrease in international competitive pressure for a firm whose exports exceed imported inputs. The import competition channel refers to the effect of real exchange rate on the domestic firm's performance which is due to its influence on the competitive position of external firms in the domestic market. An exchange rate appreciation of the home currency against its trading partners will weaken the international competitive position of the domestic firm against foreign competitors in the domestic market. This should lead to a decrease in the profitability of domestic firms.

To estimate the labour productivity model, a cross-sectional sample of firms will be used, where data from different firms in the manufacturing sector in Kenya will be used. The arrows in Figure 1 depict causality ad running from the independent variables (exchange rate, public capital, terms of trade and private capital) to dependent variable (labor productivity).

The control variables will include public capital, terms of trade and private capital. According to Marrocu and Paci (2010), public capital has a positive and significant effect on production after controlling for the impact of intangible inputs such ad research and development, human and social capital. Besides, increases in public investment spending on economic infrastructure have a

positive and highly significant effect on the rate of labor productivity growth (Miguel, 2002). International trade has a positive and significant influence on productivity (Alcalá & Ciccone, 2003). In regard to private capital, Miguel (1998) established that rate of productivity growth is positively and significantly influenced by rise in private investment.

3.2 Theoretical model

Productivity studies refer explicitly to expansion of stock of knowledge through spill overs generated by changes in the exchange rate. Theoretically exchange rate has a positive correlation with labour productivity and this relationship is positive due to use of improved technology to enhance productivity so as to promote growth (Ayanawale, 2007; Lim, 2001). To study productivity, the model to be used assumes that labour, capital and technology are the primary sources of growth. Bende-Nabende et al, 2002, 2003, Li and Liu 2005, footsteps will be followed who used the Cobb-Douglas production function;

$Q=AL^{\beta}{}_{1}K^{\beta}{}_{1}$ ……. (1)

The impact that ERC has on labour productivity is what motivates this study.

Therefore, the general production function is given as;

$Q=A_tK_t^{\beta}{}_{1}ERC_t{}^{\beta}{}_{2}L_t{}^{\beta}{}_{3}G_t{}^{\beta}{}_{3}$……(2)

Where:

Q-is the real output.

K_t-Denotes domestic private capital

ERC - Exchange Rate

L - Is the labour

$B^{1,}$ β^2, β^3 β^4 - Represent the shares of private capital, foreign capital, domestic labour, and government public investment respectively.

A-Represents technology/production efficiency

G-Is the public investment

We further assume that β_1, β_2, β_3, $\beta_4$are less than one so that there is diminishing returns to labour and capital inputs.

3.3 Model specification

To answer the objective of this study, the following model will be adopted;

$$lnl = \beta_0 + \beta_1 InERC + \beta_2 InK_t + \beta_3 InPubC + \beta_4 InToT + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where;

LnL=natural log of Labor Productivity

Ln ERC= natural log of exchange rate

LnK_t= natural log of Private Capital

LnPubC= natural log of Public Capital

LnToT= natural log of Terms of Trade

β_0 =Constant

$\beta_1 to\ \beta_4$= Coefficients of the independent variables

ε = Error Term

Table 1: Definition and measurements of variables

Variable	Data Description	Measurements	Expected Signs
Labour productivity	Labour productivity refers to the technical relationship that exists in the production process among the input from workers and outputs.	Total Output / Total Man-Hours.	
Private Capital	Is a ratio obtained by dividing the total private investments in the economy by the GDP of economy?	$k_t=\frac{private\ capital\ stock}{GDP}$ (current and capital) as a percentage of GDP.	Positive (+)
Public capital	Stock of public capital is a ratio denoting public investment spending in the economy for the infrastructural projects as a proportion of GDP.	gross capital accumulation as a percentage of GDP)	Positive (+)
Exchange rate	Is the price of local currency in terms of foreign currency?	In this case it will be measured in terms of Kenyan shillings per US dollar	Positive (+)
Terms of Trade	This is the terms of trade of a country. It is a ratio obtained by dividing the total exports of an economy by the total imports.	$TOT=\frac{Px}{Pm}$	Positive (+)

Source: Author, 2019

3.4 Data types and sources

This study will employ secondary data in the analysis. The data will be for Kenya for the period 1985 to 2018 and it will be time series in nature. It will be obtained from IMF, IFS, world development indicators, world investment directory published by UN, official publications of

economic surveys by Government of Kenya through KNBS. Other data will be also obtained from KIPPRA and ILO.

3.5 Estimation method

The study will examine Granger causality between exchange rate and labour productivity growth in Kenya. Granger causality is statistical tests that examines whether a time series predicts another time series (Granger, 1969). Granger causality uses the prior values of a time series to predict future values of another time series. The main assumption in Granger causality are that the cause happens prior to its effect and that the cause has unique information about the future values of its effect. Granger causality consist of a series of *t*-tests and F-tests on lagged values of independent variables.

Time series modeling will be used to model labour productivity and exchange rate in this study. Time series modeling involves several procedures to be done in order to determine the regression model to be estimated. The study will conduct various diagnostic tests before running the model. This will ensure that time series assumptions are not violated. There are both pre and post estimation test that will be conducted. The pre estimation tests include**:**

3.5.1 Lag Length determinations

The study will use likelihood ratio (LR) test to test select the lag length to be used in the VAR, VECM or ARDL. The selection of appropriate lag length ensures that the residuals do not have significant autocorrelation since autocorrelation leads to inconsistent least square estimates (Enders, 1995). The study will complement the LR test with Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) statistics. A smallest lag is able to be selected in the same criteria without losing too much in the freedom on degree.

3.5.2 Test for stationarity

A presence of unit root will be tested in these series on this study. According to Gujarati (2008) a stationary series is a series that has both the constants of variance and mean over a period of time and the covariance in the time that is between the two depends on the gap that is in the both time periods and not the exact time of calculation of the covariance otherwise the series is nonstationary. Estimating an Ordinary Least Square (OLS) model with non-stationary series would result to spurious results (Gujarati, 2008). The commonly used techniques for testing for unit root are Augmented Dickey-Fuller (ADF) and Phillips-Peron. ADF test has a null hypothesis of a presence of unit root, that is, the series integrated of order one. Though Phillips-Peron has a different specification as that of ADF, this study will use ADF to test for presence of unit root for the variables used in the analysis.

3.5.3 Cointegration test

In order to come up with the relationship found between variables, the series must be integrated of order one. Given that variables are integrated of order, it is then possible to test for the number of long-run equilibrium relation(s) among the variables (Johansen, 1991). This is done by use of trace or maximum eigen values. The null hypothesis of the trace statistic is that there are r cointegrating relations against the alternative that states that there are k cointegrating relations. The null hypothesis for the maximum eigen values is that there are r cointegrating relations against the alternative hypothesis of r+1cointegrating relations. However, if the series are integrated of order one and order zero then ARDL approach will be used to estimate the long and short run relationships.

3.5.4 Autocorrelation test

Running a model in the presence of autocorrelation the estimates are unbiased, consistent and asymptotically normally distributed but they are not efficient. Thus, it is important to test for serial

autocorrelation in order to ensure that the estimates are efficient. Among other tests of autocorrelation such as Runs test, Durbin-Watson tests and the Breusch- Godfrey test, this study will use Breusch- Godfrey test since it overcomes the constraints of the tests such as Durbin-Watson test (Gujarati 2008).

3.5.5 Normality test

Running a model with residuals that are not normally distributed will result to an invalid inference of t and F statistics. To ensure that the residuals used are normally distributed, the study will use Jarque-Bera test to test for normality of the residuals. The null hypothesis of Jarque-Bera is that there is no skewness in the series and the kurtosis is mesokurtic. This implies that for normally distributed residuals the Jarque-Bera statistic is equal to zero (Gujarati 2008). Other tests that the study will conduct include ARCH effects, Ramsey RESET test and test for stability of parameters.

CHAPTER FOUR: EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the empirical findings on exchange rate changes and labor productivity in Kenya. The chapter presents the data analysis and interpretation of results. It discusses the summary statistics, correlation analysis, pre-estimation and post estimation tests and the regression results.

4.2 Summary statistics

Table 2 gives a summary of the basic descriptive statistics of the data. It shows the variables, number of observations, the mean values, standard deviation and the minimum and maximum values for each of the variables employed in this study.

Table 2: Descriptive statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) Min	(5) max
Labor productivity	34	68.45	4.142	54.34	73.51
Private capital	34	14.66	6.179	7.466	25.42
Public capital	34	19.67	3.009	15.00	25.45
Exchange rate	34	63.62	27.22	16.23	103.4
Terms of trade(billion)	34	-7.458	4.105e	-1.543	2.096

Source: Compiled from Stata

From table 2, the number of observations for each variable equaled 34. On average, labor productivity for Kenya was 68.45. Labor productivity had the highest mean value of 73.51 with the least value at 54.34. Private capital had an average of 14.66% with a standard deviation of 6.179%.

Private capital recorded a maximum value of 25.42% of GDP and was at minimum at 7.466% of GDP. On the average, public capital as a percentage of GDP stood at 19.67% with a standard

deviation of 3.009%. Maximum value of public capital as a percentage of GDP was recorded at 25.45% with a least value of 15.00%. Exchange rate averaged 63.62 local currency per USD with high value recorded as 103.4. Terms of trade averaged a deficit of 7.458 billion with a maximum surplus of 20.96 billion.

4.3 Multicollinearity

The pair wise correlation matrix and Variance Inflation Factor method, were used to check for the degree of multicollinearity among the explanatory variables. Multicollinearity inflates the variance of the parameter estimates leading to wrong magnitudes of coefficient estimates (Gujarati, 2003). There is thus need to ensure a weak degree of correlation among the explanatory variables. Table 3 below presented the pair wise correlation matrix.

Table 3: Pair wise correlation matrix

	Lnlabor productivity	**lnPrivate capital**	**lnPublic capital**	**lnExchange rate**
lnlabor	1.0000			
lnPrivate capital	-0.4146	1.0000		
lnPublic capital	-0.4055	0.3585	1.0000	
lnExchange rate	0.1331	0.4038	-0.5526	1.0000

Source: Compiled from Stata

Table 3 revealed a weak degree of correlation among the explanatory variables. However, a more formal test using the Variance Inflation Factor method was employed. The correlation matrix further demonstrates that both private and public capital formation have weak and negative relationship with the labor productivity. However, exchange rate has positive but weak association with labor productivity.

The weak correlation among study variables show that the study estimated correct magnitudes of regression coefficient. The existence of a weak correlation among explanatory variables enabled the study to accurately examine the relationship between the independent and dependent variables.

4.4 Unit root test

This study employed the Augmented Dickey Fuller (ADF) in testing for stationarity of the variables. ADF test is preferred over DF as it is able to account for the problem of serial correlation. The null hypothesis postulates that there is a unit root and thus the variable is non-stationary. Table 4 shows the stationarity test results of the variables employed in this study.

Table 4: Unit root test results

Variable	**Calculated test statistic**	**Critical values**			**Stationarity status**
		1%	5%	10%	
Lnlabor productivity	-5.318	-3.696	-2.978	-2.620	I (0)
Lnprivate capital	-0.371	-3.696	-2.978	-2.620	I (1)
Lnpublic capital	-2.676	-3.696	-2.978	-2.620	I (1)
Lnexchange rate	-2.113	-3.696	-2.978	-2.620	I (1)

Source: Stata computation

From table 4, lnlabor productivity was found to be stationary in levels. Lnprivate capital, lnpublic capital and lnexchange rate were differenced once to make them stationary. They were thus integrated of order 1. An ARDL model is thus suitable for stationarity of variables of order I (0) or I (1) or a combination of both. The ARDL bounds testing procedure developed by Pesaran & Shin (1999) and Pesaran et al. (2001) were thus applicable to this scenario.

This is unlike other tests like Johansen (1995) and Jusclius (1990) that require all variables to be integrated of the same order, I (1).

4.5 Post-estimation tests

Before estimating the ARDL model, several post-estimation tests have to be conducted. The model follows certain key assumptions: No autocorrelation of the error terms, no heteroscedasticity, normal distribution of the residuals and stationarity of data at I (0) or I (1) or a combination of both (Pesaran & Shin, 1999 and Pesaran et al. 2001). The following diagnostic tests were thus performed.

4.5.1 Variance inflation factor

Variance Inflation Factor (VIF) is the reciprocal of tolerance (Gujarati, 2003). A variable can be dropped if it exhibits a very strong correlation with other explanatory variables (Gujarati, 2003). However, with the VIF method, variables can still be retained despite the presence of correlation as long as the mean VIF value of all the independent variables does not exceed 10 (Kennedy, 1992). Table 5 shows the VIF values of the explanatory variables employed in this study.

Table 5: Variance inflation factor

Variable	**VIF**	**1/VIF**
LnExchange rate	3.59	0.278915
LnPublic capital	3.44	0.290412
LnPrivate capital	2.86	0.349914
Mean VIF	**3.3**	

Source: Stata computation

Since the mean VIF of all the explanatory variables was found to be less than 10, we concluded that multicollinearity was not a problem in this study. The absence of multicollinearity enabled the study to include all the explanatory variables (exchange rate changes, private capital, public capital and terms of trade) in the ARDL model used in the prediction of labor productivity.

4.5.2 Autocorrelation test

The test was performed on the residuals using the Breusch-Godfrey (BG) test. In the ARDL model, there should be no serial correlation of the error terms in successive time periods. This would ensure consistent and non-spurious parameter estimates. Under this test, the null hypothesis postulates that there is no serial correlation of the error terms.

Table 6 shows the autocorrelation test results.

Table 6: Breusch-Godfrey LM test for autocorrelation

Lags (p)	chi2	df	Prob > chi2
1	2.073	1	0.1499
H0: no serial correlation			

Source: Stata computation

Since the probability value of chi-squared was found to be greater than the alpha level of significance, that is; 0.1499>0.05, then the null hypothesis of no serial correlation is not rejected (Breusch and Godfrey, 1979). There was no serial correlation problem of the residuals. The absence of serial correlation of the error terms in successive time periods ensured consistent and non-spurious parameter estimates among the study variables.

4.5.3 Heteroscedasticity test

To test for heteroscedasticity, the Breusch-Pagan test was employed. The error variances are constant under the null hypothesis of homoscedasticity. Heteroscedasticity does not interfere with the with the consistency and unbiasedness properties of OLS estimators. The estimators are however no longer minimum variance (Gujarati, 2003). The variance of the error term should be constant to ensure unbiased standard errors. Table 7 presented the heteroscedasticity test results.

Table 7: Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Variables: fitted values of ln Energy consumed	
chi2(1) = 1.75	Prob > chi2 = 0.1862
Ho: Constant variance	

Source: Stata computation

Since the probability value of chi-squared was found to be greater than the alpha level of significance, that is; 0.3683>0.05, we fail to reject the null hypothesis of homoscedasticity. We thus concluded that the model was homoscedastic.

4.5.4 Normality test

Jarque-Bera test was used to determine whether the data employed in this study was normally distributed. Unlike the Shapiro-Wilk test that is performed on raw data, this test is run on the residuals. The null hypothesis postulates that the residuals are normally distributed. Table 8 shows the normality test results.

Table 8: Jarque-Bera test for normal data

Calculated Chi(2) : 0.8767	Probability Chi(2) : 0.6451
Ho: normality	

Source: Stata computation

The probability of chi-squared was found to be 0.6451 which is greater than the 0.05 level of significance. We thus do not reject the null hypothesis of normality, concluding that the residuals followed a normal distribution (Jarque and Bera, 1987).

4.5.5 Model stability test

The CUSUM squared test was conducted to assess whether the fitted ARDL model was stable. Under this test, a model is considered stable if it lies within the 0.05 level of significance. The results were presented in figure 2.

Figure 2: Test for model stability

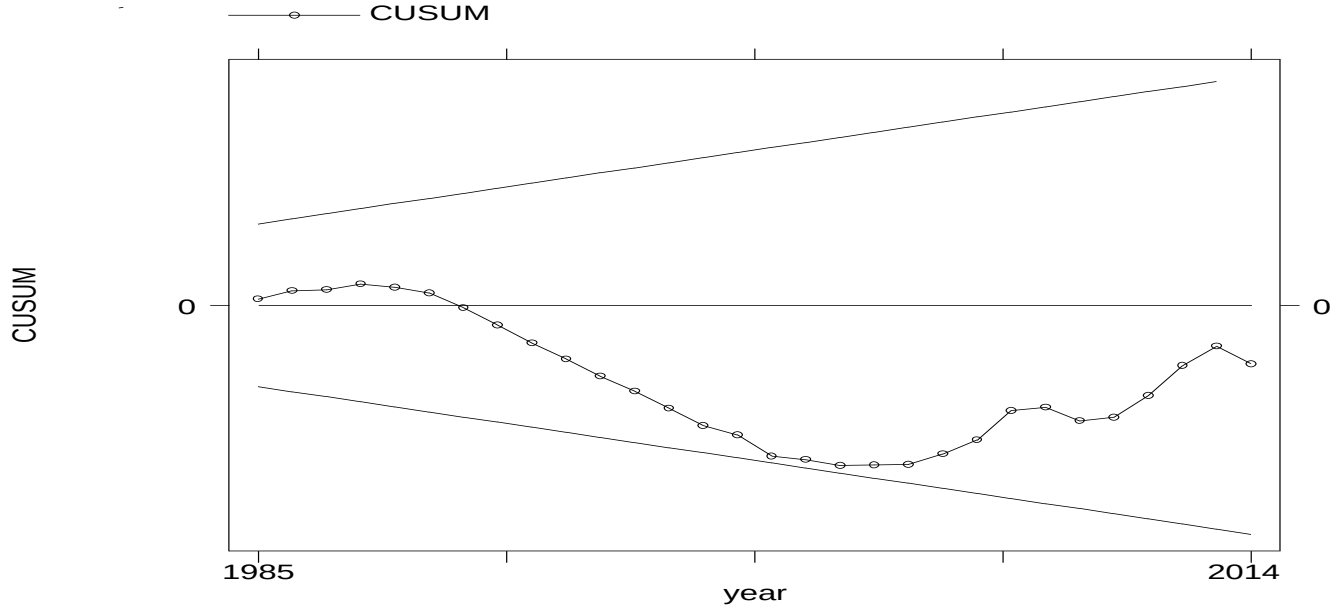


Figure 2 showed that the line graph lied within the 5% significance level and was thus stable. The model was therefore fit for determination of the effect of exchange rate on labour productivity growth in Kenya.

4.6 Lag selection criteria

The ADF test allows for the specification of a lag criterion in the fitted ADF equation. Lags are added to the ADF model so as to account for the autocorrelation problem of the error terms. To determine the optimal lag length, the Akaike Information Criterion (AIC) procedure was used. Table 9 presented the AIC lag selection criterion for the variables employed in this study.

Table 9: AIC lag selection criteria

Variable	Number of lags
Lnlabor productivity	4
Lnprivate capital	4
Lnpublic capital	4
Lnexchange rate	4

Source: Stata computation

The AIC joint lag selection criterion across all the variables specified a maximum lag of 4 for the fitted ARDL model.

4.7 The ARDL model

Since the variables were integrated of a combination of order 1 and 0, the ARDL model was fitted. It is also possible to test for cointegration within the ARDL framework. To check for the presence or absence of cointegration, the bounds testing procedure was applied. Under this test, if the F calculated is greater than the I (0) lower bound critical values, then the null hypothesis of No Cointegration is rejected (Pesaran et al. 2001).

Similarly, if the calculated test statistic is less than the t critical values for I (1) regressors, then the null hypothesis of No Cointegration is equally rejected. The Error Correction model is thus fitted within the ARDL framework to capture both the short run and long run relationship. However, failing to reject the null hypothesis implies that there is no cointegration hence we only estimate the short run relationship; that is the ARDL model.

4.7.1 The ARDL bounds test

The test was conducted to determine whether cointegration existed within the ARDL framework. The results were presented in Table 10.

Table 10: The ARDL bounds test statistics

Statistical test	**Critical values**					**Cointegration**	**Decision**
F= 3.307	I (0) values	2.72	3.23	3.69	4.29	**YES**	Estimate ECM
t = -1.633	I (1) values	-2.57	-2.86	-3.13	-3.43	**YES**	Estimate ECM

Source: Stata computation

From Table 10, the F statistic was found to be greater than the lower bound critical values leading to the rejection of the null hypothesis. Similarly, the test statistic was found to be less than the upper bound critical values hence leading to the rejection of the null hypothesis as well. Rejecting the null hypothesis of No Cointegration implies that cointegration exists. The Error Correction Model was thus estimated within the ARDL framework.

The ARDL bounds test shows that there was association between the study variables. Therefore, labor productivity had a relationship with the exchange rate changes, private capital, public capital and terms of trade.

4.7.2 The Error Correction Model (ECM) regression results

This study thus estimated the ECM. The final model results were presented in table 11.

Table 11:The ECM regression results

VARIABLES	(1) ADJ	(2) LR	(3) SR
LD.lnlabor			-1.028***
			(0.228)
L2D.lnlabor			-0.521**
			(0.201)
L3D.lnlabor			0.370**
			(0.139)
D.lnPrivate capital			-0.0923***
			(0.0184)
LD.lnPrivate capital			-0.0996***
			(0.0220)
L2D.lnPrivatecapital			-0.0510**
			(0.0173)
L3D.lnPrivatecapital			-0.0303*
			(0.0146)
D.lnPublic capital			0.150***
			(0.0379)
LD.lnPublic capital			0.138***
			(0.0333)
L2D.lnPubliccapital			0.0782**
			(0.0257)
L3D.lnPubliccapital			0.0365*
			(0.0184)
D.lnExchange rate			0.0152
			(0.0140)
LD.lnExchange rate			0.0193
			(0.0138)
L2D.lnExchangerate			0.000271
			(0.0172)
L3D.lnExchangerate			0.0161
			(0.0174)
linPrivate capital		1.011	
		(1.362)	
linPublic capital		-1.776	
		(2.264)	
lnExchange rate		-1.093	
		(1.382)	
lnlabor	-0.0845		
	(0.110)*		
Constant			0.966
			(0.548)

	(1)	(2)	(3)
VARIABLES	ADJ	LR	SR
Observations	30	30	30
R-squared	0.923	0.923	0.923

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Stata computation

4.8 Discussion and interpretation of results

First and third lag of labor productivity has a negative and significant effect on the current labor productivity. The result implies an increase in first and third lag labor productivity will respectively lead to 1.028% and 0.521% decrease in current labour productively. However, second and four lag value of labour productivity has a significant effect on the current labour productivity.

The lagged values of private capital have a significant and negative effect on labour productivity. This implies that 1% increase in private capital will lead to 0.09% decrease in labor productivity. Public capital has a significant and positive effect on labour productivity. In particular, 1% increase in the first lag public capital will lead to 0.15% increase in labour productivity. 1% increase in the second lag of public capital will lead to 0.138%. One percent increase in the third lag of public capital will lead to 0.078% increase in labour productivity. Fourth lag value of public capital has a significant and positive effect on labour productivity. The finding implies 1% increase in fourth lag of public capital will lead to 0.0365% increase in labour productivity. Exchange rate has a positive but non-significant effect on labour productivity in the short run. From the regression results, the coefficient of the speed of adjustment parameter was found to be -0.0845. This implied that 8.45% of the disequilibrium was corrected within a year. R-squared was found to be 92.3%

implying that 92.3% of the total variation in labor productivity was explained by the changes in the explanatory variables included in the model.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarized and made conclusions based on the empirical findings. The policy implications on the findings and areas for further research were also provided.

5.2 Summary of empirical findings

The descriptive statistics indicate that labour productivity ranged from 54.34 to 73.51 with an average of 68.45. The study established that average exchange rate changes was 63.62 with a minimum and a maximum 16.23 and 103.4 respectively. The average percentage of private capital was 14.66% with a minimum and a maximum of 7.466 and 25.42 respectively. The average public capital was 19.67% with a minimum and a maximum of 15.00 and 25.45 percent respectively. The terms of trade had an average deficit of KShs 7.458 billion. The maximum surplus in the terms of trade was KShs 20.96 billion.

The correlation analysis established that the explanatory variables (exchange rate changes, private capital, public capital and terms of trade) had weak correlation leading to estimation of correct magnitudes of the regression coefficient. The ADF test indicated that variables to be integrated should be of the same order. The mean VIF of all the explanatory variables was 3.3 which was less than 10 indicating that multicollinearity was not a problem in the study. Breusch-Pagan test indicated that the model was homoscedastic (P=0.3683). Jarque-Bera tests for normality indicated that data had a normal distribution (p=0.6451). The CUSUM test indicated that the model was stable. In summary, the diagnostic tests indicated that all the study variables labor productivity, exchange rate changes, private capital, public capital and terms of trade data were included in the

model and the four-lag-ARDL model developed was fit for examination of the effect of exchange rate on labor productivity for Kenya.

The main objective of this study was to analyze the effect of exchange rate on labor productivity for Kenya for the periods 1985-2018. The bound tests established that there was association between labor productivity and the exchange rate changes, private capital, public capital and terms of trade.

The study established that 92.3% of the total variation in labour productivity was explained by the changes in the explanatory variables included in the model. The findings revealed that first and third lag of labor productivity has a negative and significant effect on the current labour productivity. However, second and four lag value of labour productivity has a significant effect on the current labour productivity. The lagged values of private capital have a significant and negative effect on labour productivity. Public capital has a significant and positive effect on labour productivity. One percent increase in the third lag of public capital will lead to 0.078% increase in labour productivity. Fourth lag value of public capital has a significant and positive effect on labour productivity. Exchange rate has a positive but non-significant effect on labour productivity in the short run.

5.3 Conclusion

The study concluded that exchange rate has a positive but insignificant effect on labour productivity in the short run. Conversely, capital influenced labour productivity in Kenya. Both private and public capitals had significant effects on labour productivity in Kenya. Labour productivity in Kenya is not determined by changes in the rate of exchange. The import into Kenya exceeds exports to other nations. The imports are mainly carried out by multinational corporations

and majority of the shipping agencies are not locally owned. As a result, labor productivity in Kenya is not significantly influenced by the exchange rate.

The study also concludes that the statistically insignificant relationship between exchange rate changes and labour productivity is as a result of low levels of adoption of technology and human capacity development among Kenyan firms compared to multinational corporations. Technology increases the productivity of goods destined for export. Moreover, most of the domestic industries are not competitive in terms of prices and quality when it comes to the international market.

5.4 Recommendations

Based on the study findings, the following recommendations are made.

First, there is need for government to implement monetary policies that put Kenya exchange rate on a competitive edge. This will improve exchange rate and consequently improves terms of trade and boost labor productivity.

Secondly, government needs stimulate the economy through investment on public capital formation.

5.5 Limitations of the study

The study was not conclusive as it did not include some of the other aspects that affect the exchange rate changes but only concentrated with public capital, exchange rate, terms of trade and private capital as these are observed as the key factors affecting exchange rate changes. The limitations of time constraints and gathering of secondary information were also encountered in the study. This was because the data was not readily available to the public and therefore the researcher had to consult with the necessary authority for permission to access such information. Developing the statistical presentation was an uphill task, since the researcher was not very conversant with Stata

program. This required some extra training on the software to enable proper usage of the same to get the necessary statistical presentations for the data.

5.6 Suggestions for further studies

The study as indicated was not exhaustive of the factors affecting exchange rates changes on labour productivity in the market and its interrelationship with the factors. Therefore, it is envisaged that future scholars and researchers will investigate into details, the effects of the other factors which were not included in this study.

The study further suggested that more research be carried out to bring forth more knowledge to the pool of literature on relationship between public capital, exchange rate, terms of trade and private capital. This is because, very little literature was available to indicate the relationship between the four variables hence this study.

This study employed time series data for analysis, OLS method of estimation and standard deviation to capture exchange rate changes. A replica study should be conducted in Kenya using GARCH in capturing exchange rate changes.

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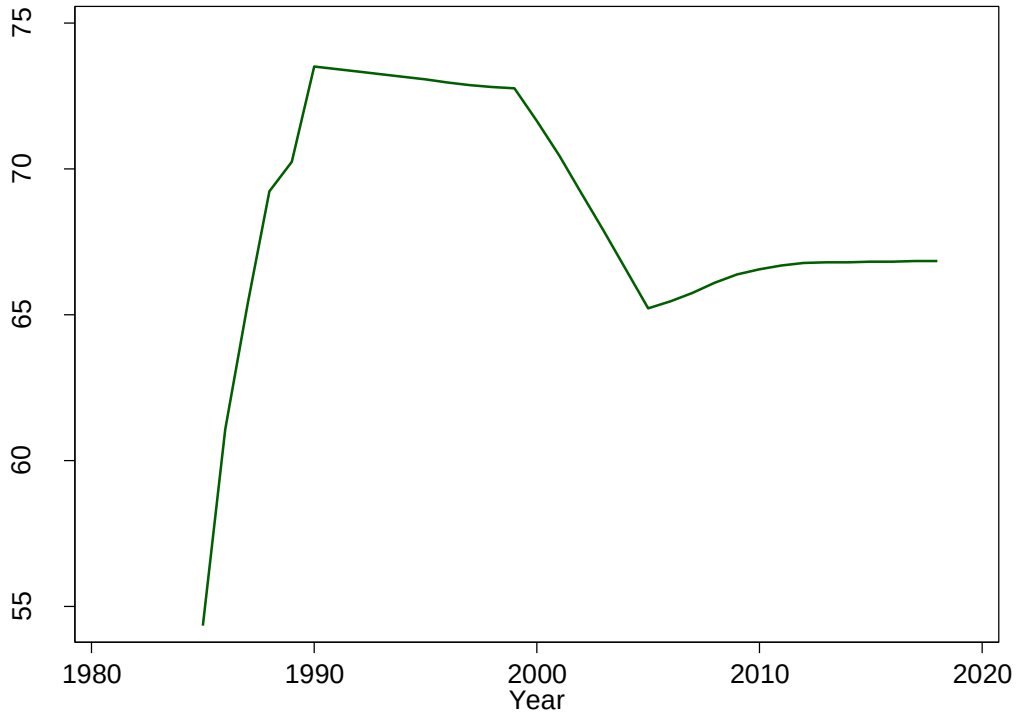
APPENDICES

Appendix 1: Trend analysis of the variables

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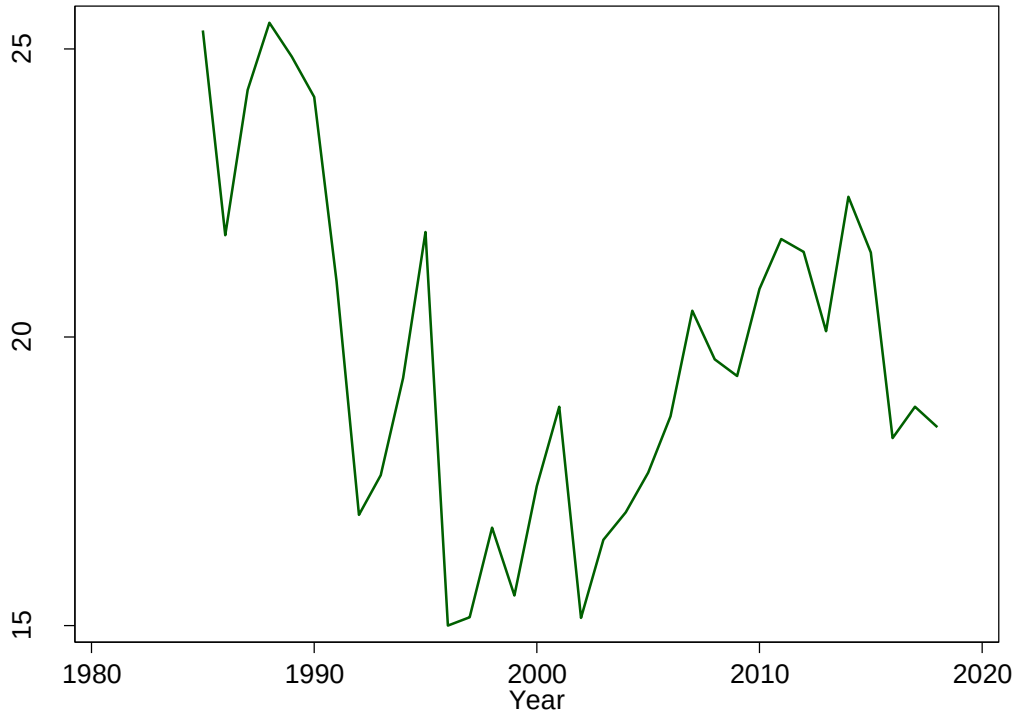
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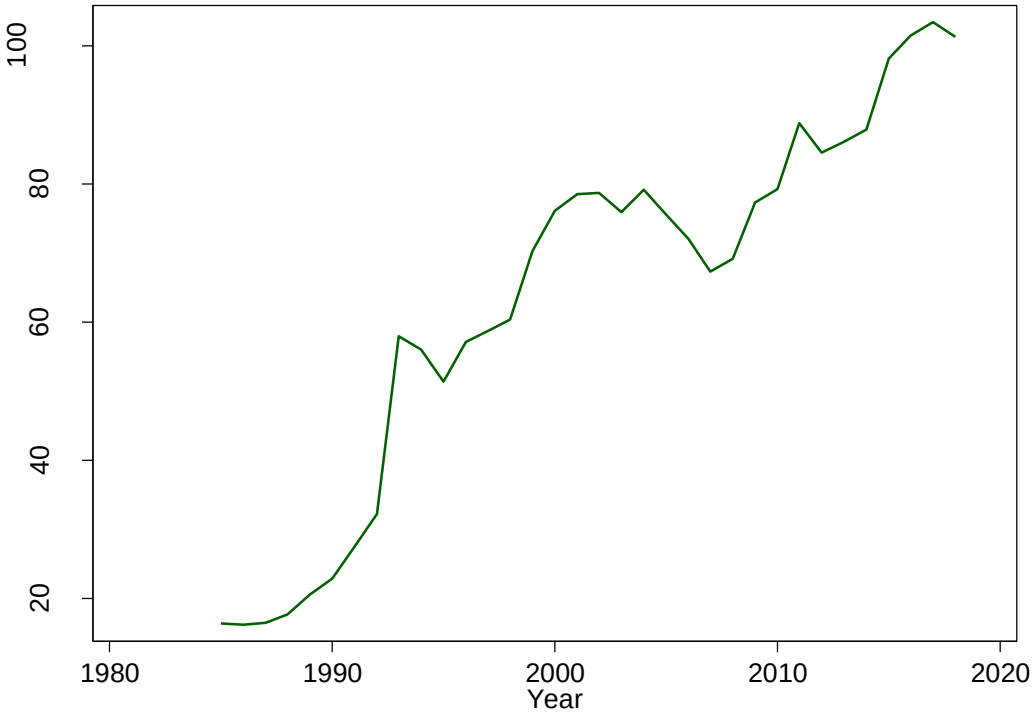
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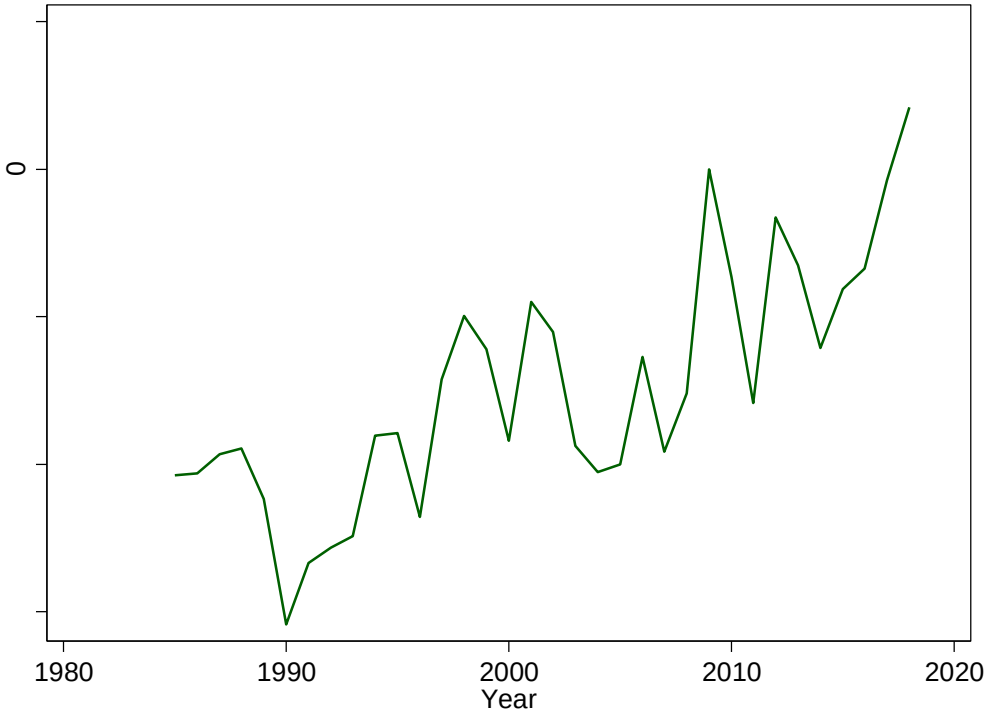
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Appendix 2: Data

Year	labor	Private capital	Public capital	Exchange rate	Terms of trade
1985	54.345	10.65472624	25.32482373	16.43211667	-1.03723E+11
1986	61.0781	11.53939803	21.76803717	16.22574167	-1.03009E+11
1987	65.367	12.49277577	24.28943287	16.45449167	-96537444010
1988	69.241	12.02059996	25.44904102	17.7471	-94649616546
1989	70.255	11.30923493	24.86207761	20.57246667	-1.11877E+11
1990	73.507	10.91269462	24.1640929	22.91476667	-1.54284E+11
1991	73.426	10.48976173	20.97051486	27.50786667	-1.33513E+11
1992	73.347	9.195458009	16.92083908	32.21683333	-1.28287E+11
1993	73.26	9.627491854	17.61043506	58.00133333	-1.24437E+11
1994	73.169	9.861981055	19.29324297	56.050575	-90212165369
1995	73.084	13.50617949	21.8197611	51.42983333	-89498331333
1996	72.965	9.423530301	15.00382269	57.11486667	-1.17918E+11
1997	72.891	8.829082464	15.14098814	58.73184167	-71202908853
1998	72.824	8.482722663	16.69271641	60.3667	-49623137701
1999	72.772	7.91928679	15.52141487	70.32621667	-61089612160
2000	71.651	7.465637832	17.41409062	76.17554167	-92108921876
2001	70.457	7.646411905	18.79034052	78.563195	-45037816894
2002	69.199	7.686862609	15.13821589	78.74914167	-55197298816
2003	67.892	7.821921536	16.48214939	75.93556944	-93663682553
2004	66.561	11.99386724	16.96249556	79.17387606	-1.0266E+11
2005	65.217	16.20632538	17.64968479	75.55410945	-1.00065E+11
2006	65.458	18.86267092	18.6335854	72.10083502	-63577561283
2007	65.76	17.79367309	20.45697839	67.31763812	-95787925595
2008	66.111	17.74830294	19.61271142	69.17531982	-75913372447
2009	66.39	18.72084861	19.33262283	77.3520123	0
2010	66.554	20.76120273	20.84090196	79.2331517	-36468573963
2011	66.704	22.37274608	21.70275889	88.81076997	-79181258634
2012	66.785	22.5248715	21.47559789	84.52960176	-16294549695
2013	66.805	22.8251365	20.10556175	86.1228789	-32504893719
2014	66.813	23.26683764	22.43165798	87.92216381	-60523545973
2015	66.826	24.29546665	21.46595654	98.17845333	-40564015877
2016	66.834	23.35452895	18.25545114	101.5043695	-33562185274
2017	66.855	25.41915569	18.79779638	103.4109163	-3641282463
2018	66.851	25.25571802	18.44275312	101.301574	20955042564

Source: Kenya Bureau of Statistics (2019)