TOTAL FACTOR PRODUCTIVITY AND KENYA'S ECONOMIC GROWTH

ANN WAIRIMU NDEGWA

X50/70044/2011

A research paper submitted to the School of Economics, University of Nairobi, in partial fulfilment of the Master of Arts degree in Economics

NOVEMBER, 2019

DECLARATION

This research project is my original work and to the best of my knowledge has not been presented for award of any academic degree in any other University

Ann Wairimu Ndegwa

Signature………………………… Date………………………………

This research project has been submitted to the School of Economics, University of Nairobi with my approval as a University Supervisor

Dr. Kennedy Osoro

Signature………………………… Date………………………………

DEDICATION

To everyone interested in this area of study.

ACKNOWLEDGEMENT

I am very grateful to my Lord and God for life and His unending Grace.

From deep down my heart I thank Dr. Kennedy Osoro, my supervisor, for his valuable input throughout the study period.

Many thanks to staff at the University of Nairobi, my course mates and colleagues at work who supported me in so many ways,

Finally, I thank my family members both nuclear and extended for encouragement and support that never failed.

I bless all of you.

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LIST OF ABBREVIATIONS

ARDL   Autoregressive Distributed Lag

ECM   Error Correction Mechanism

ERS   Economic Recovery Strategy

ESP   Economic Stimulus Programme

GDP   Gross Domestic Product

GFCF   Gross Fixed Capital Formation

KNBS   Kenya National Bureau of Statistics

KPHC   Kenya Population and Housing Census

OLS   Ordinary Least Squares

PRSP   Poverty Reduction Strategy Paper

TFP   Total Factor Productivity

ABSTRACT

This study examined empirically the role of total factor productivity over the years in shaping Kenya's GDP growth using data from 1985 to 2018. The impact of factors of production- labour, capital and human capital on economic growth was also examined. The study used the Autoregressive Distributed Lag Model to carry out the analysis. According to the ARDL model, there was no cointegration between GDP and the independent variables. The study results showed that all the factors of production used in this study (labour, capital and human capital) were positively correlated to GDP and statistically significant. TFP, which was estimated as the constant in the model, was found to be statistically significant and the most important source of economic growth in Kenya. Arising from the analysis, we concluded that Kenya should put more emphasis on the policies that increase TFP growth or technological advancement in the country in order to increase economic growth.

CHAPTER ONE

INTRODUCTION

1.1. Background

Kenya has developed and implemented many economic policies that have been aimed at increasing the growth of the economy to and above 10% which of course has proven to be a huge task to achieve. The main goal for Kenya, as envisioned in the main development blueprint the Kenya Vision 2030, has been to achieve an economic transformation that increases economic growth and development. Currently the Kenya Government has identified and is implementing programmes and projects in four key areas that are expected to drive the growth of the economy upwards dubbed the "Big Four Agenda" namely, Manufacturing, Housing, Health and Food and Nutrition.

Kenya enjoys a huge pool of resources whereby a higher population is youthful and a good indicator of high labour endowment. Coupled with this is the fact that the Labour Force Participation Rate (LFPR) has been high ranging from 75.7% in 1989 to 77.4% in 2016 (Republic of Kenya, 2018). There is also a highly skilled workforce that means increased human capital. The private sector is dynamic due to the good environment created for them by the government. In addition, there is improved infrastructure throughout the country which leads to increased production possibilities. These factors if well harnessed would enhance her fundamental role in the East African region as well as Africa at large.

Given these resources, the main goal for Kenya's policy makers is to identify the areas that produce sustainable growth by learning from previous economic experiences arising from the implementation of policies and programmes. Kenya needs to adopt an economic transformation strategy that increases production and productivity of resources. Empirical studies in developed countries have found that Total Factor Productivity (TFP) which indicates the productivity of resources has been the leading source of economic growth. Question therefore is why Kenya has not achieved the desired growth levels despite its higher exposure to existing technology, a growing and skilled population and high capital accumulation.

In order for Kenya to implement rational choices that lead to this desired goal of sustainable growth, policy makers require appropriate information and necessary empirical input. Studies

on TFP contribution to growth in Kenya, that would provide insight and guidance to policy, are very few. Decomposition of the contribution of each of the factors of production and TFP to economic growth in Kenya is therefore very necessary so as to gain a clear picture of the differences that each of the factors has produced in the process of growth.

This study therefore seeks to analyse growth in the overall economy with the aim of establishing the role that TFP plays in shaping economic growth. The study aims to establish how essential TFP growth has been for economic growth in Kenya and establish how much economic growth is attributable to TFP in Kenya between 1985 and 2018. The study findings will help to recommend policy measures for improving either total factor productivity growth or factor inputs growth to put the economy in an upward and sustainable trend.

1.1.1. Kenya's Economic Performance

Kenya, being a developing country for a long time, has recorded mixed performance in growth. The economy was basically agricultural with a monetary sector that was based on specialized production of goods for money at independence. After independence, Kenya achieved its objective of rapid economic growth remarkably very well (World Bank, 1963). In the period between 1964 and 1972, the average rate of growth of Gross Domestic Product (GDP) was about 7%. Kenya was at a very early stage of development and compared to other countries in such a stage, its growth performance and the performance of almost all other indicators was remarkable and on an upward trend (World Bank, 1975). This rapid rate of growth was necessitated by a politically stable atmosphere which led to higher levels of private investment as well as a reliable and sound management of the economy. The economy however slowed down after 1973 as a result of various adverse effects such as inappropriate fiscal and monetary policies and the failure of diversifying and expanding exports.

In the period between 1980 and 2003, the economy recorded its worst performance ever with several years recording a growth rate of less than 1%. This was attributable to stagnated agricultural growth in the 1980s being the major sector of the economy. The agricultural sector shrank at an average rate of 3.9%. The economy was further hit by external shocks and this was made worse by imprudent fiscal and monetary management. Poor performance and downward fluctuations was also recorded in the years that the economy experienced drought

due to unfavourable weather conditions especially in 1984 being the first year that Kenya had recorded a less that 1% growth since after independence.

The change of government in 2003 reversed the gloomy prospect of slowed growth that had been experienced in the early 2000s.The new government put in place economic reforms and the cooperation between Kenya and the World Bank and the International Monetary Fund (IMF) which had been cut off in the 1990s was resumed. As a result, the economy became more resilient, there was improved business and investor confidence, a stable macroeconomic environment coupled with a rebound of the global economy which saw the economy improve from a real growth of 0.4% in 2002 to 7.1% in 2007 as shown in Figure 1.1

After dropping in 2008, economic growth resumed reaching a rate of 5.9% in 2016 from 5.7% recorded in 2015 and Kenya became one of the fastest growing economies in Sub-Saharan Africa. The continued economic reforms that included infrastructure development initiatives stabilized the macroeconomic environment and led to a rebound in tourism and this was complimented by low oil prices and strong remittance inflows into the country. However, despite the speeded economic growth in that period, Kenya has not yet achieved a prosperous society for all as envisioned in the Kenya Vision 2030 blueprint. Poverty levels are high at around 40% and the economy is still among the 25% of the poorest countries in the world (World bank Group, 2016). Figure 1.1 indicates Kenya's annual GDP growth rates from 1963 to 2017

Figure 1. 1: Kenya GDP Percentage Annual Growth Rates 1963 – 2017
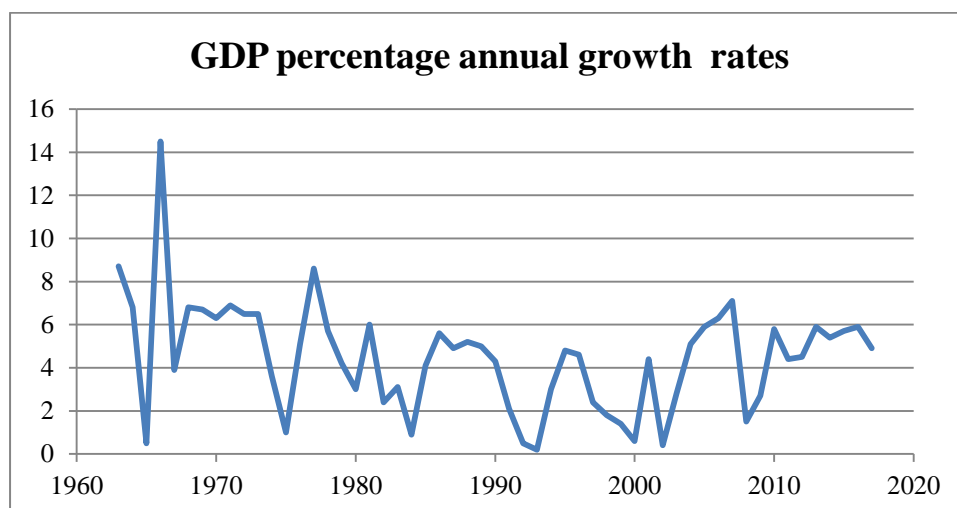
Source: Kenya National Bureau of Statistics

1.1.2. Total Factor Productivity Growth Trends in Kenya

Empirical studies have shown that in the short to medium term, capital and labour increments encourage growth however, sustainable growth can only be achieved through enhancing productivity of factors. There ought to be synchronized improvements through increases in factor inputs and higher growth of productivity or technological progress. Studies in developed countries have majorly shown that growth could be attributed to TFP rather than factor accumulation.

As shown in Figure 1.2 TFP growth rates in Kenya have been low and have recorded a declining trend since 1997 recording the least rate of 0.92% in 2002 up from the highest rate ever attained of 1.2% in 1990. The low rates of growth are in consistence with the results of Onjala (2002) and Kalio, Mutenyo, & Owuor (2012) who found TFP to have contributed the least to economic growth in Kenya.

Figure 1. 2: Kenya's TFP Percentage Annual Growth Rates 1963- 2017
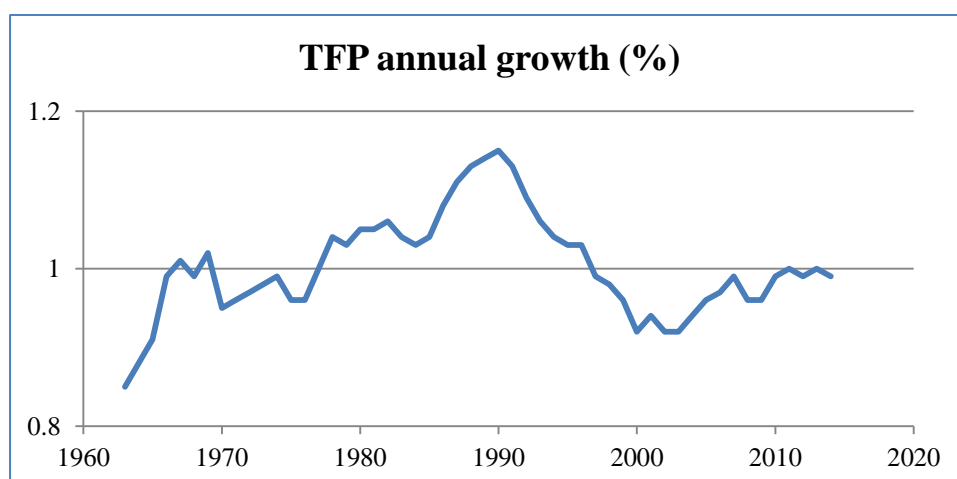
Source: Penn World Tables 9

1.1.3. Trends in Factor inputs accumulation in Kenya

1.1.3.1. Labour

Labour is a necessary input in the production process and very key. The labour factor of production requires to be well nurtured and to be engaged optimally for there to be faster growth of the economy and positive social transformation. Labour comprises the employed and the unemployed categories or the active population. According to the Kenya Population and Housing Census (KPHC) in 2009, 63.2% of the total active population was actively engaged representing a labour force of 20.5 million people as shown in Table 1.1. This,

according to the Census was expected to increase to 24.5 million people and 28.5 million people in 2015 and 2020 respectively. Hence more employment and income generating opportunities would be required for the swelling labour force.

The Labour Force Participation Rate (LFPR) has been high throughout since 1989 although the working age population has been growing faster than the economically active population. The 1999 KPHC recorded the highest labour force participation rate of 82.4% though this rate has dropped to 77.4% as shown in Table 1.1.

Table 1. 1: Trends in Labour Force Indicators

Year of Census	Population aged between 15-64 years (Mn)	Economically Active- Labour Force aged between 15-64 years (Mn)	Economically Inactive aged between 15-64 years (Mn)	Labour Force Participation Rate (LFPR) (%)
1989	10.3	7.8	2.5	75.7
1999	15.3	12.4	2.9	82.4
2005/2006	19.9	14.6	5.3	73.4
2009	20.5	15.8	4.7	76.7
2015/2016	25.0	19.3	5.7	77.4

Source: KNBS, Labour Force Basic Report 2015/16

Kenya's working age population has grown from 10.3 million people in 1989 to total of 25 million people in 2015/16. Over the years the Government has adopted and implemented strategies that create employment opportunities in order to absorb the growing population into the economically active category of the workforce. The Fifth Development Plan (1984-1988) and the Sessional Paper No.1 of 1986 on Economic Management for Renewed Growth, put emphasis on the importance of employment creation to absorb the fast growing labour force. The economic development policy papers underscored the importance of accelerating employment creation and in particular in the private sector and the small scale and medium enterprises. This was geared towards gradually decreasing the employment creation rates in the public sector and increasing employment creation in other economic sectors.

Currently the programmes being implemented by the government are intended to increase employment rates that are specifically targeting the youth, women and persons with

disabilities. To this effect, 30% of all Government procurement opportunities are reserved for these categories as a way of increasing their access to income generating opportunities. The government has also devolved some of its services and functions to counties and has increased resource allocation to the devolved units. These efforts are all intended to increase Kenya's employment to population ratio which currently stands at 71.6%. (Republic of Kenya, 2018).The high ratio is a good indicator that employment is high within the population in the working age category and one would therefore expect that Kenya's GDP should be growing in tandem with the labour force which is not the case.

1.1.3.2. Capital

Capital accumulation in Kenya has been increasing over time resulting from high savings rates and increases in labour force input. Growth of capital stocks has however been affected by the prevailing economic conditions at that particular time. After independence, capital accumulation grew at relatively high rates but recorded a decline in the 1980s as shown in Figure 1.3. This was majorly a result of high world oil prices in 1980 as well as the aftermath of the 1982 disturbances besides the waning of the growth of the aggregate domestic savings in the period.

The situation continued in the 1990s where capital formation majorly recorded a slow growth since there were low external inflows and this also was reflected in the slow growth rate of the general economy. There was diminishing foreign investments including loans and grant inflows into the country. Investment was very low in this period recording its lowest in 1992 where capital formation plunged reaching -18.2%%. The foreign currency crisis in this period discouraged the importation of capital goods since foreign currency had become very expensive and there was also partial liberalization of the foreign exchange regime. This was further worsened by the measure by the monetary authorities to contain the excessive supply of money which resulted in the commercial banks opting to invest in Treasury Bills which offered very high returns rather than lending their funds to the private sector.

The government has continued to adopt policies that encourage foreign investment such as reduced cost of doing business and improvement of infrastructure since for a long time domestic savings have financed a huge part of capital formation. In the 2000s and the past decade, capital formation recoded a positive growth resulting from increased Foreign Direct Investments into the country, increased investments in Information Communication Technology and favourable economic conditions that encourage private investments. The

government has also invested heavily in capital expenditures and majorly in infrastructural development. Physical capital accumulation has been successful for Kenya which should impact growth positively.

Figure 1. 3: Gross Fixed Capital Formation Percentage Annual Growth rates
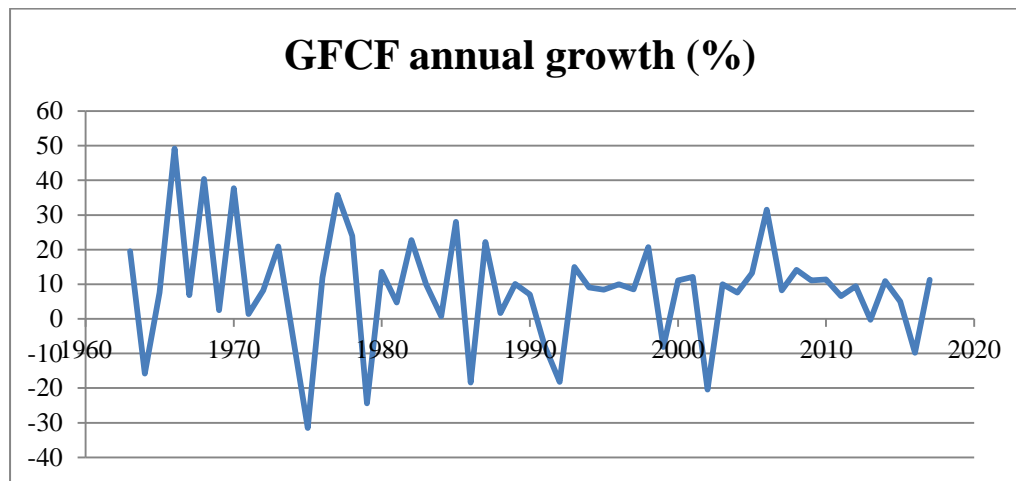
Source: World Development Indicators

1.1.3.3. Human Capital

A high percentage of Kenyans are educated and skilled having passed through the education system. Enrolment in primary and secondary schools as well as higher learning institutions has grown over the years and hence increased the percentage of the educated population. This also implies that there is increased educated labour force. Some of the policies that the government has put in place to support the uptake of education include the introduction of compulsory and free education in primary and secondary schools in 2003 and 2008 respectively.

As shown in Figure 1.4, school enrolment rates were notably higher in the years that the government introduced free primary education such as 1974 and 2008. In recent years the rates of completion have increased considerably. The Pupil Completion Rate in primary schools in 2017 stood at 84% while the Primary to Secondary Transition Rate stood at 83.1% (Republic of Kenya 2018). The government intends to increase this rate to 100% and currently a policy on full transition from primary to secondary school is being implemented. It is expected that a highly skilled population would in turn lead to high rates of economic growth.

Figure 1. 4: Primary and Secondary Schools Enrolment Rates
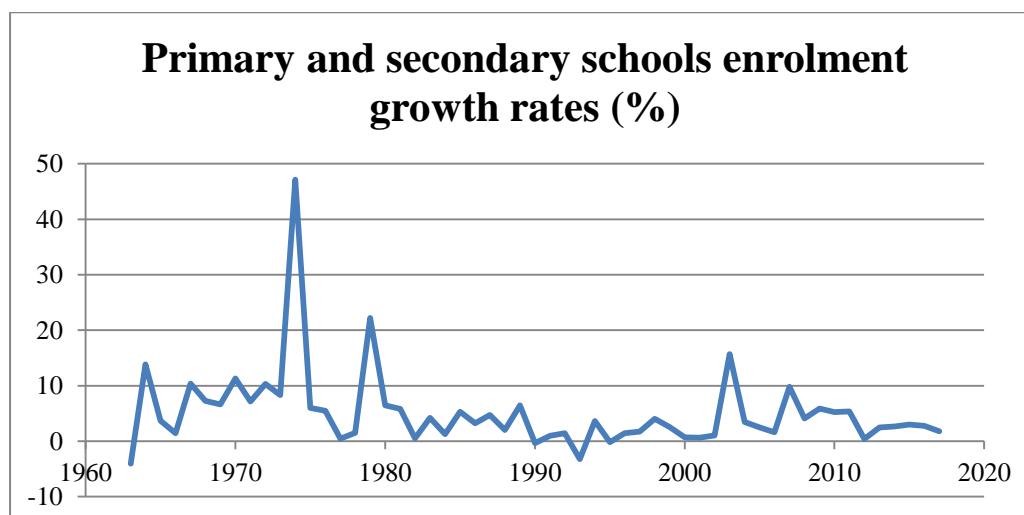
Source: World Development Indicators

1.1.4. Government policies related to economic growth in Kenya

The government has pursued policies that encourage growth in national and per capita income over time. After independence Kenya implemented the sessional paper No. 1 of 1965 to address the challenges of hunger, illiteracy, poverty and diseases. Implementation of the paper up to the 1970s enabled the country to attain reasonably high economic growth rates.

The Structural Adjustment Programme (SAP) was introduced to correct the inefficient and inequitable growth as well as the balance of payments that occurred in the 1980s and 1990s when the economy's growth plummeted to below its potential. The strategy was to establish a new set of price signals that would restructure the pattern of industrial development into a more efficient one. It was also to increase the growth of agricultural sector and expand and diversify exports. By addressing these challenges, the programme would put the growth of the economy in an upward trend.

In 1999, Kenya was guided by the World Bank in conjunction with the IMF to adopt the Poverty Reduction Strategy Paper (PRSP) approach with the main objectives being to reduce poverty and raise economic growth. This was to be achieved though the provision of critical links between support received from donors, national public sector activities and the national outcomes of achieving the Millennium Development Goals (MDGs). GDP growth then was very low averaging between 0 to 4%. Poverty levels were very high and approximately 60% of Kenyans were living below the poverty line. The strategy was seen as a measure of reducing poverty in low-income countries such as Kenya.

1980s and 1990s was the worst period for Kenya and the reforms that the government had undertaken in these periods did not revamp the economy as had been envisioned. As a result, the government adopted the Economic Recovery Strategy for Wealth and Employment Creation (ERS) 2003-2007 with the main objectives of the strategy being to revive the economy and create rapid economic growth, entrench good governance, expand physical infrastructure and invest in the human capital of the poor so as to create jobs and thereby reduce unemployment (Government of Kenya,2003). The target was to achieve growth rate of 8% and achieve an industrial status by 2025 which would further create 500,000 jobs per year. The ERS was fairly successful and enabled the economy to grow from 2.8% in 2003 to 7.1% in 2007, (Government of Kenya 2008).

The post-election violence experienced in Kenya in 2007 had serious adverse effects on growth. The economy grew at a rate of 2.7% in 2009 which was further worsened by prolonged drought in the country, increased oil and food prices in addition to the effects of the 2008 global economic crisis. To correct these economic problems and challenges, the government introduced the Economic Stimulus Programme (ESP) which was aimed at directing the economy on a long term growth and development recovery path.

The ESP was followed by the current development blueprint, the Kenya Vision 2030 whose goal is "to create a globally competitive and prosperous country with a high quality of life by 2030". The blueprint aims to transform the economic growth path from low to a high one that will achieve a double digit growth of more than 10%. Its implementation is through five year rolling plans and the first one, Medium-Term Plan (MTP1) 2008-12 of the Vision 2030, made important efforts to promote growth of the major sectors of the economy and implement comprehensive economic policies. It saw the GDP growth reach 4.5% in 2012 even with challenges of repeated droughts, high international commodity prices, political uncertainty in the period preceding the 2013 general elections and the global financial and economic crisis.

These policy documents have been implemented to a great extent though faced by unique challenges depending on the social and political situations prevailing in the country. Some sectors have excelled while others performed poorly at a given time. Kenya is however still far from achieving its long run development agenda of self-sustenance and sustainable rapid growth.

1.2. Problem Statement

Despite the fact that Kenya has succeeded in factor inputs accumulation, and hence a rich endowment of the factors of production, a double-digit GDP growth has not been attained as envisioned in the Vision 2030 blueprint and other earlier development plans and strategies. Growth has had a fluctuating pattern with some years recording remarkable growth while others recorded dismal performance. In the past decade, the highest level of growth attained was a 7.1% in 2007. Kenya enjoys a large pool of resources and the presumption is that with an increased labour force and gross capital investments coupled with a highly educated labour force, generation of growth should be at a more rapid rate and more sustainable rate than it currently is. TFP growth has however been low within the period that the study covers.

Kenya's labour force increased from 10.3 million people in 1989 to 25 million people in 2016 (Government of Kenya, 2018). Capital stocks have also been increasing over the years resulting from increased domestic savings and foreign inflows which have been the major sources of funding capital accumulation. In addition, the Kenyan population is better educated today as compared to the 1980s and 1990s. The government has implemented policies that encourage acquisition of knowledge including compulsory and free primary and secondary schools education as well as 100% primary to secondary schools transition rate. As a result, school enrolment rates are higher at all levels. The higher institutions of education have been increasing thereby increasing the student enrolment rates in these institutions and hence the number of graduates being released into the economy annually. This indicates that there is a large pool of human capital even in excess of what the government can place in employment.

Therefore, with the increased rate of factor accumulation and a low rate of productivity growth, it is important to analyse and establish the contribution of each of these factors into the growth of the economy and draw policy measures that would favour growth of the factors found to be the most important sources of growth. This is necessitated by the fact that the source of growth in the Kenyan economy is a central issue in policy development.

1.3. Research Questions

i. Is slow economic growth in Kenya a result of slow growth of Kenya's total factor productivity?

ii. What is the effect of TFP on Kenya's economic growth?

iii. What are the policy recommendations arising from the relationship established between TFP and Kenya's economic growth?

1.4.   Research Objectives

The general objective of the study is to establish the relationship between Kenya's economic growth and changes in total factor productivity. This will be guided by the following specific objectives:

i. Establish the relationship between productivity growth and the growth of the economy

ii. To determine the effect of TFP on Kenya's economic growth

iii. Propose policy recommendations with regard to the research findings

1.5.   Justification and Motivation of the study

Establishing the sources of GDP growth has been a critical issue in all economies. Economists have over the years developed models that attempted to establish how economies increased their total output over the years while others have gone further to establish why different economies have grown at different rates despite similar resource endowments. The Kenya's Vision 2030 which is the current government blue print aims at achieving and sustaining a growth rate of more than 10% by the year 2030. Increasing Kenya's GDP growth is one of the top policy priorities for the government. But the question would be how best this would be achieved. And this brings about the question of the route that the government would take to achieve the desired GDP growth. The two main methods of achieving growth are either increasing the quantity and/or increasing the quality of resources or productivity. Each of the methods enlarges the capabilities of production of the economy and this can promote growth through increased quantities of production. This study is therefore aimed at providing such important information which will go a long way in informing decision making and policy formulation in Kenya. It will also build and augment the existing literature and enhance the groundwork for further research in this field.

CHAPTER TWO

LITERATURE REVIEW

2.1. Theoretical Literature

The task of understanding why economies experience different growth rates, that is some growing faster than others and some lagging behind and the factors behind these growth patterns has been one of the basic goals of economic research. Arising from this many models have been developed to attempt to resolve this issue. Growth theories are majorly categorized into three; Classical, Neoclassical and the new/endogenous theories. They have developed over time and each builds upon the previous theory.

2.1.1. Classical Growth Theories

This theory evolved in the eighteenth and nineteenth centuries. David Ricardo, Adam Smith, and Robert Malthus were the main postulators of this theory. According to the theory, there exists a steady state GDP in every economy and if an economy deviates off that steady state the deviation will be temporary and ultimately the economy will return to its steady state. The basic concept of the theory is that changes in GDP affect the population either negatively or positively thereby affecting the demand for resources and consequently influences the Gross Domestic Product to return to its steady state. Therefore, growth in GDP leads to increased population and as a result there is increased demand for the limited resources by the larger population which affects the GDP negatively. This causes the GDP to ultimately fall back to its steady state. On the other hand, a negative GDP growth implies a growth rate below the steady state, population decreases lowering the demand for the resources by the lower population. The GDP eventually rises back to its steady state.

2.1.2. Neoclassical Growth Theories

Solow (1957) advanced this theory by aggregating the production function to productivity and this laid in the simple theoretical link between the production function and the productivity index. According to the theory, there are three factors labour, capital, and technology also known as technological progress that influence the growth of the economy. Technological progress is exogenous and is regarded as the most significant growth factor. There is an equilibrium state for capital and labour. This is so because as capital increases the

per capita output also increases though at a decreasing rate. Therefore capital is seen to exhibit diminishing marginal returns.

According to this theory a nation can remain at its steady point by determining the amount of labour and capital necessary to remain at that point and therefore only technological advances can drive the growth of economy. Economic growth takes place only when there are technological advances. The economy will then adjust labour and capital accordingly. The Neoclassical theories assign the greatest weight to productivity improvements which are achieved through technological advances and organization of production (Hulten, 2000).

This model is the growth accounting framework and gives a measure of contribution of each of the factor inputs and their aggregate productivity to economic growth. The theory uses the neoclassical production function and many researchers have used it to explain the growth that is experienced in different economies. It has the advantage that it applies definite aggregate inputs and outputs and it specifies maximum output given the quantities of inputs.

The Solow model gives a TFP growth estimation approach but does not distinguish the two components of TFP, technical efficiency and technical progress. This growth model assumes factor markets are competitive and there are constant returns to scale. Economists have applied the model to measure factor contributions to growth at sectoral and aggregate levels and literature on the contribution of TFP to growth has in essence increased.

2.1.3. New Growth Theories

The new growth theory postulates that economic growth takes place as a result of endogenous forces and not exogenous forces as stipulated in the neoclassical theory. It was put forward by scholars such as Rebelo (1991), Lucas (1988) and Romer (1986) among others. They were inspired by the fact that technological progress was regarded as exogenous in the neoclassical theory of growth. According to the new growth theory, growth happens even without the exogenous advances in productivity that are considered to come from increased productivity in the neoclassical model. Rather it highlights the important role of complementary activities such as education, retraining, research and development in explaining economic growth.

The Romer model is the most commonly applied in this theory. Both Romer and Lucas emphasized on the importance of creation and accumulation of human capital and new knowledge for growth to take place. The important contributors to growth in this theory are innovations, knowledge and investment in human capital. Any economy must deliberately

undertake policy measures since in the long run the economy's rate of growth will depend on these measures. Some of the policy measures are such as subsidies to undertake research and development which are seen to increase the incentive for innovation thereby increasing growth. Therefore a higher rate of innovation and investments in human capital improvements can lead directly in productivity enhancements. Investment in human capital therefore becomes a very important component of growth because it defines the quality of the labour force.

While the neoclassical model has three basic inputs, this model has four inputs being labour, capital, a technological progress index and human capital which in this case is education or training. These models have been applied and tested by economists in both national and sector specific growth analysis in different economies.

2.2. Empirical Literature

Researchers on this field of study have mainly concentrated on the supply side factors of production and have tried to identify the most important factors of production that would maintain a long-run sustainable growth. The vast empirical literature attempts to sort out factor inputs contribution to growth from factor productivity contribution to growth but there has not been a clear consensus. Economic growth rates have been shown to differ among countries depending on the level of technology adoption, different rates of accumulation of capital stocks, level of human capital resources, labour force availability and differing determinants of efficiency of savings and investments among others

Though TFP growth had been given limelight before the 1950s, Solow (1957) showed that TFP growth could be isolated from individual inputs by decomposing output growth into that portion attributable to increases in factor input and a residual. He estimated that high United States of America's economic growth rates were for the most part the end result of increased overall productivity as only 12.5% of growth in output per capita in the period 1909-1949 owed to accumulation of physical capital while 87.5% to the residual.

The Solow's model paved way for studies that relate output to factor inputs and has been stressed by other economists such as Prescott (1998) who proved that economic growth and per capita income inter-country differences were largely to be attributed to differences in total factor productivity. Differences in physical capital and human capital accumulation played only a minor role. Prescott therefore concluded that there ought to be a theory of TFP that would help understand the forces behind the huge income differences experienced in the international economy. Chenery, Robinson , & Syrquin (1986) using the growth accounting framework and the neoclassical production function carried out an analysis of thirty-nine economies for several periods. The study compared the role of factor inputs and that of productivity growth in developing and developed countries in order to identify the major differences in their growth patterns. The study findings indicated that growths of capital, labour and productivity were similarly significant in the two categories but differed significantly given the economic structure of the particular country and how effective its policies were. The developed economies recorded little growth of labour inputs of 1.1%, growth of capital was moderate at 5.2% while output grew at 5.4%. The contribution of TFP to aggregate growth was however comparatively large at 50%. On the contrary, developing

economies were characterized by a high growth of labour inputs of 3.3% while total factor growth was also higher at 4.3%. TFP contribution to aggregate growth was moderately small at 30%.

Young (1992) studied the degree to which TFP growth affected output growth in Hong Kong and Singapore economies between 1970 and 1990. The study applied growth accounting framework and used the trans-logarithmic value added production function. The study found that 56% of the growth in output per capita in Hong Kong was attributed to TFP growth while -8% of the growth in output per capita in Singapore was attributed to TFP growth. Capital accumulation contributed the most to growth in output per worker in the Singapore economy at 117%.

Using the growth accounting approach, Kim & Park (2017) studied the extent to which TFP growth contributed to output growth in middle-income countries between 1975 and 2014. The study used cross-country panel data and applied the Cobb–Douglas production function. The study results showed that the slowdowns in growth in middle-income countries could be significantly attributed to the decline in the TFP growth. Labour and capital growth was found to have contributed minimally to the growth slowdown. The upward transition of economies from low to higher income levels and especially to the middle-income level was found to have been greatly enabled by TFP growth.

In Africa, there have been several studies on TFP growth and economic growth which have proved that developing countries heavily rely on capital intensive output growth. Such is the study by Nafar (2017) on the sources of economic growth in Sub-Saharan African Islamic Development Bank (IDB) member countries between 1990 and 2012. The study estimated the sources of growth in the region with the objective of identifying the main driving factors of economic growth and extended the analysis to country specific and added an angle of time dimension by considering time coverage. It applied the growth accounting framework and the aggregate production function. The most important source of output growth was found to be aggregate capital accumulation at 52% while labour force accumulation followed at 39%. TFP was the least contributor and accounted for a paltry 8%.

Amin (2002) examined Cameroon's growth patterns and its main components between 1961 and 1997 as well as the main motivating factors behind it's sources of growth. The study applied both econometric and growth accounting approaches in a production function. Both

methods gave similar results that indicated a higher contribution of factor inputs to growth with capital accumulation playing the greatest role such that capital contributed 67% to GDP growth, labour contributed 38% while factor productivity contributed 6%. The results were similar at aggregate economy level and at sectoral levels.

 Kumo (2017) conducted a detailed growth decomposition exercise in post-apartheid South Africa using the growth accounting approach for the period 1996–2015 to measure factor contributions to economic growth using the Cobb Douglas production function. He investigated the trends in factor intensity, output gap and the potential output growth in the period. The study found that TFP remained the dominant source of economic growth at 23%, accumulation of capital at 8% and growth of labour force at -3%.

Nachega & Fontaine, (2006) using the growth accounting framework, studied the sources of aggregate growth of output in Niger and the determinants of TFP for the period 1963 to 2003. TFP growth was found to be averagely negative over the sample period. Output per capita recorded a decline of 0.3% and this was attributable to negative growth rates of both total factor productivity and physical capital per worker. TFP was most important and accounted for 70.6% of the decline while physical capital per capita accounted for 29.4%.

In Kenya, studies on TFP have mostly concentrated on the manufacturing and agricultural sectors as opposed to the aggregate economy. Gachanja, Were, & Etyang (2013) applied the Malmquist index method to examine the changes in productivity in several sub-sectors of the manufacturing sector. The study decomposed TFP changes into technical changes and efficiency changes. The results revealed that despite the structural changes that saw policy changes from time to time, TFP of the sector declined during the study period. This indicated that growth of output in the manufacturing sector was fundamentally attributable to inputs increases and the volume of output while improvements in efficiency and productivity contributed less to output growth of the sector.

Gerdin (2002) studied the aggregated Kenyan agriculture sector growth and its productivity patterns for the period 1964 and 1996 using the econometric estimation approach. The study found that the leading source of growth of the sector was accumulation of capital followed by growth of TFP at 26.8% while labour was the least contributor. TFP growth of the sector had decreased over time increasing by less than 0.4% per year but its contribution to output growth had increased.

Kalio, Mutenyo, & Owuor (2012) analysed Kenya's economic growth trends between 1970 and 2003 using the growth accounting approach and the Cobb-Douglas production function, found out that the most important source of growth was aggregate capital accumulation which explained 71.4% of output growth followed by workforce accumulation at 25%. TFP was found to only account for 3.6%. These findings were consistent with the findings of Onjala (2002) in his study on TFP in Kenya and the links to trade policy between 1961 and 1995. The study results indicated that output growth was a largely explained by changes in accumulation of factor inputs.

2.3.　Literature Review Overview

Changes in both TFP and factor accumulation in the analysis of growth have both been proven important by the existing empirical studies. As revealed by these studies, technological progress is a more important factor of growth in some countries and less significant in others especially developing countries. On the overall a majority of the studies undertaken in rich countries reveal that TFP is the leading source of output growth while labour force growth and capital accumulation play a larger role in output growth in poor countries. The contribution of TFP to growth is also dissimilar in a majority of countries whether rich or poor and there has not been a consensus regarding factor inputs and productivity contribution to the growth of economies.

The role that TFP plays in shaping the growth of Kenya's GDP is not quite established. Along this line, it is necessary to undertake an analysis of the Kenyan economy with respect to changes in TFP and factor accumulation so as to establish the role that it has played in shaping the trends in growth of the Kenyan economy over the years. Since the government would be required to undertake policy reforms to promote growth based on evidence of what has worked and what would work for Kenya, this study seeks to establish the role that TFP has played in shaping the output or econoic growth. The study also takes into account the role of human capital, as a separate factor, in growth which has not been covered by any of the studies carried out in Kenya regarding the sources of growth. Human capital is used in many models of economic growth as it helps understand the process of producing output and the differences in growth rates between countries. The relationship established will inform policy formulation in the public sector regarding attainment of higher economic growth rates.

<div align="center">**CHAPTER THREE**</div>

METHODOLOGY

3.1. Theoretical Framework

The two main approaches used to study and analyse the sources of output growth are; the parametric and non-parametric. The parametric approach entails decomposing GDP into its constituent parts. Output growth is given as a total contribution of labour added to the contribution of capital and the contribution of technological progress or total factor productivity. The non-parametric method empirically estimates the marginal contribution of each of the individual factors and the index of TFP using the production function approach. The later method is flexible and more advantageous since it allows for factor substitution and for empirical testing of returns to scale.

3.1.1. Growth Accounting Approach

In this approach, output and TFP growths are measured using the Solow model which gives the Solow residual. Total output is modelled as a function of the various factors of production using the aggregate production function. The major factors are capital and labour. The model assumes a set of assumptions - perfect competition meaning that each factor gets its marginal product and constant returns to scale meaning that doubling both labour and capital would lead to double the output.

The neoclassical production function is commonly used and defines the economy's output at time t being a function of the capital stock, the labour force and the TFP of the economy. The function is estimated as follows;

$$Y_t = A_t (K_t)^{\sigma} (L_t)^{1-\sigma} \tag{1}$$

Where, $(1-\sigma)$ and σ give the labour and capital shares of output respectively. Time is assumed to be continuous such that the t does not assume integer values such as $t = 1$ and $t = 2$ but is seen to evolve smoothly.

Equation (1) is static which means that the amount of output will depend on the amount of inputs in a definite period of time t. We need to derive an equation that disaggregates output growth rate into its different components of factor accumulation and technological progress.

To do so we derive a dynamic version of equation one that will describe output as changing over time. Hence we differentiate the production function (1) with respect to time to have;

$$\frac{\delta Y_t}{\delta t} = \frac{\delta (A_t\, K_t^{\sigma}\, L_t^{1-\sigma})}{\delta t} \qquad (2)$$

This implies;

$$\frac{\delta Y_t}{\delta t} = K_t^{\sigma}\, L_t^{1-\sigma}\, \frac{\delta A_t}{\delta t} + A_t\, L_t^{1-\sigma}\frac{\delta K_t^{\alpha}}{\delta t} + \frac{A_t\, K_t^{\alpha}}{\delta t}\,\delta L_t^{1-\alpha} \qquad (3)$$

To separate the impact of changes in labour and capital inputs we have;

$$\frac{\delta K_t^{\sigma}}{\delta t} = \frac{\delta K_t^{\sigma}}{\delta K_t}.\frac{\delta K_t}{\delta t} = \sigma K_t^{\sigma-1}\,\frac{\delta K_t}{\delta t} \qquad (4)$$

$$\frac{\delta L_t^{1-\sigma}}{\delta t} = \frac{\delta L_t^{1-\sigma}}{\delta L_t}.\frac{\delta L_t}{\delta t} = 1-\sigma L_t^{-\sigma}\,\frac{\delta L_t}{\delta t} \qquad (5)$$

Substituting equation (4) and (5) in equation (3) we have;

$$\frac{\delta Y_t}{\delta t} = K_t^{\sigma}\, L_t^{1-\sigma}\,\frac{\delta A_t}{\delta t} + A_t\, L_t^{1-\sigma}\,\sigma K_t^{\sigma-1}\,\frac{\delta K_t}{\delta t} + A_t\, K_t^{\sigma}\, 1-\sigma L_t^{-\sigma}\,\frac{\delta L_t^{\sigma}}{\delta t} \qquad (6)$$

Dividing equation (6) by Yt which is the same as dividing by $A_t\, (K_t)^{\sigma}\, (L_t)^{1-\sigma}$ will give the growth rate of output

$$\frac{\delta Y_t}{\delta t}.\frac{1}{Y_t} = K_t^{\sigma}\, L_t^{1-\sigma}\,\frac{.\,\delta A_t}{A_t\, K_t^{\sigma}\, L_t^{1-\sigma}\,\delta t} + A_t\, L_t^{1-\sigma}\,\sigma K_t^{\sigma-1}.\frac{\delta K_t}{A_t\, K_t^{\sigma}\, L_t^{1-\sigma}\,\delta t} + A_t\, K_t^{\sigma}\, 1-\sigma L_t^{-\sigma}.\frac{\delta L_t^{\sigma}}{A_t\, K_t^{\sigma}\, L_t^{1-\sigma}\,\delta t} \qquad (7)$$

Cancelling the like terms we get;

$$\frac{\delta Y_t}{\delta t}.\frac{1}{Y_t} = \frac{1}{A_t}.\frac{\delta A_t}{\delta t} + \sigma.\frac{1}{K_t}.\frac{\delta K_t}{\delta t} + (1-\sigma).\frac{1}{L_t}.\frac{\delta L_t}{\delta t} \qquad (8)$$

Denoting $\frac{\delta Y_t}{\delta t} \cdot \frac{1}{Y_t} = G_t^Y$ equation (8) can be written as;

$$G_t^Y = G_t^A + \sigma G_t^K + (1-\sigma) G_t^L \tag{9}$$

Equation (9) is the basic neoclassical growth equation. The parameter σ determines the weight of capital and labour. Therefore the growth rate of output is a summation of the technology term (Solow residual) growth rate and the weighted average growth rates of both capital and labour.

$(1-\sigma)$ and σ are the output elasticities of labour and capital respectively. They indicate the effect that a 1 percent growth of that input would have on output growth. Subtracting the weighted sum of average growth rates of capital and labour, $\sigma G_t^K + (1-\sigma) G_t^L$ from the growth rate of output G_t^Y gives us the total factor productivity (TFP) growth rate, G_t^A. This formulation applies to any number of inputs and gives the growth accounting technique of estimating TFP.

Since the marginal products of labour and capital, $(1-\sigma)$ and σ respectively, are not observable, the method assumes that the marginal products of the factor inputs reflect the observed input factor prices. That is, factor input prices are paid their marginal products. Therefore, the rate of wage is equal to the marginal product of labour while the real rental price is equal to the marginal product of capital. Arising from this, the equation is solved by use of the factor prices.

3.1.2. Econometric Approach

The second approach of estimating output and TFP growth rates is the econometric approach whose starting point is usually in a Cobb-Douglas production function given as follows;

$$Y_t = A_t (K_t)^\sigma (L_t)^{1-\sigma} \tag{10}$$

Where Y_t is the output, L_t and K_t are the labour and capital inputs at time t respectively and A_t gives the technology parameter that represents shifts in the production function. σ and $(1-\sigma)$ are the output elasticities with respect to capital and labour respectively. The parameter of technology A_t is defined as follows;

$$A_t = A_o e^{\lambda t} \tag{11}$$

This implies that technology progress or growth is given by a constant exponential rate λ. Substituting (11) into (10) gives,

$$Y_t = A_o e^{\lambda t} (K_t)^\sigma (L_t)^{1-\sigma} \tag{12}$$

Taking logarithms of equation (12) gives;

$$\ln Y_t = \ln A_o + \lambda_t + \sigma \ln K_{t\,+}(1-\sigma)\ln L_t \tag{13}$$

Solution to equation 13 gives the output elasticities σ and (1-σ) as well as the technology coefficient λ, which is the contribution of changes in technology to output growth. The marginal products of factor inputs are not assumed to be reflected by the real prices of the factors and hence this approach becomes more advantageous to use. The main problem with this method is that changes in capital and labour are not completely exogenous from changes in TFP. This implies that there would be correlated variation in the observed changes in TFP with changes in the factor growth rates. Hence technological changes may be a component of the factor growth rates.

3.2. Empirical Model to be estimated

To estimate the relationship between TFP growth and Kenya's GDP growth for the period 1985 to 2018, the study applied the econometric estimation approach and used the Cobb Douglas aggregate production function. The study used a framework similar to that of Benhabib & Spiegel (1994), in which the Cobb-Douglas production function considers human capital as a distinct factor of production. In this model human capital is considered as an independent form of capital interacting with labour, physical capital and technology to create output.

The aggregate production function takes the form of;

$$Y_t = A_t (K_t)^\alpha (L_t)^\beta (HK_t)^\delta \tag{14}$$

Taking the logarithmic differences of equation 14 gives the main econometric model to be estimated as;

$$\ln Y_{t\,=}\ln A_{t\,+}\alpha \ln K_{t\,+}\beta \ln L_t + \delta \ln HK_t + \varepsilon_t \tag{15}$$

Where:

Y_t is real Gross Domestic Product at time t

α, β and δ are the elasticities of output with respect to Capital, Labour and Human Capital

A_t is the TFP

K_t is the stock of capital at time t

L_t is the total labour at time t

HK_t is stock of human capital at time t

ε_t is the error term

The average TFP growth rate for the period of study is a constant term, given by ln A_t.

3.3. Variables Description, Measurement and expected signs

This is discussed in table 3.1

Table 3. 1: Variables, Description, Measurement and expected signs

Variable	Definition	Measurement	Reference	Priori sign
Y_t	GDP	This is the total output of the economy and is measured in real figures. Data on GDP is given in constant Local Currency Unit (LCU) from WDI over the period of study.		
L_t	Labour/ Work force	This is the number of people in active employment between the ages 15 - 64. It includes the family workers who are not paid and those who are self-employed from both the public and private sectors but excludes rural small scale farming and pastoralist activities. Data obtained from KNBS.	Benhabib and Spiegel (1994)	+
K_t	Capital Stock	As a proxy for physical capital stock, Gross Fixed Capital Formation was used. GFCF gives, in monetary terms, the value additions to fixed assets. Data on GFCF is taken at constant local currency units from WDI of the World Bank over the period of study.	Benhabib and Spiegel (1994)	+
HK_t	Human capital	The components of human capital are ordinarily very difficult to measure and thereby most researchers have resulted in the use formal education in their studies. In order to simplify things, this study used figures on secondary and primary schools enrolment as the human capital proxy. This data is obtained from various issues of the Economic Surveys of the KNBS.	Ali , Egbetokun , and Memon (2018)	+
A_t	Total Factor Productivity	This is estimated in the model and it is usually an index of technological progress and was estimated in the model.		+

3.4. Estimation Procedure

The model was estimated using the Autoregressive Distributed Lag (ARDL) technique of analysis. One of the major issues with this type of study is the potential simultaneity bias between the unobserved TFP and factor inputs. The use of lagged endogenous independent variables accounts for potential simultaneity bias as is frequently used in the literature. This study further controlled for the endogeneity bias by the use of the ARDL model for estimation. While using this technique the variables don't have to be integrated of the same order but should not exceed integration of order 1, I(1). The method also allows for the independent variable in the study to be treated an as endogenous variable and this corrects for the simultaneity bias or the reverse causality. It has further the advantage that it determines sufficient lags for the estimation. This therefore generates a dynamic Error Correction Model which ties the short-run to the long-run behaviour by correcting the disequilibrium in the short-run.

The ARDL model specified for this study is as follows;

$$\Delta \ln Y_t = \square + \sum_{i=1}^{z} \sigma \Delta \ln Y_{t-i} + \sum_{i=1}^{z} \alpha \Delta \ln K_{t-i} + \sum_{i=1}^{z} \beta \Delta \ln L_{t-i} + \sum_{i=1}^{z} \delta \Delta \ln HK_{t-i} +$$

$$\beta_0 \ln Y_{t-1} + \beta_1 \ln K_{t-1} + \beta_2 \ln L_{t-1} + \beta_3 \ln HK_{t-1} + \ln \varepsilon \quad (16)$$

Where;

ա is the $\ln A_t$ and gives the average TFP growth rate over the period of study

z is the optimal lag length

ε is the usual white noise

The expressions σ, α, β, and δ give the model's short run component while the last expressions with β_0 to β_3 give the model's long run component of the model

3.4.1. Tests of stationarity

Prior to analysis, the study applied the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) unit root tests to test the data for stationarity. The presence of non-stationarity in the series renders the estimates not consistent. This test checks if the variables have unit roots and also determines the number of times that the time series would have to be differenced to make it stationary thereby giving the variables' order of integration

3.4.2. Tests of cointegration

Tests of cointegration are used to analyse nonstationary time series and hence help to estimate the long-run equilibrium parameters in series. The study used the Johansen cointegration test to establish the cointegration levels. The Johansen cointegration test was chosen as it has the advantage of accommodating several co-integrating relationships and the various variables are considered endogenous.

3.5. Diagnostic tests

After estimating the model parameters, diagnostic testing helps to determine if the model chosen fits the data reasonably well.

3.5.1. Tests of Autocorrelation

If observations of the same variable over a period of time have a relationship implying that successive observations are likely to exhibit inter-correlations, then there is Autocorrelation. The presence of autocorrelation renders ordinary least squares estimators inefficient and hence one cannot validly apply the t, F and χ^2 tests. To test for autocorrelation the study applied the Breusch - Godfrey Serial Correlation LM test.

3.5.2. Multicollinearity tests

The data was tested for multicollinearity since the explanatory variables should not exhibit any exact linear relationships between them. This means that the model independent variables cannot be expressed as an exact linear combination of the other independent variables.

3.5.3. Heteroscedasticity test

The assumption of homoscedasticity is that the variance of the disturbances u_i should be the same for all and equal to some constant number σ^2. Tests of Homoscedasticity were carried out on the data since the estimators obtained in the presence of heteroscedasticity are not efficient. However, even if heteroscedasticity is present, the ordinary least squares estimators remain unbiased and consistent. This study used the Breusch-Pegan - Godfrey test to test the model for heteroscedasticity.

3.5.4. Normality test

Normality is one of the assumptions of the OLS and the Jarque-Bera test was used to test the residuals for normality.

3.5.5. CUSUM test

This is the Cumulative Sum Control Chart test which tests the model for stability.

3.6. Data and data sources

For empirical analysis to be undertaken, time series was used and obtained from secondary sources on GDP, capital stock, labour / population and human capital from the Kenyan economy with a sample period of 34 years between 1985 and 2018. This data was acquired from various sources that included the World Development Indicators (WDI) from World Bank and from the Kenya National Bureau of Statistics' yearly publications of the Economic Surveys.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

4.1. Introduction

The descriptive statistics of the study variables, results of the Autoregressive Distributed Lag (ARDL) Model, time series properties tests results and an interpretation of the findings are discussed in this chapter.

4.2. Descriptive Statistics

The descriptive statistics of the study variables- Gross Domestic product (Y), Labour (L), Capital (K) and Human Capital (HK) are illustrated in Table 4.1 and include the mean, standard deviation, and Jacque-Bera normality test.

Table 4. 1: Variables' Descriptive Statistics

	Gross Domestic Product	Labour	Capital Stock	Human Capital
Mean	2,489,764,859,085.29	1,802,750.00	378,312,871,582.35	8,391,741.18
Median	2,115,898,458,250.00	1,697,550.00	243,111,444,900.00	6,914,500.00
Std. Dev.	972,345,367,433.78	418,712.85	262,758,590,171.42	2,736,866.20
Jarque-Bera (JB)	4.70174	3.02965	4.95389	3.93095
JB Probability	0.09529	0.21985	0.08400	0.14009
Observations	34	34	34	34

Source: Own Computation using Eviews Version 10

From Table 4.1, the mean of GDP for the period between 1985 and 2018 was Kshs. 2.49 trillion, labour was 1,802,750 persons, capital was Kshs. 378 billion, and human capital was 8,391,741 persons. The standard deviation for the variables as shown in the table were Kshs. 972 billion for GDP, 418,712.9 persons for labour, Kshs. 263 billion for capital and 2,736,866 persons for human capital. The times series data used in this study was adequately varied to justify its use in regression analysis because the data values were not constant over the study period, that is, their Std. Dev. was different from zero.

The Jarque-Bera statistic and its associated probabilities in Table 4.1 tested the normality of the data. The probabilities of Jacque-Bera test statistics of Gross Domestic Product, Labour,

Capital, and Human Capital were 0.095286, 0.219847, 0.084000, and 0.140089 respectively. The time series data were normally distributed since all the variables P-values were more than their respective 0.05 significance level values. The null hypothesis of normality was not rejected.

4.3. Correlation Test Results

As illustrated in Table 4.2, GDP was positively correlated with all the independent variables – labour force, capital stock and human capital.

Table 4. 2 Variables Correlation Matrix

	Gross Domestic Product	**Labour**	**Capital**	**Human Capital**
Gross Domestic Product	1.000			
Labor	0.991	1.000		
Capital	0.983	0.961	1.000	
Human Capital	0.982	0.966	0.984	1.000

Source: Own Computation using Eviews Version 10

4.4. Pre- estimation tests

4.4.1. Stationarity Test

According to Aue & Delft (2017) statistical stationarity means that the statistical properties of a series for instance variance, autocorrelation, and mean among others are constant over time and the structure of these properties do not change over time. If in regression analysis non-stationary data is used, the results obtained are spurious and hard to interpret. Table 4.3 gives the stationarity tests results of the PP and ADF tests.

Table 4. 3: Unit Root test results for PP and ADF tests

Study Variables	Test Statistics					
		Augmented Dickey-Fuller		Phillips-Perron		Conclusion
		Statistic	Critical Values (5%)	Statistic	Critical Values (5%)	
Gross Domestic Product	Level	7.593834	-2.954021	6.812668	-2.954021	Stationary
Labor	Level	4.048956	-2.954021	2.817391	-2.954021	Stationary
Capital	Level	1.617291	-2.954021	1.617291	-2.954021	Non-Stationary
	1st Difference	-4.817883	-2.95711	-4.811329	-2.95711	Stationary
Human Capital	Level	1.868129	-2.954021	1.868129	-2.954021	Non-Stationary
	1st Difference	-4.584238	-2.95711	-4.569687	-2.95711	Stationary

Source: Own Computation using Eviews version 10

Table 4.3 shows that GDP and Labour data were stationary at level using ADF test though using PP Test, Labour was only stationary at 1st difference. Capital and Human Capital were stationary at 1st difference for both tests meaning that they were integrated of order I (1). Therefore in order to use the time series data with ARDL, they would have to be differenced once.

4.5. Model Estimation

Since the stationarity tests indicated that the series were integrated of both orders zero and one, the study adopted the ARDL model estimation method. This method has the advantage that it can be used with both I(0) and I(1) orders of integration. It also allows for different optimal lags of variables in sample sizes that are small and therefore was the most suitable model for this study

4.5.1. Cointegration Test

Cointegration was tested using the Johansen test which comprises of both the Maximum Eigen and Trace statistics. The results are illustrated in Table 4.4. This test tested the existence of any long run relationships among the variables that used in this study.

Table 4. 4: Results of the co-integration test

Assumed No. of Cointegration Equation(s)	Trace Statistics	Critical Values (5%)	Prob.**	Maximum Eigen Statistics	Critical Values (5%)	Prob.**
0	47.07275	47.85613	0.0591	26.436	27.58434	0.0696
At most 1	20.63649	29.79707	0.3807	14.311	21.13162	0.3401
At most 2	6.325665	15.49471	0.657	6.2587	14.2646	0.5803
At most 3	0.066925	3.841466	0.7959	0.0669	3.841466	0.7959

Source: Own Computation using Eviews Version 10

The study tested the null hypothesis of absence of co-integration the presence of cointegration being the alternative one. The results, tested at 0.05 significance level, showed that at rank 0 trace statistic (47.07) and Maximum Eigen statistic (26.44) are less than their corresponding critical values of (47.86) and (27.58) respectively. At most 1 rank the trace statistics (20.64) and Max-Eigen statistics (14.31) are less than their corresponding critical values of (29.8) and (21.13) respectively. At most 2 ranks the trace statistics (6.33) and Maximum Eigen statistics (6.26) are less than their corresponding critical values of (15.49) and (14.26) respectively. The study variables did not exhibit any long-run relationship since the null hypothesis could not be rejected. Thus, the ARDL short-run model was estimated.

4.5.2. Lag Selection

Table 4. 5: Results of Lag Order Selection

Vector Autoregressive Lag Order Selection Criteria
Included observations: 32
Sample: 1985 - 2018
Exogenous variables: C
Endogenous variables: lnY lnL lnK lnHK
Date: 08/27/19 Time: 15:05

Lag	LR test statistic (each test at 5% level)	Final Prediction Error (FPE)	Akaike Information Criteria (AIC)	Schwarz Information Criteria (SC)	Schwarz Information Criteria (HQ)
0	NA	1.12e-09	-9.254392	-9.071175	-9.193661
1	252.2675*	2.70e-13*	-17.59763*	-16.68155*	-17.29398*
2	22.01715	2.97e-13	-17.55490	-15.90595	-17.00832

* Specifies the lag order that is chosen by the criterion

This criterion of lag selection estimates the optimal lags that the model should include. Based on all the lag selection criteria results shown in Table 4.5, the maximum lag or the optimal lag was identified as 1. Thus, the ARDL model will be specified with a maximum lag of 1.

4.6. The Model

Table 4. 6: Results of ARDL Estimation

Dependent Variable: lnY
Selected Model: ARDL(1, 1, 0, 0)
Maximum dependent lags: 1 (Automatic selection)
Fixed regressors: C
Sample (adjusted): 1986 - 2018
Dynamic regressors (1 lag, automatic): ΔlnL ΔlnK ΔlnHK
No. of observations: 33

Variables	Coefficient	Standard Error	t-Statistics	Prob.*
ΔlnY(-1)	0.555979	0.122015	4.556662	0.0001
ΔlnL(-1)	0.904677	0.200304	4.516514	0.0001
ΔlnK(-1)	0.052154	0.024850	2.098721	0.0453
ΔlnHK(-1)	0.172658	0.065990	2.616417	0.0144
C	3.603195	0.941493	3.827108	0.0007

R-squared	0.998688	Dependent variable mean	28.49372
Adjusted R-squared	0.998445	Std. Dev. of dependent variable	0.355848
Log likelihood	97.27292	HQ criterion	-5.440141
F-statistic	4109.326	Durbin-Watson statistic	1.742882
Probability of (F-statistic)	0.000000		
Regression Std. Error	0.014034	Akaike info criteria	-5.531692

The estimated equation based on the ARDL results illustrated in Table 4.6 is as follows;

$$lnY_{t\,=}\,3.603 + 0.052\,lnK_t + 0.905lnL_t + 0.173lnHK_t$$

The adjusted R-squared was 0.998445 or 99.8445% which meant that the variation in labour, capital, and human capital explained 99.8445% of the variation in gross domestic product.

A unit increase in labour or the number of people in active employment would lead to an increase in Gross Domestic Product by 0.905 units holding all other explanatory variables constant. The t-statistic for the labour input was 4.516514 while its p-value was 0.0001 this was less than the 0.05 significance level and therefore labour was statistically significant to the growth of GDP. The labour input contributed 34.8% to the output growth which was expected since Kenya has a high supply of labour

A unit increase in the stock of capital would increase in GDP by 0.052 units holding all other explanatory variables constant. The t-statistic of the capital input was 2.098721 while its p-value was 0.0453. This was less than the 0.05 significance level meaning that capital was

statistically significant to the growth of GDP. Capital accumulation contributed the least to GDP growth at 4.9%.

A unit increase in human capital would increase GDP by 0.173 units holding all other explanatory variables constant. The human capital input had a t-statistic of 2.616417 while its p-value was 0.0144. This was less than the 0.05 significance level meaning that human capital was statistically significant to the growth of GDP. Human capital had a much smaller contribution of 7.5% to GDP growth as compared to labour.

TFP average growth rate as represented by the constant in the model was 3.6% within the period. TFP had a t-statistic of 3.827108 while its p-value was 0.0007. this was below the 0.05 significance level and therefore statistically significant. The moderate growth of 3.6% could be attributed to the adoption of existing technologies abroad in the recent years.

On the overall, TFP was found to be the leading source of GDP growth within the period of study having contributed 52.8% to the total output growth. The study results therefore show that TFP explains the vast share of output growth of the Kenyan economy over the study period. These results are inconsistent with Kalio, Mutenyo, & Owuor (2012) and Onjala (2002) who analysed the sources of growth in Kenya for different periods and found out that output growth was largely explained by changes in accumulation of factor inputs and specifically capital accumulation.

4.7. Diagnostic Tests

In order to guarantee that the requirements of ARDL are met before the model is estimated, diagnostic tests are carried out. ARDL requires that the model error terms should not be autocorrelated with each other, no heteroscedasticity in the data, the data should be normally distributed and stationary.

4.7.1. Multicollinearity Test

According to Winship, Winship, & Western B., (2016), there is multicollinearity if there is high correlation among the multiple regression independent variables meaning that their correlation is statistically high. The problem of multicollinearity leads to related variables having larger than actual standard errors in the regression analysis. This leads to t-statistics being too small and eventually leading to accepting of null hypothesis when it should be rejected giving wrong conclusion. According to Gujarati & Porter, (2009), if the correlation is

above 0.8 then multicollinearity is present. Table 4.2 represents the correlation of variables in the study.

There was multicollinearity in the study variables since their correlation coefficient in all the cases was above 0.8. To deal with the problem of multicollinearity, we recognize three scenarios of multicollinearity; perfect multicollinearity where correlation is perfect or equal to one, imperfect multicollinearity where correlation is between zero and one, and no multicollinearity where correlation is zero. From Table 4.2, the case is that of imperfect multicollinearity which means it will still give regression results. According to Gujarati & Porter, (2009), multicollinearity is essentially a data deficiency problem. Thus the suggestion is that we do nothing about the presence of multicollinearity and work with the data as it is because many a time there is no much choice over the data we have available. This is the solution taken in this study. The other available solution is to remove the correlated variables in the model which was not practical and therefore not applicable for this study.

4.7.2. Serial correlation test

If the residuals of the model from one period are correlated with those of another period then there is serial correlation. This test was undertaken at 0.05 significance level and the results are tabulated in Table 4.7.

Table 4. 7: Serial Correlation results of the Breusch-Godfrey LM test

Test Statistics		Statistics	P-Values F(2,16); Chi-square (2)	Conclusion
F-Statistic	Level	1.323027	0.2939	No Autocorrelation
Obs* R squared	Level	4.257289	0.1190	No Autocorrelation

Source: Own Computation using Eviews Version 10

A null hypothesis of no serial was tested. The Obs*R-squared statistic at level was 4.257289 while its P-value was 0.1190. The Obs*R-squared P-value was higher than the 005 significance level value and therefore the no serial correlation hypothesis was not rejected. Thus, the model fulfilled the requirement of ARDL.

4.7.3. Heteroscedasticity test

A null hypothesis of no heteroscedasticity was tested. The results of the Breusch-Pegan-Godfrey test, at 0.05 significance level, are presented in Table 4.8.

Table 4. 8: Breusch-Pegan-Godfrey heteroscedasticity test results

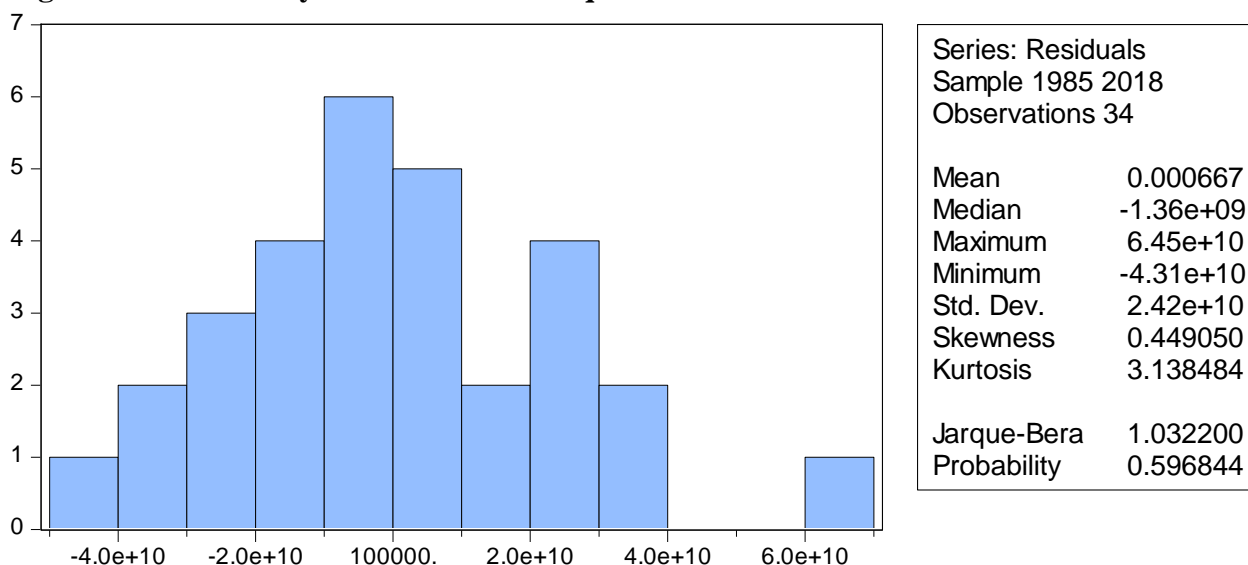| Test Statistics		Statistics	P-Values F(11,18); Chi-square (11)	Conclusion
F-Statistic	Level	0.575907	0.8240	Heteroscedasticity absent
Obs*R-squared	Level	7.809719	0.7302	Heteroscedasticity absent

Source: Own Computation using Eviews Version 10

At level, the Breusch-Pegan-Godfrey test statistic's Obs*R-squared was 7.809719 while its P-value was 0.7302. This was greater than the 0.05 significance level and hence the null hypothesis was not rejected. Thus, ARDL requirement of No heteroscedasticity was therefore met and the model was fit to use.

4.7.4. Normality Test

The study used the Jarque-Bera test to test for the normality of residuals and the results are provided in Figure 4.1.

Figure 4. 1: Normality Results for the Jarque-Bera test

Series: Residuals Sample 1985 2018 Observations 34	
Mean	0.000667
Median	-1.36e+09
Maximum	6.45e+10
Minimum	-4.31e+10
Std. Dev.	2.42e+10
Skewness	0.449050
Kurtosis	3.138484
Jarque-Bera	1.032200
Probability	0.596844

A null hypothesis of normally distributed residuals was tested. The Jarque–Bera test's P-value was 0.596844. This was greater than the 0.05 significance level and therefore the null hypothesis was not rejected. The model fulfilled the ARDL requirement of normality of residuals and was thus fit for use in the study.

4.7.5. CUSUM test

This is a test for coefficients stability in the econometric model used in the study. According to this test, the stability of the model is guaranteed if the plotted recursive line of residuals falls between two critical values line of 5% Brown, Durbin, & Evans (1975).

These results are presented in Figure 4.2.

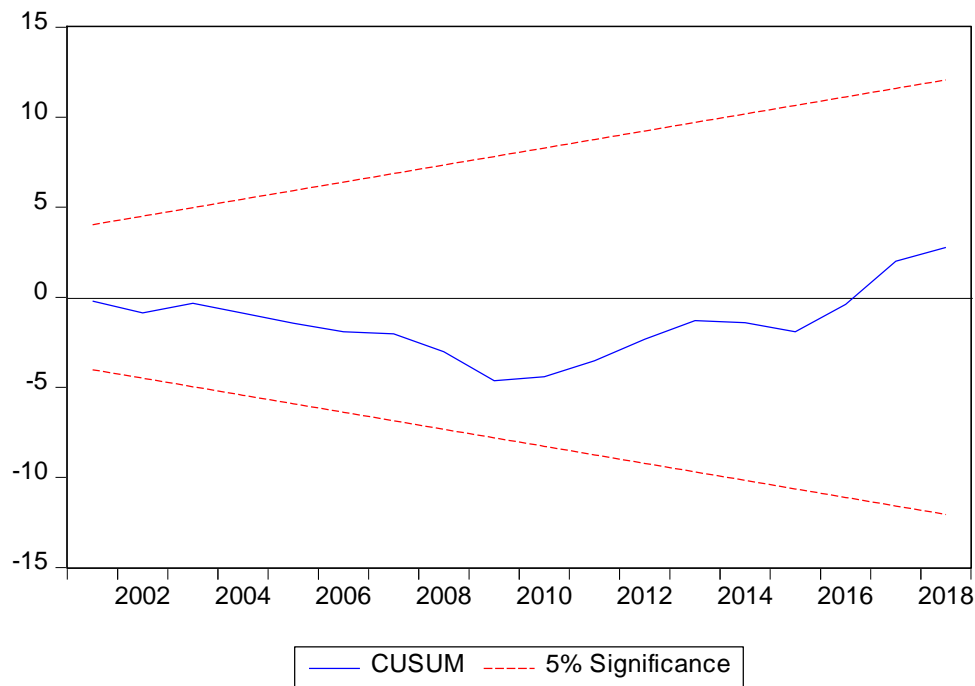**Figure 4. 2: Results of the CUSUM Test**

Figure 4.2, shows that the plotted recursive residuals graph lies within the two 5% critical lines and this makes the model stable and fit for estimation using ARDL technique.

CHAPTER FIVE
SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1. Summary

Kenya has been striving to achieve high economic growth rates of 10% while the many economic policies adopted and implemented have not increased the growth rates to that level. This study's purpose was to analyse empirically the role that total factor productivity and factor accumulation have played in shaping Kenya's economic growth. The study therefore first gives an overview on Kenya's economic growth from 1963 to 2018 which indicates that Kenya's economic growth has recorded mixed performance over the years and then identifies and quantifies the contribution of some important factors namely, human capital, physical capital, labour and TFP into the process of growth.

A review of related literature shows that developed countries most important source of GDP growth is TFP while factor accumulation takes the lions share in the output growth process of developing countries. A majority of the developing countries have not been able to achieve high growth rates such as those recorded by developed countries and very few have crossed to the developed countries category. This means that factor accumulation has not been a strong enough engine of growth in these countries. This could be attributed to the increasing costs of factor inputs. It therefore becomes very necessary to develop and implement appropriate measures that would increase the growth of the economy.

The study therefore sought to examine Kenya's growth process for changes in total factor productivity with a view to establishing the role that TFP has played in shaping Kenya's growth process. Specifically, the study measured the average growth rate of TFP over the study period and established the contribution of TFP, labour, capital and human capital to the growth of GDP. The study applied the econometric approach to estimate the output elasticities of the factors and hence their percentage contribution to the growth process as well as the contribution of TFP to output growth. The short-run ARDL model was used to analyse data since cointegration tests revealed that there was no long relationship between the dependent variable and independent variables.

The study results revealed that TFP had recorded a reasonable growth which could be attributed to the recent policy changes adopted by the government that resulted into increased adoption and implementation of technologies from more advanced countries. TFP was

established to have contributed the most to the growth process. Factor accumulation was found to have contributed less that TFP despite the increased number of people in active employment, high school enrolment rates and increased capital accumulation. As expected the labour input contributed much more to the growth process than capital accumulation and human capital input. Human capital also contributed more to the growth process than physical capital accumulation.

5.2. Conclusion

The conclusion of this study is that total factor productivity is the most important factor of growth in Kenya. This is inconsistent with the findings of Onjala (2002) and Kalio, Mutenyo, & Owuor (2012) who concluded that accumulation of factors played a bigger role in Kenya's growth process. This indicates that economic growth on average was basically driven by growth in total factor productivity as opposed to accumulation of factors of production. Although Kenya's growth has not been as high as predicted by the government and other policy makers, there is evidence that productivity has been on an upward trend and as such, more important for Kenya than factor accumulation. The Kenya Vision 2030 envisions a sustainable growth rate of 10% and above and for this to be achieved productivity of factors has to be enhanced. With time and adoption of appropriate policies it would be expected that TFP would significantly boost the growth process of the economy.

5.3. Policy Recommendations

Productivity performance has become a very important area of interest in research. As such, and in light of the finding of this study that TFP is very important in Kenya's growth process, the government should adopt policies that enhance and promote productivity of both capital and labour inputs. Policies should be aimed at increasing the growth of TFP from the 3.6% obtained to a higher level that would be much more productive.

Kenya should take advantage of inflows of foreign investment and put more emphasis on the adoption and application of these technologies and experiences to the local economy. The huge human capital endowments should be utilized in a way that they embrace these technologies and experiences so as to be able to advance especially the manufacturing sector. Much more efforts should be put towards the development of the human capital through research and development as it aids greatly in the technological investments

The government should also put in place policies that address the challenges that impede productivity growth. Such challenges include brain drain of the well-educated population, corruption, and factor markets failures that lead to inefficient allocation of resources.

5.4. Limitations of the study

This study considered only three factors of production labour capital and human capital as sources of economic growth while in the real world there are other factors that affect the output growth of any economy. It was however not possible to include all the factors of production in this study. It was also not possible to get the real data on capital accumulation for the study period since this data was not available. The study therefore resulted to using gross capital formation as a proxy for capital stock. In addition the study only considered output growth since 1985 while it would have been much more representative to consider the period since independence.

5.5. Areas of further research

The study results established that TFP is a very important factor of Kenya's growth. It is therefore recommended that future studies could consider splitting the effects TFP into its two main components, technical efficiency and technical progress so as to establish their separate contributions into the growth process. The study also recommends for further studies that would be aimed at establishing the factors that determine the growth of TFP as to enhance its growth in the Kenyan economy

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