HIGHER EDUCATION EXPENDITURE AND ECONOMIC GROWTH IN KENYA

LUCY NYIVA WAMBUA

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF ECONOMIC THEORY IN THE SCHOOL OF ECONOMICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ECONOMICS (POLICY AND MANAGEMENT) OF KENYATTA UNIVERSITY

JUNE 2019
DECLARATION

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

Signature……………………………………….Date………………………………………..

LUCY NYIVA WAMBUA

K102/CTY/PT/26950/2013

This research project has been submitted for examination with my approval as University Supervisor:

Signature……………………………………….Date………………………………………..

DR. CHARLES MUGENDI (PHD)

DEPARTMENT OF ECONOMICS THEORY

SCHOOL OF ECONOMICS

KENYATTA UNIVERSITY.
DEDICATION

I dedicate this study to my family who supported and encouraged me all through my studies.
ACKNOWLEDGEMENTS

I thank the Almighty God for enabling me to write this paper. I am grateful for the good health, strength, financial providence and grace freely granted. I am also greatly indebted to my devoted supervisor Dr. Charles Mugendi
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OPERATIONAL DEFINITION OF TERMS

Causality: Is the capacity of past estimations of one variable to foresee another variable.

Cointegration: This refers to when there is a long-run economic relationship between variables.

Economic growth: Refer to an increase in a country’s output of goods and services, measured by changes in real Gross Domestic Product.

Government Expenditure: Refers to the amount spent on goods and services, public debt servicing, and on capital investment by the government.

Gross domestic product: This is the monetary measure of all goods and services produced over a given time period (usually a year) excluding net property income from abroad.

Higher Education: Alludes to a level of training that is given by colleges, Technical schools, foundations of innovation and other university-level establishments that grant scholastic degrees or expert accreditations that is Tertiary Education.

Higher Education Expenditure: This is refers to the act of committing funds geared towards higher education

Human Capital: Refers to the value of human capacities. It can be invested through education, training and enhanced benefits that lead to an improvement in the quality and level of production.
**Productive Government Expenditure**: It is the expenditure that increases the productive potential of the economy. It involves an addition to the capital stock and production of tangible assets.

**Vector Autoregressive**: Is a forecasting technique in economics that does not distinguish between endogenous and exogenous variables but is concerned with the path through time of a vector of variables.
## ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADF</td>
<td>Augmented Dickey-Fuller</td>
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<td>AIC</td>
<td>Akaike Information Criteria</td>
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<td>CHE</td>
<td>Commission for Higher Education</td>
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<td>CUE</td>
<td>Commission for University Education</td>
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<td>ECM</td>
<td>Error Correction Model</td>
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<td>ECT</td>
<td>Error Correction Term</td>
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<td>FPE</td>
<td>Final Prediction Error</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>HELB</td>
<td>Higher Education Loans Board</td>
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<tr>
<td>HQIC</td>
<td>Hannan Quinn Information Criteria</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund MME Modified M-Estimator OLS Ordinary</td>
</tr>
<tr>
<td>KIPPRA</td>
<td>Kenya Institute of Public Policy Research and Analysis</td>
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<tr>
<td>KNBS</td>
<td>Kenya National Bureau of Statistics</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
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<tr>
<td>SBIC</td>
<td>Schwarz’s Bayesian information criterion</td>
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<tr>
<td>USIU</td>
<td>United States International University</td>
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<tr>
<td>VAR</td>
<td>Vector Auto-Regressive</td>
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<td>VECM</td>
<td>Vector Error Correction Model</td>
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ABSTRACT

Higher education investment has been at the centre of government policy since independence with a commitment to fight ignorance. This study aimed at analyzing the relationship between higher education expenditure and economic growth in Kenya. The study was guided by the following specific objectives; to assess the relationship between government expenditure on higher education and economic growth in Kenya; to establish the causal relationships between government expenditure on higher education and economic growth in Kenya; to find out the direction of causality between government expenditure on higher education and economic growth in Kenya. Econometric analysis was done using Vector Error Correction Model. The data was collected from secondary sources such as World Bank, ILO and economic surveys and statistical abstracts of Kenya National Bureau of Statistics. To correctly fit the model, higher education expenditure was modeled together with labor force participation, fixed capital formation and inflation towards GDP. The results revealed that Higher education expenditure, Labor force Participation Rate and Fixed Capital Formation had long-run adjustment towards equilibrium. The short run equations showed that none of the variables caused RGDP at the lag level but jointly had significant causality towards RGDP. The results from test for joint causality indicated that although higher education expenditure had no significant individual short run effect of RGDP, its absence in the model fades the short-run joint causality of the other variables on RGDP. The long-run dynamics revealed that higher education expenditure and labor force participation rate have positive and significant long-run impact on RGDP while fixed capital formation and Inflation had a negatively significant long-run impact on RGDP. From the findings, the study recommends that the government should increase the proportion of spending on higher education to promote high quality training, research and infrastructure in order to increase its impact in the short-run and long-run.
CHAPTER ONE

INTRODUCTION

1.1 Background

There has been a strong belief among economists that educational advancement would prompt heighten growth, more riches and salary circulation, more prominent correspondence of chance, accessibility of gifted human influence, a decrease in human population, increased life expectancy, low crime rates and political security. It is this belief that has led to widespread investment in education.

Schultz (1981) noted that the future welfare of man was based on principle determinants such as population quality and enhanced learning. Explaining this further, Harbison (1973) argues that the wealth of a county relies upon its ability to build up its human resources and less on their physical assets. He goes further to say that a nation which is unable to create skill and knowledge of its people and to use them appropriately in the national economy will not be able to develop.

Education is considered as the pathway to economic success, the way to logical and innovative progression, the way to battle joblessness, the establishment of social equity, the initiate of political socialization and cultural diversity (Pscharopolos, 1988). Education is additionally observed as a tool for guiding and directing social, economic and political elements and the generational developmental imperative of societies (Ayodo and Gravenir, et al., 1999).

Education adds to the development of national income and individual income. While land was the fundamental wellspring of riches and income in agrarian social structure,
capital and machinery became essential in modern social structures. In today’s social orders, learning drives monetary development and improvement. Higher education is the fundamental source of that information, its generation, dispersal and its retention by any general public. Economic growth right now relies upon the ability to create knowledge-based products. However, the fate of knowledge economies depends more on their ability to create knowledge through research improvement as opposed to knowledge-based products. Therefore, knowledge economies put more prominent esteem and bestow higher need to the generation and disbursement of knowledge. Therefore, it is evident that higher education foundations are a major source for providing the human capital. (Wilkinson et, al 2013)

Higher education is paramount in building up the human capital that result in the organizations that are viewed as an essential factor of progress. Higher education has facilitated the rise of a lively middle-class society, which was not part of aristocracy which was land-tied and that drew its benefits from feudalism. The middle-class society comprises of professionals such as the bookkeepers, engineers, legal counsellors, educators and many other specialists. This was important for the advancement of modern institutions of capitalism and democracy (Crawley, 2004).

While it is obvious that there has been a considerable growth in higher education, it is not clear exactly how important this vast growth is. Researchers have not been able to get a decent hold on two basic yield estimates on how to gauge quality in higher education and how to decide the value added by higher education over and beyond the understudy's inborn capacities. It is completely conceivable that even in frameworks which are of good quality, the credentialing parts of higher education advantage the
people who approach it and crowd out from work others with comparable capacities but lack formal education qualifications (Wolf, 2004). As indicated by Bloom et al (2006), Higher education may make more prominent tax income, increment of reserve funds and venture, and prompt a more innovative and urban culture. It can likewise enhance a country's wellbeing, lead to a decreased populace, enhance innovation, and strengthen governance.

The circumstances have changed as of late. Public universities no longer depend fully on the state for their funding. The asset allotment arrangements received in a few nations demonstrate that administrations encourage pioneering exercises which create pay and a closer association among universities and beneficial sectors, particularly in innovative work. Furthermore, numerous legislatures have enabled the private sector to operate institutions of higher education, sector which is developing quickly in many nations. These have reinforced market forces in higher education, now and again crossing the limits of national frontiers (Anywanwu and Erhijakpor, 2007).

In both developed and underdeveloped nations, education enhancement has been broadly perceived as the key to improving growth and development. In the past few decades, macroeconomic literature has highlighted how education as a measure of human capital could create long haul supported economic growth.
From one perspective, as asserted by Stevens and Weale (2003), since education brings about individuals gains, the same should be observed for the entire nation, as the benefits are expected to trickle down to the entire nation leading to economic growth (Sianesi and Van Reenen, 2003).

Human capital is semantically the blend of human and capital. From the economic viewpoint, the capital alludes to ‘components of production’ used to make merchandise or services but are not expended in the process (Boldizzoni, 2008). Aside from the importance of capital in the economic point of view, the human assumes the responsibility of every single economic movement, for example, production, consumption, and transaction. On the foundation of these ideas, human capital can be viewed as a production component that generates added-value through inputting it.

The creation of human capital can be classified into two types. The first is to use ‘human as labour force’. This is where economic products are generated by inputting labour force just like any other factor of production such as capital, land, machinery, and labour hours. Up until the 1950's, most economists’ had asserted the significance of such quantitative work. The other depends on the suspicion that the use of physical capital may have a similar impact with that of human capital on education and training (Little, 2003). Taking into account that the supposition acknowledges that, the human capital expansively incorporates the significance of human being as the ‘maker’. As per the arguments, it will in general be perceived that the latter is more important than the former (Beach, 2009). Several literary works show that human capital affects a significant number of social aspects. In the 1950's, some economist
found that human capital was the essential component to increase people's wages as opposed to an increase in production factors (Salamon, 1991).

Amassing of human capital through education impacts numerous divisions. Macroscopically, numerous analysts argue that gathering of one's human capital on education and training investment to a great extent influences the development of an individual's wage, firms' efficiency, and national economy (Denison, 1962; Schultz, 1961). Microscopically, Lepak and Snell (1999) demonstrate that a company's upper hand is determined by the investment of human capital involved with value-creating potential.

Human capital is highly valued in the work place, as it is believed that a highly educated worker is efficient in their undertakings. Education is believed to enhance specialists and therefore increase profitability. Alongside the conviction of education improves workers by enhancing specialists' profitability, numerous researchers emphasize the significance of education and training in the human capital field (Griliches and Regev, 1995; Rosen, 1999).

Economists and researchers have proposed numerous ways in which education may affect growth, not only through the individual’s returns' but also through a variety of externalities. Highly developed countries, the most discussed externality is education where they focus most on innovation and technology which makes labour more efficient and leading to economic growth. Regardless of the gigantic enthusiasm for the connection between education and economic growth, the proof is fragile, best case scenario (Bils and Klenow, 2000). More so, when it comes to the relationship between higher education and its contribution to economic growth.
1.1.1 History of Higher education in Kenya

In Kenya, after the completion of Primary and Secondary education, graduates have a variety of choices. The choices are based primarily on their performance in Kenya Certificate of Secondary Education and also financial capability. Graduates who have performed well can proceed to Public Universities. Others may opt to join private universities for a number of reasons such as unavailability of the desired course in the public university or failure to qualify for the desired course in public university. For graduates who do not qualify for public university selection, they also have the option of joining private universities depending on their performance as well. The other graduates, who do not meet the university cut-off points, have the option of joining Vocational schools. Examples of the Vocational schools are; Teachers Training colleges, Technical colleges and mid-level colleges where they graduate with diploma certificates. There are also other graduates who choose to join the job market.

Post-secondary education centers in Kenya known as polytechnics started as shadow system forms of education. According to Court and Ghai (1974) "The shadow systems were established to complement the formal system by meeting needs which were not being met and which may have a wider application in the national system."

In the polytechnics, students learning were focused mainly on: On-the job training, acquiring sills which would be essential in everyday life. In the late 1990s polytechnics fell out of favour. With the slow demise of Polytechnics, others converted to colleges such as Utalii College. It is during this period that we see emergence of multiple mid-level colleges.
In Kenya, establishment of University education can be traced from back to 1961 with Royal Technical College becoming University College, Nairobi. It was a constituent of the University of East Africa which had two other constituent colleges in Dar es Salaam and Kampala (Makerere). Up until 1966, The University of East Africa offered programmes of the University of London. In 1970, the University of East Africa was dissolved to create three independent universities in Nairobi, Dar es Salaam and Makerere. The University of Nairobi was thus established as the first university in Kenya (C Chacha, 2004).

Since independence in the year 1963, Kenya placed education in high regard as the tool that would promote economic and social development (Sifuna, 1998). This brought about fast development and expansion of institutions of education in order to accommodate qualified persons who would in turn, bring forth some reforms to reflect the aspirations of an independent state (Court and Ghai, 1974).

Throughout the 1970’s Kenya continued to expand The University of Nairobi in an effort to provide education for all qualified Kenyans who would in turn, serve in both the public and private sectors. As the number of Kenyans seeking higher education increased, it led to the establishment of other universities like; Moi University in 1984, Kenyatta University a former constituent of the University of Nairobi in 1985 and Egerton University a previous agricultural college in 1988.

In late 1988, Jomo Kenyatta College of Agriculture and Technology became a constituent college of Kenyatta University and became an independent university in 1994. Siriba Teachers’ College became Maseno University College, a constituent
college of Moi University, and later a full-fledged Maseno University in 2001 and later Masinde Muliro University was established in 2007.

In order to accommodate the high number of students that demanded higher education, a parallel programme was established in 1998 at the University of Nairobi. Later on, the program has been acquainted with every state-funded college. Students under the parallel programme are self-supported while those in the normal program are supported by the Government, which pays 70 percent of the expense of education through credits from the Higher Education Loans Board (HELB). The education loan is to be repaid once the student graduates and the one year grace period lapses. Nonetheless, in July 2008, HELB extended its loan facility to self sponsored students who faced cash flow difficulties.

In 2007 again, an even greater need to expand the number of universities arose with the then sitting President establishing 15 constituent colleges of the then existing 7 fully fledged public universities. The university colleges were later chartered in late 2012 and in 2013. At present university education has been expanded, leading to a total of 23 fully fledged public universities and 10 constituent colleges.

Not forgetting the private universities which emerged in the 1980’s and 1990’s, a majority being religiously controlled with the exception of USIU (United States International University). The private universities have increased tremendously over the last three decades to have 17 Chattered universities, 5 constituent colleges, 14 institutions with Letter of interim authority and 1 registered private institution (KNBS, 2018).
Commission for Higher Education (CHE) was established in 1995 under the provisions of the Universities Act. This commission was later on replaced by The Commission for University Education (CUE). The Commission has made incredible strides in ensuring the maintenance of standards, quality and relevance in all aspects of university education, training and research. The Commission continues to uphold quality assurance practices in university education.

1.1.2 History of Economic Growth in Kenya

After Kenya’s independence in the year 1963, GDP averaged at 7% that is between the years 1964 and 1976, right before the death of the first president of Kenya Jomo Kenyatta. However, between the years 1982 and 1990 GDP growth declined, averaging 1-2%. Between the year 1997 and 2002, the economy grew at an average rate of 1% per annum. In the year 2003, after Mwai Kibaki took over as president, GDP growth quickly picked up to 2.3% in the year 2004 reaching an all time high of 7% in the year 2007. GDP growth declined to 1% in the year 2008 due to post election violence then picked up to 2.9% in the year 2009 before averaging 5% between the years 2009 and 2013. At that time Kenya’s GDP was US$55.1 Billion with a Population of 44.83 Million and a per capita of US$1,229. Between the years 2013 and 2017 GDP growth averaged 5% per annum. In the year 2018, the GDP growth averaged 5.7% in the first quarter and nearly 6.3% in the second quarter, which is much higher compared to the first quarter of the year 2017 when it grew by 4.7%. In 2019, real GDP growth continues to accelerate attaining 5.7% in the first quarter of 2018, 6.0% in the second quarter of 2018 and 6.2% in the third quarter.
Real GDP is expected to continue to improve largely because of the continuing expansions in the various sectors of the economy such as tourism, transport, construction and a recover in the agricultural sector.

1.1.3 Trend of GDP and Expenditure in Higher education

This is a display of the growth rate in GDP and amount invested by the central government in Higher education.

![Graph showing the trend of GDP and Expenditure in Higher education](image)

**Figure 1.1: Comparison of the trend between Expenditure in higher education and GDP**

Source: Various Economic Surveys

From diagram 1.1 it is observed that there is a positive correlation between investments and GDP where the higher the GDP, the higher the investment in higher education. This trend has been observed almost in all the years. However, there have been a few exceptions where higher education investment is not correlated with GDP economic growth. This can be attributed to the internal reforms within the higher education department. There can also be observed some years with great variations from the previous in both investment and GDP growth. Some of the notable years can be explained as follows. In 2009/2010 there was a spike in higher education
investment. This was attributed to an expansion of capacity among the existing public universities. This expansion had to do with opening new constituent colleges and campuses. In 2011/2012 there was a drastic increase in the expenditure on higher education from the previous year. This was attributed to the increase in development expenditure because of the expected double intake by the universities later in the year.

In 2004 to 2005, an increase in GDP growth rate was observed; this was contributed by the stabilization of the Kenyan currency after the new political regime took over. There were extensive reforms coupled by the empowering of regulatory bodies like the Central Bank of Kenya, the Capital Markets Authority, the Insurance Regulatory Authority among others has given rise to a vibrant private sector and also the economy was boosted by both foreign and local investments as the climate was becoming favourable. In 2007 to 2009 there was a decrease in the GDP growth rate due to the elections and violence that followed thereafter, affecting significant development and economic growth.

1.2 Statement of the problem

Higher education investment has been at the centre of government policy since independence with a commitment to fight ignorance set as a key goal of independent Kenya. Subsequent decades saw the establishment of the first university in Kenya raising the number to 7 in three decades. By the year 2000, about 50,000 people enrolled in higher education institutions, a number that increased rapidly to 100,000 enrollments in 2010. According to the country’s blueprint, vision 2030, Kenya aims at becoming a prosperous middle-income country centred on developing its human capital. In the last 8 years, through the implementation of first and second mid-term
plans, the government has increased spending on higher education to nearly 100 billion Kenya Shillings, targeting over 200,000 beneficiaries. This has led to increased student intake through expansion of existing universities, upgrading constituent colleges to universities totaling to more than 40 fully fledged Universities in Kenya (KIPPRA, 2017).

The widespread consensus that higher education is a major driver of economic competitiveness in an increasingly knowledge-driven global economy has made quality university education the most esteemed factor of production in recent times (Ojiambo, 2009). Thus, the massive expenditure by the government on higher education is expected to have significant impacts on the economic performance. The growth of the country’s economy started at -0.3 in 2001 to 7% in 2007 then looped to 1.7% in 2008 after the violence following the disputed elections. In the following 8 years, the country’s economic growth has oscillated between 4.7 and 6.2%. Despite the rise in human capital development through investing in higher education, it is not clear whether huge investment in the sector by the government has a bearing on growth. Education improves the quality and efficiency of labour (Kapur and Crowley, 2008), thus the increased output of graduates from the university is expected to impact on growth either directly or through other mechanisms.

Many Studies on the phenomenon have analyzed the effect of government expenditure in the entire education system that is the relative elasticity of government expenditure in primary, secondary and tertiary level (Ojiambo, 2009; Mutiso et al., 2015) and how government expenditure on a multitude of factors in human development affect economic growth (Machuki et al., 2013)
However, few studies have been carried out to measure the direct relationship of government expenditure on higher education and economic growth. Such is a study like ‘The Impact of Human Capital on Economic Growth in Sri Lanka’ (Rathnayaka and Athukorala, 2012), a research that studied the impact of expenditure on different levels of education on economic growth, this included higher education as a level of education.

While some of these studies may suffer from methodological weaknesses (Thuku and Maingi et al, 2013), they also fail to measure the causality and direction of causality thus yielding varied inconclusive results. In order to bridge this gap and yield results that can lead to more targeted policy recommendations on higher education expenditure, this study aimed at assessing how government expenditure in higher education affects the performance of the economy and causal relationship between the two variables.

1.3 Research Questions

i. What is the relationship between government expenditure on higher education and economic growth in Kenya?

ii. What is the causality and direction between government expenditure on higher education and economic growth in Kenya?

1.4 Objectives of the study

General objective

The main objective of the study was to determine the relationship of government expenditure on higher education and economic growth in Kenya.
Specific Objectives

i. To assess the relationship between government expenditure on higher education and economic growth in Kenya.

ii. To establish the causality and direction between government expenditure on higher education and economic growth in Kenya

1.5 Significance of Study

The study generated insights into the relationship between expenditure in higher education and economic growth in Kenya.

The results of the study are useful in giving proper policy recommendation regarding government investment in higher education in Kenya. The study added knowledge to the existing literature on the same. Finally, the study sought to bridge the knowledge gap in that area of study and also invoke more research to be undertaken.

1.6 Scope of the study

This study was limited to the periods of 1986 to 2016 since this period was characterized by a substantial increase of higher education recipients, and because time series data for expenditure in higher education is available for this period of time. The research project also looked at the causality and direction of higher education expenditure in Kenya and economic growth over the said span of years. The research project was divided into five chapters. Chapter one introduces the study and its objectives. Chapter two presents the theoretical and empirical literature. Chapter three focused on research design and methodology. Empirical results are presented and discussed in chapter four while the summary, conclusions and policy implication are presented in chapter five.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This section reviews the literature on the works done by various aspects on higher education investment and economic growth. The chapter includes a review of the theoretical and empirical literature on higher education and economic growth.

2.2 Theoretical Literature

2.2.1 Education

Education is an essential tool that will lead a country to dynamic advancement and sustainability of human capital. An economist Gary Becker, a Nobel Laurent once emphasized the role of education as the key to development of the human capital. In this day and age, knowledge and skills are paramount for progress.

Mincer (1981) hypothesized that similarly as collection in individual human capital produces individual financial development (salary), the equivalent applies for social benefits. Human capital is a factor of production which works hand in hand with physical capital. Human capital is acquired through several ways, such as informal and formal education and on the job training through training, work experience mobility of labour not forgetting knowledge and vocational training. Researchers and other economists have conducted a statistical study on the cost of education and its returns. The study concluded that employers tend to pay educated employees higher wages as opposed to their less-educated workers, this is because of their ability to produce knowledge-based goods and services.
Ashton and Green (1996) postulated that with no doubt education brings about economic success. They argued that there is great competition worldwide when it comes to modern technology which is basically Knowledge-based. Their discussion was based on how education and training can be improved so as to attract prosperity.

Becker, Mincer and Schultz (1970) contended that investment in education and training develops a supply of knowledge and skills (as capital) in the populace that can profit national economies and fuel monetary development. Numerous others have stressed the significance of investment in human capital as a basic determinant of long-haul economic growth.

Harbison (1987) adds to the contention by affirming that human capital is the main source of wealth and prosperity in a country. He depicted physical capital and other tools of production as passive and human beings as the ultimate factor of production who uses the passive factors of production to build economic and political organizations to enhance national development.

### 2.2.2 Human Capital expenditure by Schultz (1961)

This is the hypothesis of human capital investment as proposed by Schultz (1961) who contends that both knowledge and skill are a type of capital and that this capital is a result of "intentional investment." Schultz speaks of how Western nations have increased their national yield as a result of investment in human capital. He additionally makes a connection between an increase in human capital and the general increment in labourers income.
This theory has three sections, the first one deals with ‘shying Away from Investment in Man’. It argues that economists for a long time now have been afraid to refer to human beings as capital. Schultz whole concept has been based on investing in people. With education and training, he suggests that many opportunities are opened up, most of which would not have been realized if not for education. He compares acquisition of education with acquiring a ‘means of production’ as it introduces a new method of production which was otherwise not there, to begin with. With education, workers can be in charge of their productivity and earnings due to the acquisition of skill and knowledge.

The second section deals with Economic Growth from Human Capital. Schultz argues that the observed differences in earnings between individuals are as a result of the differences in access of education and health. He gave an example of African-American Children who venture out to look for employment. They come across a barrier resulting from lack of human capital that is they have no sufficient education and training to get the desired employment. This kind of barrier will be experienced mostly in underdeveloped countries of marginalized communities where food and shelter is a major concern and therefore short-term investments are made to cater to for these basic needs. In developed societies where acquiring basic needs is not a problem they lean towards long-term investments, like education, health and migration (assisting refugees to resettle and find employment by offering them an opportunity to learn and improve their skills). In the long-run, these investments will pay off and improve the economy and standards of living.
The third section deals with 'Scope and Substance of These Investments'. Schultz contends that as individuals invest in human capital; their primary aim must be on acquisition of relevant skill set that will contribute in one’s ability to be efficient in production. He strongly believes that any enhancement in human capital leads to increased profitability. He argues that in as much as cost will be incurred in the investment process (school fees, lack of income while in school etc) in the long-run, the returns will greatly outweigh the cost.

### 2.2.3 O-Ring theory

Kremer (1993) hypothesized the O-ring hypothesis of economic improvement, a model of economic advancement. The hypothesis suggests that in order for work to be of high and significant quality, tasks must be executed proficiently together. The key component of this model is positive assortative coordinating, whereby individuals with comparative expertise levels work together. The name originates from the 1986 Challenger carry fiasco, a calamity caused by the disappointment of a solitary O-ring. Kremer believes that the O-ring hypothesis clarifies why rich nations create more entangled items, have bigger firms and significantly higher labourer profitability than poor nations.

There are five noteworthy suppositions of this model: firms are hazard unbiased, work markets are aggressive, specialists supply work flexibly, labourers are imperfect substitutes for each other, and there are adequate complementarities of assignments. Production is separated into 'n' undertakings. Workers can utilize a huge number of systems of differing productivity to complete these undertakings relying upon their expertise. Ability is indicated by q, where $0 \leq q \leq 1$. The idea of q contrasts differs on
interpretation. It could mean the likelihood of a worker effectively finishing a task, the quality of task completion expressed as a percentage, or the quality of task completion with a margin of error that could reduce quality. The output is determined by multiplying the q values of every one of the n tasks and then multiplying this outcome by another term (suppose, D) representing the individual attributes of the firm. Below is the production function.

\[ DF(q_i, q_j) = q_i q_j \] ...............................................................2.1

Here we see a four-person economy with two lowly skilled workers \((q_L)\) and two highly skilled workers \((q_H)\)

Below equation indicates the productive efficiency of skill matching:

\[ q_H^2 + q_L^2 > 2q_H q_L \] ...............................................................2.2

By this equation, total product is maximized by pairing those with similar skill levels.

Jones (2013) expounds upon Kremer's O-ring hypothesis to clarify why differences in laborer skills are linked to the huge variances in productivity levels despite causing unexceptional differences in wages within a nation. For this reason, he distinguishes between O-ring occupations, employments including high vital complementarities regarding aptitude and foolproof occupations; employments portrayed by diminishing returns to labour and expect both technologies to be accessible to all nations. He at that point proceeds to demonstrate that little global variances in worker skills per nation result in both expansive universal and little infra-national salary imbalance.
2.2.4 Estimating the Private Return to Schooling: The Mincer model.

The Mincer model was proposed by Jacob Mincer in 1974 by demonstrating that "if the main expense of going to class an extra year is the cost of undergraduates' time, and if the corresponding increment in profit caused by this extra year is steady after some time, at that point the log of income would be directly identified with person's long periods of schooling" (Kruegel and Lindahl, 2001).

He acknowledges on-the-job experience also enhance productivity and therefore wages, and hence below Mincerian equation:

\[
\ln W = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X + \varepsilon
\]

Where \(W_i\) represents individual’s wage, \(S_i\) the level of schooling and \(X_i\) the years in the labour market (experience) and \(\varepsilon\), a disturbance term. This equation has become one of the most used regression models in economic literature. Psacharapoulous (1994, 2004) calculated these estimates for several countries, in order to compare the results. He concluded that the Mincerian regression adjusts quite well the data and that the correlation between a return to schooling and GDP per capita in a given country is negative and statistically significant.

In this condition, \(\beta_1\) is the key variable to consider and relates to the gain in log wage for an individual that opts for an extra year of schooling as opposed to going straight to work.
Broadly, these estimates go from 0.05 to 0.15, with somewhat bigger estimates for ladies than for men (Kruegel and Lindahl, 2001).

2.2.5 Endogenous Growth theory

Endogenous growth theory brings out the idea that, economic growth is as a result of endogenous and not external forces. Endogenous growth theory holds that investment in the human resource, technological advancement, and information contributes towards economic growth. The theory also centers on positive externalities and overflow impacts of a knowledge-based economy which will prompt economic growth. The theory essentially holds that the long-run growth rate of an economy relies upon policy measures, for instance, subsidies for innovative work.

In the mid-1980s, a group of economists scholars were dissatisfied with the consensus that exogenous elements determined long-run growth. They supported a model that displaced the model with unexplained technical progress with a model in which the key determinants of growth were in the model. Research by Kenneth Arrow (1962), Hirofumi Uzawa (1965), and Miguel Sidrauski (1967) formed the basis for this study. Paul Romer (1986) together with several other economists did away with technological change and supported that growth in these models is because of unlimited investment in human capital which had an overflow impact on the economy and reduces the diminishing return to capital accumulation.

The AK model, the least difficult endogenous model, gives a steady-savings rate of endogenous growth. It shows technological progress with a solitary parameter (normally A). It utilizes the supposition that the production function does not exhibit
diminishing returns to scale to lead to endogenous growth. Various reasons for this supposition have been given, for example, positive overflows from capital investment to the economy as a whole or upgrades in innovation prompting further enhancements (learning by doing). In any case, the endogenous growth theory is additionally upheld by models in which optimally determined the consumption and saving, optimizing the resources allocation to research and development leading to technological progress.

There are a number of other literary works on education, and human capital, some of the works were by; Nelson and Phelps (1966) argued that a more educated labour force would mimic frontier technology faster. A state that is further away from the frontier stands to benefit more from catching up. Benhabib and Spiegal (1994) added that a more educated labour force would also innovate faster.

Acemoglu, Aghion, and Zilibotti (2003) gave a clarification to why higher education may be more growth-enhancing in some states than in others. They gave an example; in states where exceptionally educated people make up an expansive share of the workforce, the states get more growth out of investing in higher education as opposed to states in which highly educated workers make up only a small share. In both developed and developing countries, education advancements have been recognised as essential in enhancing growth.

Several theories have been advanced to emphasise the role of human capital and the different ways in which it may affect economic growth. But the main theories
highlighting a link between human capital and economic growth are augmented Solow neo-classical approach and the new growth theories.

2.3 Empirical Literature

Empirical studies have been undertaken in order to support this theoretical premise. Most of these studies focus on education and economic growth. Very few research studies have specifically looked into the relationship between higher education and economic growth. We shall look at the empirical literature available for education and economic growth and higher education and economic growth.

Machuki *et al* (2013) researched on the relationship between human capital (as proxied by capital expenditures on education and health) and economic growth in Kenya (1981-2011). He used the Ordinary Least Square multiple regression analytical method to examine the relationship between capital expenditures on education, healthcare and economic growth. The results showed a positive relationship between health expenditures and economic growth; while showing a significant but negative relationship between education expenditures and economic growth. The results can be influenced by the estimation method used in this case (OLS), that is its advantages and disadvantages when compared to other estimation methods and the selected years of study. This study however covered expenditure on entire education system and not expenditure on higher education only, hence the research gap addressed in this research study.

Rathnayaka and Athukorala (2012) took up a research study to identify the impact of human
Capital on economic growth in Sri Lanka. The study also examined how different skill levels in human capital that is Primary, Secondary and higher education affect economic growth. For the econometric estimation, Vector Error Correction Model (VECM) was employed.

The results of the VECM showed that the short-run impact of both government expenditure on university education and general education are significant, however, the magnitude of the coefficient of general education is greater than the university education. The difference between this research and the research in question is the country of origin, hence the specific data used. Therefore this necessitates a research study to be undertaken for the case of Kenya.

The causality between government expenditure on education and economic growth in Malaysian economy was studied by Hussin, Muhammad and Razak (2012) using time series data from 1970 to 2010 and applying Vector Auto Regression (VAR) technique. The results showed that education expenditure had Granger-Causality with GDP. They also found out that economic growth cointegrated with fixed capital formation, labour, labour force participation and government expenditure on education and would to a greater extent influence long-run economic growth. Apart from the varying data due to the country of origin and time frame selected, this study used entire education expenditure as opposed to higher education expenditure which is used in this research study, which leaves a gap to be filled by the results of this research study.

Sianesi and Van Reenen (2003) undertook a survey on the relationship between human capital and growth. The research data samples were from OECD and
developing countries. The model of choice was the Solow model and growth accounting. The results indicated that human capital increases productivity, suggesting that education is productivity enhancing, and not merely a device used by individuals to signal their ability to potential employers. The survey results suggest that a one year increase in average education raises the level of output per capita by between three and six percent, or raise the rate of potential growth by just over one percentage annually depending on the model adopted. The study focused on education as a whole and variable of choice to represent human capital in the production function was number of years in schooling as opposed to capital injected in higher education.

Lau, Jamison, and Louat (1990) estimated an aggregate production function relating real GDP to capital stock, labour force, land and average education of the labour force based on data for 58 developing countries. They found positive and statistically significant estimates for the elasticities of output with respect to average education. In their study, sub-Saharan Africa had the lowest elasticity - of 0.03 – followed by the Middle East and North Africa. Barro and Sala-i-Martin (1995). This study majored on the average education of a particular labour force in various developing countries as opposed to this study which looks at expenditure geared into developing human capital in Kenya.

2.4 Overview of Literature

Theoretical literature has shown that education is central to economic growth as it enhances labour productivity and shapes production trajectories through pushing for Knowledge-based growth. According to the arguments (Becker, et al., 1970)
investment in education is imperative in building the stock of skills and abilities essential in economic growth in that education and training systems improves per capita productivity and efficiency in production (Mincer, 1981; Ashton and Green, 1996). Considering human capital as a means of production, investing in its development imparting skills will not only strengthen the economy but also improve people’s standards of living (Schultz, 1961). Kremer O-ring theory through assortative matching shows the variation in income and income inequalities per country is linked to skills difference. However, Mincer model introduces the skills gained in the job market and empirical verification have shown that there is a more significant contribution to labour efficiency by one year spent in on job learning than return to school. Endogenous growth theory shows that investment in human capital creates positive spillover and this only varies with the type of investment from subsidies, research and development and innovation.

On the other hand, empirical studies have measured the productivity of human capital (Sianesi and Van Reenen 2003), return on investment (Hussin, Muhammad and Razak, 2012) by measuring expenditure on education, average school years (Barro and Sala-i-Martin, 1995), elasticity of output with respect to average education (Lau, Jamison, and Louat 1990) and relative impact of investment in education and health (Machuki et al., 2013). These studies have shown that education and development of human capital have positive impacts on personal productivity and economic growth through enhancing efficiency with an exception of the research study by Machuki et al., 2013 observed that investment in health has significantly positive impacts on economic growth compared to investment on education which yield negative impacts
citing anomalies in the sector in Kenya. Barro and Sala-i-Martin (1995) also observes that investment in education has varied impacts depending on the level; particularly primary level has negative impacts on economic growth

Having reviewed several empirical works on education and economic growth, we have learned a great deal from them. The studies tend to differ from this research study in question in a number of ways such as country of origin of the research study, variables used to represent human capital like number of years used in education, the model employed in the study and econometric analysis method used. Majority of the studies however only focus on education as a whole and not higher education, and the ones that do, do not apply to Kenya. These studies have therefore gone a great length to expose the necessity of conducting this research study of relationship between higher education expenditure and economic growth in Kenya, with Higher education expenditure representing human capital in the augmented Solow Model. We are however also persuaded by the argument of Bils and Klenow (2000) that existing studies tend to establish correlation, but tend not to establish causation and the direction of causation.
CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction
This chapter specifies the model and the methodology used to examine the relationship between higher education expenditure and economic growth in Kenya. It's followed by an explanation of variables used, sources of the data and the diagnostic tests employed in the study.

3.2 Research Design
This research sought to unravel the relationship between higher education expenditure and economic growth in Kenya. The research study is a non-experimental time series study. The research used data study recorded between the years 1986 and 2016. The collected data was analysed using Vector Error Correction Method (VECM) after undergoing time series diagnostic tests. Time series analysis was adopted in this study because of the sample size selected. VECM was used in analysis because it allows for analysis and interpretation of short and long run relationships and also allows for causality tests.

3.3 Theoretical Framework
3.3.1 The human-capital augmented Solow model
The study adopted the human-capital augmented Solow model as postulated by Mankiw, Romer and Weil (1992). They presented Solow’s (1956) model of economic growth augmented to include human capital investment as a separate input into a standard Cobb-Douglas production function. Augmented Solow model estimated two specifications. The first specification assumes that the economy is in steady state and described by Cobb-Douglas constant returns to scale production function:
\[ Y(t) = K(t)^{\alpha} H(t)^{\beta} A(t)L(t)^{-\alpha+\beta} \] .................................3.1

Where \( Y \) is output, \( A \) is technology, \( K \) is physical capital, \( H \) is human capital, and \( L \) is labour.

The parameters \( \alpha \) and \( \beta \) are the output elasticities with respect to physical and human capital (shares of physical and human capital in total income), respectively. Mankiw, Romer and Weil (1992) extended the Solow dynamics of physical capital accumulation to human capital.

Thus the dynamics of growth takes the form:

\[ K(t) = skY(t) - \delta K(t) \] .................................3.2

\[ L(t) = nL(t) \] .................................3.3

\[ A(t) = gA(t) \] .................................3.4

\[ H(t) = shY(t) - \delta H(t) \] .................................3.5

Where \( sk \) and \( sh \) denote the fraction of devoted income to the accumulation of, respectively, physical and human capital, \( n \) is the rate of growth of labour, \( g \) is technological progress, and \( \delta \) is the rate of depreciation. Assuming the existence of a steady state with \( \alpha + \beta < 1 \), Mankiw, Romer and Weil (1992) obtained the following steady-state estimable version of the model:

\[
\ln \frac{Y(t)}{L(t)} = \ln(A(0)) + gt \left( \frac{\alpha + \beta}{1 - \alpha - \beta} \right) \ln(n + g + \delta) + \left( \frac{\alpha}{1 - \delta - \beta} \right) \ln(sk) + \left( \frac{\beta}{1 - \beta - \delta} \right) \ln(S_h)
\] .................................3.6

The equation above provides the basic framework for testing the augmented Solow model. The model predicts that the steady-state level of income per capita is
positively affected by investment in both physical and human capital and negatively
affected by population growth, depreciation, and exogenous technological progress,
and requires that the second specification of the augmented Solow model relaxes the
assumption that the economy is in steady state.

Letting $y^*$ be the steady-state level of income per effective worker and $y(t)$ the actual
value at time $t$. Mankiw, Romer and Weil (1992) showed that the speed of
convergence can be obtained by linear approximation around the steady state:

$$\frac{\partial \ln\left(\frac{y(t)}{y^*}\right)}{\partial t} = \lambda [\ln(y^*) - \ln(y(t))]$$

Where

$$\lambda = (n + g + \delta)(1 - \alpha - \beta)$$

The first-order differential equation above implies that

$$\ln(y(t)) - \ln(y(0)) = \left(1 - e^{-\lambda t}\right) \ln(y^*) + e^{-\lambda t} \ln(y(0))$$

Where $y(0)$ is income per effective worker at some initial point in time.

$$\ln(y(t)) - \ln(y(0)) = -\left(1 - e^{-\lambda t}\right) \left(1 - e^{-\lambda t}\right) \ln(n + g + \delta) + \left(1 - e^{-\lambda t}\right) \left(1 - e^{-\lambda t}\right) \ln\left(\frac{\alpha}{1 - \beta - \alpha}\right) \ln\left(S_h\right) - \left(1 - e^{-\lambda t}\right) \ln(y(0))$$

Since income per effective worker $y(t)$ is not observable, Mankiw, Romer and Weil
(1992) expressed equation above in terms of income per capita and obtained the out-
of-steady-state estimable version of the model:
Solow growth model predicts conditional convergence, i.e. convergence to a steady state that may differ across countries. Thus, the finding that the parameter estimate of
\[
\ln \left( \frac{Y(0)}{L(0)} \right)
\]
\(Y\) is significantly less than zero, which implies; \(\lambda > 0\), provides additional evidence in favour of the augmented Solow model.

Mankiw, Romer and Weil made three other important assumptions;

1. Investment in human capital is the same as investment in physical capital, as individuals forego consumption to redirect their income to human capital accumulation.(comparable to the fraction \(s_k\) invested in physical capital)

2. Human Capital and physical capital depreciates at the same constant rate \(\delta\).

3. Output produced in an economy can be used for either consumption or investment in (physical or human) capital.

From equation 3.9, we get the model specification
\[
\ln Y = \alpha + \beta_1 (\text{EDUEXP}) + \beta_2 (\text{LFPR}) + \beta_3 (\text{GFCF}) + \mu_i
\]

Where:

\(Y = \text{Real GDP}\)

\(\text{EDUEXP} = \text{Higher education expenditure}\)

\(\text{LFPR} = \text{Labor Force Participation Rate}\)

\(\text{GFCF} = \text{Gross Fixed Capital Formation}\)
3.4 Empirical Models, Models Specification and Estimation

3.4.1 Pre Estimation Tests

Both linear and non-linear specifications of the functional relationship in the equation were estimated using time series data for the period 1986-2016. Time-series data usually exhibits non-stationarity (has both time and variable specific variant) and if the OLS method is applied directly, the results would be spurious. Because of this, diagnostic tests were done before the model is fitted using Vector Error Correction Model.

3.4.1.1 Unit Root Test

Unit root test was the first diagnostic procedure done on the properties of the data and aimed at testing for stationarity. The test is important and helps in avoiding spurious regression problem as most standard econometric procedures require time series tests to be stationary. This study required some order of stationarity for the time series data, as this is a prerequisite in cointegration analysis and Granger causality version VECM.

The study used the Augmented Dickey-Fuller (ADF) and Philip Peron (PP) tests to test the unit root in the data.

\[ \Delta Y_i = \alpha + \alpha_2 Y_{i-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{i-1} + \epsilon_i \]  \hspace{1cm} 3.10

Where Y is the choice variable; \( \Delta \) is the first difference operator; \( \alpha_i \) (for \( i = 1 \& 2 \)) and \( \beta_i \) (for \( i = 1, 2, \ldots, p \)) are constant parameters; and \( \epsilon \) is a non-stochastic.
Based on the Vector Auto regression, appropriate lag length selection is important in order to assure the research findings reflect the real economic situation and importantly the findings are consistent with economic as well as econometric theories. Akaike Information Criteria (AIC) was used to choose the lags in this study to determine the order of integration of a particular series, the equation has to be modified and include the second difference on lagged first and p lags of second differences as follows

\[ \Delta^2 Y_t = \theta_1 \Delta Y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta Y_{t-i} + \xi_t \]  

Where \( \Delta^2 \) is the second difference operator; \( \theta_1 \) and \( \theta_i \) are constant parameters; and \( \xi_t \) is a stationary stochastic process. Due to the inclusion of difference lagged term i.e. ‘p’ the error terms \( (s_t \) and \( \xi_t \) \) in the respective equations are serially independent. To test stationary, the augmented Dickey Fuller (ADF) [Dickey and Fuller, 1981] and Phillips and Perron (1988) tests were applied to equations 1 and 2. The null hypotheses are \( H_0: \alpha_2 = 0 \) against \( H_1: \alpha_2 \neq 0 \) and \( H_0: \theta_i = 0 \) against \( H_1: \theta_i \neq 0 \) respectively which signifies non-stationarity of both \( Y_{t-1} \) and \( \Delta Y_{t-1} \).

### 3.4.1.2 Cointegration

After testing for stationarity, the next step was to test for cointegration to assess the long-run linkages among study variables. The premises behind cointegration is that there exists a vector whose linear combination with variables of I(d) make such variables I(0) thus stationary or co-integrated, or possess a long run (equilibrium) relationship. This study employed Johansen Maximum likelihood test to check for cointegration. Whether the variables are co-integrated or not, using the Johansen (1991, 1988) maximum likelihood test. This method produces optimal estimates since it
incorporates a parametric correction for serial correlation. This means that the estimates are robust to simultaneity bias, and it is robust to departure from normality (Johansen, 1995). Johansen method detects a number of co-integrating vectors in non-stationary time series and will therefore be used to determine the rank \( r \) and to identify a long-run relationship of Investment in higher education (EDUEXP) and Real Gross Domestic Product (RGDP).

3.4.2 Vector Error Corrección Model (VECM)

The Granger representation theorem (Granger, 1988) states that if two variables (say Gross Domestic Product (GDP) and Education Expenditure (EE)) are co-integrated and each is individually \( I(1) \), then neither \( Y_1 \) Granger causes \( Y_2 \) or \( Y_2 \) to \( Y_1 \). Therefore, Vector Error Correction Model (VECM) captures the dynamics of both short-run and long-run causality of the variables. The model is expressed as follows:

\[
\Delta RGDP_{1,t} = \Omega_1 + \sum_{k=1}^{n-1} \alpha_{11,k} \Delta RGDP_{1,t-k} + \sum_{k=1}^{n-1} \alpha_{12,j} \Delta EDUEXP_{2,t-k} + \sum_{h=1}^{r} \alpha_{1,h} EC_{h,t-1} + C_{1,t} \hspace{1cm} \text{(3.12)}
\]

\[
\Delta EDUEXP_{2,t} = \Omega_2 + \sum_{k=1}^{n-1} \alpha_{21,k} \Delta EDUEXP_{21,t-k} + \sum_{k=1}^{n-1} \alpha_{22,j} \Delta RGDP_{2,t-k} + \sum_{h=1}^{r} \alpha_{2,h} EC_{h,t-1} + C_{2,t} \hspace{1cm} \text{(3.13)}
\]

Where, \( EC_{h,t-1} \) is the \( h \)-th error correction term, the residuals from the \( h \)-th cointegration equation, lagged one period, and \( \alpha_{ij,k} \) describes the effect of the \( k \)-th lagged value of variable \( j \) on the current value of variable of \( i \): \( I_1 = GDP_1, EDUEXP \). VECM approach captures both between short-run and long-run causality. In Equations (3.5.1.
and 3.5.2) above, long-run Granger causality from variable GDP\(_i\) to variable EDUEXP\(_j\) in the presence of co-integration is evaluated by testing the null hypothesis that \(\alpha_h = 0\) for \(h = 1, \ldots, r\), whereas the short run Granger causality from variable GDP\(_i\) to variable GDP\(_j\) is evaluated by testing the null hypothesis that \(\alpha_i, 1 = \ldots \alpha_i, p-1 = 0\), using F statistics. We can reject null hypothesis of either one or both and can conclude that variable GDP\(_i\) Granger-causes variable EDUEXP\(_j\).

### 3.6 Data Type and Sources

To achieve the objectives of the study, annual time series were used. The data used in this study was collected from various secondary sources. The secondary sources include; the *Kenya National Bureau of Statistics* (statistical abstracts and economic surveys), World Bank Africa database 2018 and ILO *datastat*.

### 3.7 Data Collection

Secondary data was utilized for the purpose of this study. The data collected covered the period 1986 to 2016. The brevity of the sample period was dictated by the availability of consistent data, which are compiled on an annual basis. The collected data was for the following variables; economic growth and government investment in higher education, labor force participation rate, fixed capital formation and inflation rates.
CHAPTER FOUR
EMPIRICAL FINDINGS

4.1 Introduction

This chapter presents the analysis of data and interpretation, both descriptive findings and econometric model for the relationship between higher education expenditure and GDP. In this chapter, the findings are presented in figures, tables and charts.

The analysis aimed at measuring the relationship between higher education expenditure and GDP growth rate through labor force participation rate in Kenya from 1986-2016. However, GDP is also affected by other productivity parameters such as inflation rate, which also was considered for modeling to avoid under specification. From the Cobb Douglas production function, output (GDP) is affected by both capital formation and labor force productivity. On the other hand, research (Feldstein, 2002, Bulman and Simon, 2003) has shown that inflation affects return on capital negatively, slows down capital formation, and triggers labor force efficiency losses resulting from unproductive activities for coping with rising prices. Thus, to properly fit the model on relationship between Higher Education Expenditure and GDP, Inflation (INF) was included in the model. The figure below presents the trend and distribution of the variables across the study period.
Figure 4.1: Trends in GDP Growth, Education Expenditure, Labor Force Participation, Fixed Capital Formation and Inflation Rates 1986-2016

From figure 4.1, we can see that all the variables with an exception of LFPR are fairly constant and on a more so similar level within the specified time of the study. LFPR reads on a very high level because the variable represents all forms of labour participation in the country as documented by various sources. For the case of INF, we observe the highest level of inflation in the years 1992 and 1993 due to the devaluation of the Kenyan shilling coupled with excess money supply in the years 1992 and early 1993. In the year 2011, there was an increase in inflation which was as a result of drought, rising global oil prices and depreciation of the Kenyan shilling. For RGDP, there is a notable decrease in the year 2008 this was attributed to the post election in the period after the disputed election of December 2007.

4.2 Descriptive Analysis

The analysis explored data characteristics through getting a summary computation where the measure of central tendency (mean) and dispersion (standard deviation) for
the variables was obtained. Normality of the variables was also tested using Skewness, Kurtosis, Jarque-Bera and Shapiro WilkW test. The results were as presented in table 4.1 below;

**Table 4.1: Descriptive Analysis**

<table>
<thead>
<tr>
<th></th>
<th>EDUEXP</th>
<th>LFPR</th>
<th>RGDP</th>
<th>FCFR</th>
<th>INF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>1.515</td>
<td>69.2245</td>
<td>3.82903</td>
<td>6.2226</td>
<td>10.89032</td>
</tr>
<tr>
<td><strong>Std. Dev</strong></td>
<td>3.4457</td>
<td>3.4883</td>
<td>2.3914</td>
<td>2.2844</td>
<td>9.2397</td>
</tr>
<tr>
<td><strong>Min</strong></td>
<td>11.19</td>
<td>64.84</td>
<td>-1.1</td>
<td>3.5</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Max</strong></td>
<td>28.57</td>
<td>75.9</td>
<td>8.4</td>
<td>8.4</td>
<td>46</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>0.0000</td>
<td>0.6790</td>
<td>0.2708</td>
<td>0.9433</td>
<td>0.0000</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>0.0004</td>
<td>0.0000</td>
<td>0.3996</td>
<td>0.4396</td>
<td>0.0006</td>
</tr>
<tr>
<td><strong>Jarque-Bera Test</strong></td>
<td>21.37</td>
<td>14.37</td>
<td>2.08</td>
<td>0.63</td>
<td>21.10</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0008)</td>
<td>(0.3532)</td>
<td>(0.7306)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Shapiro Wilk<code>W</code> Test</strong></td>
<td>0.84184</td>
<td>0.86941</td>
<td>0.75455</td>
<td>0.84330</td>
<td>0.94329</td>
</tr>
<tr>
<td></td>
<td>(0.00135)</td>
<td>(0.00001)</td>
<td>(0.11037)</td>
<td>(0.10178)</td>
<td>(0.00034)</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)  
*P-value in parenthesis*

The results show that Labor force participation rate had the highest mean (M=69.22%, SD=3.49) followed by inflation (M=10.89%, SD=9.24), Fixed Capital Formation Rate (M=6.22%, SD=2.28), Real GDP (M=3.83%, SD=2.39) while education expenditure had the lowest average (M=1.52%, SD=3.45). For the Standard deviation, variables with highest SD indicate that the data points are spread out over a wide range of values, while low SD indicate that data points tend to be close to the mean of the set, also called the expected value. From the tabulated data, EDUEXP has
the highest coefficient of variation (CV=SD/Mean), of CV=> 1, meaning that the
variables data points are spread out over a large number of values. While the other
variables all have a CV<1 indicating data points are close to the mean. The normality
hypothesis was tested using Jarque-Bera statistic distributed as Chi square with 2
degrees of freedom (for skewness and Kurtosis). The p-value for Jarque-Bera statistic
show that apart from real GDP and FCFR, the null of normal distribution is rejected
for EDUEXP, LFPR and INF. Shapiro WilkW test is used to test normality for smaller
sample size and was used to countercheck the outcome of Jarque-Bera test. The W test
equally indicated that the null hypothesis is rejected for EDUEXP, LFPR and INF.

4.3 Stationarity Analysis

Stationarity test which checks whether the mean and variance of the time series are
time invariant. In this analysis, stationarity was tested using Augmented Dickey Fuller
unit root tests and Philip-Perron statistic.

The null hypothesis is that the variables have unit root and it is rejected when the test
statistics is larger (in absolute terms) than the critical values. The results were
presented in table 4.2 below.
Table 4.2: Unit Root Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Augmented DF Test</th>
<th>Philip-Perron Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Statistic</td>
<td>Stationarity</td>
</tr>
<tr>
<td>EDUEXP</td>
<td>-3.436</td>
<td>Non Stationary @ 0.1 level</td>
</tr>
<tr>
<td>LFPR</td>
<td>-0.451</td>
<td>Non Stationary</td>
</tr>
<tr>
<td>RGDP</td>
<td>-3.164</td>
<td>Non Stationary @ 0.1 level</td>
</tr>
<tr>
<td>FCFR</td>
<td>-2.129</td>
<td>Non Stationary</td>
</tr>
<tr>
<td>INF</td>
<td>-2.669</td>
<td>Non Stationary</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

The results of both Dickey Fuller and Philip-Perron tests show that none of the variables were stationary as the test statistics had absolute values less than at least one of the critical tests levels. Transforming the variables from non-stationary to stationary is done through differencing. In this study, first difference were obtained and tested for stationarity. As shown in table 4.3, below all the differenced variables became stationary after taking the first difference.
### Table 4.3: Unit Root Tests Taking First Difference

<table>
<thead>
<tr>
<th>Variable</th>
<th>Augmented DF Test</th>
<th>Philip-Perron Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Statistic</td>
<td>Stationarity</td>
</tr>
<tr>
<td>EDUEXP</td>
<td>-8.753</td>
<td>Stationary</td>
</tr>
<tr>
<td>LFPR</td>
<td>-5.521</td>
<td>Stationary</td>
</tr>
<tr>
<td>RGDP</td>
<td>-6.547</td>
<td>Stationary</td>
</tr>
<tr>
<td>FCFR</td>
<td>-4.896</td>
<td>Stationary</td>
</tr>
<tr>
<td>INF</td>
<td>-5.196</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

#### 4.4 Model Estimation

The unit root tests showed that the series is I (1) whose implication is that, before estimating the model, the series must be tested for cointegration in order to determine whether to use VAR in differences or VECM. If VAR is fitted in cointegrated series, the model is deemed as mis-specified, sub optimal and spurious. The suitability of fitting a VECM for cointegrated series is due to the fact that it adjusts to both short-run shocks in variables and resulting long run deviations from equilibrium.

#### 4.4.1 Lag Order Selection

Lag order was estimated for cointegration testing and for fitting the ideal model. Optimal lags to be included in the model were estimated using various criterions. As shown in table 4.4, Final Prediction Error (FPE), Akaike Information Criteria (AIC),
Hannan Quinn Information Criteria (HQIC) and Schwarz’s Bayesian information criterion (SBIC) yielded an optimal lag order of 4.

Table 4.4: Selection Order Criteria

<table>
<thead>
<tr>
<th>Lag</th>
<th>LL</th>
<th>LR</th>
<th>df</th>
<th>p</th>
<th>FPE</th>
<th>AIC</th>
<th>HQIC</th>
<th>SBIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-290.479</td>
<td></td>
<td></td>
<td></td>
<td>5115.3</td>
<td>22.7292</td>
<td>22.7989</td>
<td>22.9711</td>
</tr>
<tr>
<td>1</td>
<td>-263.474</td>
<td>54.011</td>
<td>25</td>
<td>0.001</td>
<td>4572.75</td>
<td>22.5749</td>
<td>22.993</td>
<td>24.0266</td>
</tr>
<tr>
<td>2</td>
<td>-222.796</td>
<td>81.356</td>
<td>25</td>
<td>0.000</td>
<td>1742.55</td>
<td>21.3689</td>
<td>22.1353</td>
<td>24.0303</td>
</tr>
<tr>
<td>3</td>
<td>-165.036</td>
<td>115.52</td>
<td>25</td>
<td>0.000</td>
<td>293.279</td>
<td>18.8489</td>
<td>19.9637</td>
<td>22.72</td>
</tr>
<tr>
<td>4</td>
<td>-90.4097</td>
<td>149.25*</td>
<td>25</td>
<td>0.000</td>
<td>52.9185*</td>
<td>15.0315*</td>
<td>16.4946*</td>
<td>20.1123*</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

4.4.2 Cointegration

Johansen Maximum Likelihood test for cointegration was estimated using 4 lags obtained from selection criteria. The results table 4.5 show that the null hypothesis for at most one cointegrating equation among the variables cannot be rejected 5% level.
Table 4.5: Johansen Tests for Cointegration

<table>
<thead>
<tr>
<th>Trend:</th>
<th>Constant</th>
<th>Number of obs = 27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample:</td>
<td>1990 - 2016</td>
<td>Lags = 4</td>
</tr>
<tr>
<td>Maximum rank</td>
<td>parms</td>
<td>LL</td>
</tr>
<tr>
<td>0</td>
<td>80</td>
<td>-7.1567695</td>
</tr>
<tr>
<td>1</td>
<td>89</td>
<td>65.132109</td>
</tr>
<tr>
<td>2</td>
<td>96</td>
<td>96.042955</td>
</tr>
<tr>
<td>3</td>
<td>101</td>
<td>114.60286</td>
</tr>
<tr>
<td>4</td>
<td>104</td>
<td>122.56727</td>
</tr>
<tr>
<td>5</td>
<td>105</td>
<td>124.12622</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

4.4.3 Vector Error Correction Model (VECM)

The study main hypothesis was to assess whether expenditure on higher education has an impact on economic growth either directly or indirectly. The 4 lag VECM coefficients give the short run causality from one variable to the target variable. The principle for short run causality is having positive and significant coefficients of first difference of the VECM. Taking GDP as the target variable, table 4.6 shows the short run effects of each variable towards RGDP.
Table 4.6: Vector Error Correction Model

|            | Coef.   | Std.Err. | z       | p>|z|   | [95% Conf. Interval] |
|------------|---------|----------|---------|-------|----------------------|
| D_RGDP     |         |          |         |       |                      |
| _ce1       |         |          |         |       |                      |
| L1.        | -0.1140968 | 0.0451797 | -2.53  | 0.012 | -0.2026475 to -0.0255462 |
| RGDP       |         |          |         |       |                      |
| LD.        | -0.0032769 | 0.2753444 | -0.01  | 0.991 | -0.5429400 to 0.5363883 |
| L2D.       | -0.0960559 | 0.2734910 | -0.35  | 0.725 | -0.6320884 to 0.4399767 |
| L3D.       | -0.1478108 | 0.2578736 | -0.57  | 0.567 | -0.6532337 to 0.3576121 |
| EDUEXP     |         |          |         |       |                      |
| LD.        | -0.0196068 | 0.0482000 | -0.41  | 0.684 | -0.1140772 to 0.7486350 |
| L2D.       | -0.0066242 | 0.0430940 | 0.15   | 0.878 | -0.0778386 to 0.0910870 |
| L3D.       | -0.0252212 | 0.0466098 | 0.54   | 0.588 | -0.1165748 to 0.0661324 |
| LFPR       |         |          |         |       |                      |
| LD.        | -0.1552492 | 0.2859991 | -0.54  | 0.587 | -0.7157972 to 0.4052987 |
| L2D.       | -0.1373924 | 0.2874938 | -0.48  | 0.633 | -0.7008699 to 0.4260851 |
| L3D.       | -0.0796409 | 0.2859067 | -0.28  | 0.781 | -0.6400078 to 0.4807260 |
| FCFR       |         |          |         |       |                      |
| LD.        | -0.7533963 | 0.3321512 | -2.27  | 0.023 | -1.4044010 to -0.1023919 |
| L2D.       | -0.3485879 | 0.2968097 | -1.17  | 0.24  | -0.9303243 to 0.2331484 |
| L3D.       | -0.4004317 | 0.3075036 | -1.3   | 0.193 | -1.0031280 to 0.2022643 |
| INF        |         |          |         |       |                      |
| LD.        | -0.0313524 | 0.0169746 | -1.85  | 0.065 | -0.0646219 to 0.0019171 |
| L2D.       | -0.0135304 | 0.0163059 | -0.83  | 0.407 | -0.0454893 to 0.0184285 |
| L3D.       | -0.0084278 | 0.0166307 | -0.51  | 0.612 | -0.0410234 to 0.0241678 |
| _cons      | -0.0617529 | 0.0541571 | -1.14  | 0.254 | -0.1678989 to 0.0443930 |

Source: Author’s Computation (2019)
The results across the LD, L2 and L3 show that there is no short-run causality from each variable towards GDP, including EDUEXP.

**4.4.4 Testing Short-Run causalities of the model Variables**

Table 4.7: Testing joint (for all lags) short run causality of EDUEXP towards RGDP by setting the null that joint short run causality is zero at \( p \leq 0.05 \), yields the following results.

<table>
<thead>
<tr>
<th>( \Delta \text{RGDP} )</th>
<th>LD.EDUEXP</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L2.D.EDUEXP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L3.D.EDUEXP</td>
<td>0</td>
</tr>
<tr>
<td>Chi2 (9)</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td>0.8309</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.8: Testing Joint short run causality of model variables including EDUEXP \( (p \leq 0.05) \)

<table>
<thead>
<tr>
<th>( \Delta \text{RGDP} )</th>
<th>L. _ce1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>LD.RGDP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L2.D.RGDP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L3.D.RGDP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>LD.EDUEXP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L2.D.EDUEXP</td>
<td>0</td>
</tr>
<tr>
<td>( \Delta \text{RGDP} )</td>
<td>L3.D.EDUEXP</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 4.9 Testing Joint short run causality of model variables without EDUEXP (p≤0.05)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[D_RGDP] LD.LFPR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L2D.LFPR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L3D.LFPR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] LD.FCFR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L2D.FCFR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L3D.FCFR</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] LD.INF</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L2D.INF</td>
<td>0</td>
</tr>
<tr>
<td>[D_RGDP] L3D.INF</td>
<td>0</td>
</tr>
</tbody>
</table>

Chi2 (9) 26.71

Prob>chi2 0.0448
The joint linear hypothesis shows that there is no sufficient evidence presented in the data to reject the null ($\alpha = 0.05$). Thus, education expenditure has no joint short run causality on RGDP. However, testing the total joint short run causality for all the variables, the null, of zero short run effect of all the variables towards GDP is rejected as the Chi square results (Test 1 below) yield a p-value 0.0446 which is less than 5%. Under test 2, joint short run causality of the model variable is done excluding EDUEXP lags and the results (p-value=0.3863) show that we cannot reject the null of zero joint short run causality of the variables. Thus, EDUEXP causes RGDP in the short run as part of other production parameters while short run effects of the other variables in the model are not statistically significant to cause RGDP in the short run.

4.4.7 Error Correction Model

The cointegration test revealed there is at least one linear combination that yields long-run association ship among the variables. Error Correction Term (ECT) or the cointegration equation (ce) shows the speed of the model adjustment, from the short term shocks, towards the long-run equilibrium implying that rapid short run change
by one or more model variable(s) that deviates the association ship from equilibrium fades off in the long-run to return the series to equilibrium. In the VECM output, this is reported from the coefficients of cointegration terms, which are summarized in table 4.7 below.

**Table 4.10: Long run Error Correction Terms**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Speed of Adjustment (Lagged Error Correction term)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D RGDP</td>
<td>-0.1141</td>
<td>0.012</td>
</tr>
<tr>
<td>DEDUEXP</td>
<td>0.4056</td>
<td>0.011</td>
</tr>
<tr>
<td>DLFPR</td>
<td>-0.1118</td>
<td>0.002</td>
</tr>
<tr>
<td>DFCFR</td>
<td>-0.1013</td>
<td>0.036</td>
</tr>
<tr>
<td>DINF</td>
<td>-0.3274</td>
<td>0.676</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

The results show that the error correction terms for RGDP, LFPR and FCFR are negative and significant at 5% level implying that they have long-run causality towards these variables in the model. Precisely, the results suggest that previous period errors or deviation from the long-run equilibrium are corrected for within the current period at a convergence speed of 11.4% for GDP, 11.2% for LFPR and 10.1% for FCFR. The other variables, i.e. EDUEXP and INF do not have significant long-run correction. From the results, the long-run model can be summarized as follows;

\[
\Delta RGDP = 0.062 + \text{Shortrun shocks} - 0.1141ECT_{t-1}
\]

Including the EDUEXP short-run coefficients;

\[
\Delta RGDP = -0.062 + \begin{pmatrix} -0.196LD \\ 0.0066L2 \\ -0.0252L3 \end{pmatrix} \Delta EDUEXP_{t-1} - 0.1141ECT_{t-1}
\]
The Johansen normalization restriction imposed presents the long-run dynamics of the model, where the error term is generated. RGDP was taken as the target variable thus the restrictions were imposed on it.

Table 4.11: Johansen Normalization Restriction Imposed

| beta | coef. | Std. Err | z    | P>|z| | [95% Conf. Interval] |
|------|-------|----------|------|------|---------------------|
| _ce1 | RGDP  | 1        | .    | .    | .                   |
| EDUEXP | -0.09351 | 0.027139 | -3.45 | 0.001 | -0.146702, -0.04032 |
| LFPR  | -4.78387 | 0.151574 | -31.56 | 0.000 | -5.080951, -4.48679 |
| FCFR  | 1.570619 | 0.134872 | 11.65 | 0.000 | 1.306276, 1.834962 |
| INF   | 0.625629 | 0.02546  | 24.57 | 0.000 | 0.575728, 0.67553 |
| _cons | -31.8374 | .        | .    | .    | .                   |

Source: Author’s Computation (2019)

The Johansen normalization coefficient signs are reversed in the long-run. The results show that RGDP and LFPR have a significantly positive long-run effect on RGDP while FCFR and INF significantly affect RGDP negatively in the long run.

4.5 Post Estimation Tests

In order to determine the robustness of the model, the VECM was subjected to post estimation tests. The tests included; normality of distribution disturbances, autocorrelation and model stability. This section presents the results.

4.5.1 Normality of Residuals

Jarque-Bera test was used to test for normality of distributed disturbances. The null hypothesis for the test is; $H_0$: The disturbances of the differenced equations are normally distributed. The results are as shown below;
Table 4.12: Jarque-Bera Test for Normality of Distributed Disturbances

<table>
<thead>
<tr>
<th>Equation</th>
<th>chi2</th>
<th>df</th>
<th>Prob&gt;chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_RGDP</td>
<td>0.678</td>
<td>2</td>
<td>0.71257</td>
</tr>
<tr>
<td>D_EDUEXP</td>
<td>1.427</td>
<td>2</td>
<td>0.49004</td>
</tr>
<tr>
<td>D_LFPR</td>
<td>1.149</td>
<td>2</td>
<td>0.56288</td>
</tr>
<tr>
<td>D_FCFR</td>
<td>0.538</td>
<td>2</td>
<td>0.76399</td>
</tr>
<tr>
<td>D_INF</td>
<td>4.214</td>
<td>2</td>
<td>0.12159</td>
</tr>
<tr>
<td>ALL</td>
<td>8.006</td>
<td>10</td>
<td>0.62822</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)

The results show that, for all the variables under the model, the Chi square distributed statistics had large probability which imply no sufficient evidence to reject the normality hypothesis. Thus the disturbances are normally distributed.

4.5.2 Lag Order Autocorrelation

The ‘no autocorrelation at lag order’ is the key assumption underlying the robustness of VECM. A Chi Square distributed Langrage multiplier was applied on the VECM to test for autocorrelation. The results in table 4.10 indicate that the significance level of the chi square tests is above 5% level at lag 2 but not in lag one.

Table 4.13: Langrage Multiplier test for Autocorrelation at Lag Order

<table>
<thead>
<tr>
<th>Lag</th>
<th>chi2</th>
<th>df</th>
<th>Prob&gt;chi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48.4837</td>
<td>25</td>
<td>0.00326</td>
</tr>
<tr>
<td>2</td>
<td>34.6633</td>
<td>25</td>
<td>0.09447</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019)  
Ho: no autocorrelation at lag order
4.5.3 Model Stability

The stability of the VECM model was measured using modulus of Eigen value for the matrix with 5-1 (variables minus co-integrating relationships). A stable model has the moduli of the remaining Eigen values strictly less than unity. As shown in table 4.11, the Eigen values meet stability condition thus the model is stable.

Table 4.14: Eigen value Stability Condition

<table>
<thead>
<tr>
<th>Eigen value</th>
<th>Modulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>-0.6422342+.2704835i</td>
<td>696869</td>
</tr>
<tr>
<td>-0.6422342-.2704835i</td>
<td>696869</td>
</tr>
<tr>
<td>-0.207113+.5526693i</td>
<td>590203</td>
</tr>
<tr>
<td>-0.207113-.5526693i</td>
<td>590203</td>
</tr>
<tr>
<td>-0.3636416+.111741i</td>
<td>380422</td>
</tr>
<tr>
<td>-0.3636416-.111741i</td>
<td>380422</td>
</tr>
</tbody>
</table>

Source: Author’s Computation (2019) The VECM specification Impose 4 unit moduli

4.5.4 Roots of the Companion Matrix

The roots’ of the companion matrix is a visual representation of the eigen values within a X-Y plane, where; X axis presents real components while Y axis present the complex components. From the figure below, all the eigen values lie inside the unit circle thus the model satisfies stability condition.
4.6 Discussion of Results

The study aimed at analyzing the relationship of higher education expenditure and economic growth in Kenya. It also sought to establish causality and its direction through other economic parameters.

4.6.1 Relationship between Government Expenditure on Higher Education and Economic Growth

The results of the VECM across the all short-run lags of education expenditure towards RGDP revealed that education expenditure did not cause RGDP in the short run. Similarly, education expenditure does not have a composite (include all lags) short run effects on education. Further, although education expenditure did not adjust RGDP in the long-run, the cointegration equations revealed that RGDP, LFPR and FCFR adjusted to equilibrium in the long-run.
The short run equations showed that all the variables in the model did not cause GDP at the lag level but had a jointly and significantly cause RGDP in the short run. This implies that education expenditure cause RGDP in the short-run as part of broader economic context.

This outcome deviates from Rathnayaka and Athukorala (2012) findings where their VECM model yielded significant short-run impacts on education expenditure to RGDP in Sri Lanka which is attributable to different economic structure between Kenya and Sri Lanka. The results from test for joint causality indicated that although higher education expenditure had no significant individual short-run effect of RGDP, its absence in the model fades the short-run joint causality of the other variables on RGDP. The results of this study differ with Machuki et al (2013) who established significant negative impacts of education expenditure on economic growth in Kenya. The variation in findings can be attributed to period covered in the time series data, variables included in the model, levels of education considered, that is all education levels as opposed to this study only considering higher education, as well as modeling method.

4.6.2 Causality and Direction of Causality between Government Expenditure on Higher Education and Economic Growth

The analysis revealed that, in the short-run, higher education expenditure alone does cause RGDP but causes RGDP in the short-run through a joint effect that include FCFR, LFPR and Inflation. Likewise, RGDP does not cause higher education expenditure in the short-run which implies that changes in higher education expenditure is not attributable to changes in RGDP. The long run dynamics revealed
that higher education expenditure (and labor force participation rate) has positive and significant long-run impact on RGDP. This empirically verified the postulations of Shultz (1961) human capital expenditure theory’ where he argued that education enhances labor productivity in the long-run increasing economic output and growth.

On the other hand, fixed capital formation and Inflation had a negatively significant long-run impact on RGDP. According to Solow’s Model of economic growth, capital formation needs to accumulate at a higher rate than depreciation to positively impact economic growth in the long-run, otherwise capital output will decline therefore converging the economic growth to a steady state (Karl, 2005). Thus, higher rate of capital depreciation explains the long-run negative capital impact on economic growth in the model. Finally, the negative effects of inflation on GDP in the long-run resonates well with Feldstein, (2002) and Bulman and Simon, (2003) argument that Inflation affects return on capital negatively, slows down capital formation, and triggers losses in labor force efficiency resulting from unproductive activities for coping with rising prices.
CHAPTER FIVE
SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

5.1 Introduction
This chapter presents summary, discussion of findings, conclusion as well as recommendation. The presentation is in line with the objectives of the study.

5.2 Summary
To correctly fit the model, higher education expenditure was modeled together with labor force participation, fixed capital formation and inflation towards GDP. Labor force participation rate had the highest mean while education expenditure had the lowest mean. Normality tests revealed that only GDP and Inflation followed a normal distribution.

The time series for all the variables were non stationary but became stationary after taking the first difference, thus, I(1). The lag order selection estimated using various ((FPE), (AIC), (HQIC) and (SBIC)) yielded a lag of order 4. Since the series were I(1), cointegration test was carried out to assess whether there is a long run linear combination of the variables and it was revealed that indeed, there was at least one co-integrating equation. This implied fitting of a VECM model which is optimal and has long-run error correction mechanism.

The cointegration equations revealed that RGDP, LFPR and FCFR had long-run adjustment towards equilibrium. The short-run equations showed that the variables did not cause RGDP at the lag level but jointly and significantly caused RGDP in the short-run. The results from test for joint causality indicated that although higher
education expenditure had no significant individual short-run effect of RGDP, its absence in the model fades the short-run joint causality of the other variables on GDP. Finally, the long-run dynamics revealed that higher education expenditure and labor force participation rate have positive and significant long-run impact on RGDP while fixed capital formation and Inflation had a negatively significant long run impact on RGDP. The test for robustness of the model indicated that autocorrelation was detected in lag order one, the distribution of disturbances were normally distributed and the model satisfied Eigen value stability conditions. Thus the model can be used in forecasting.

5.3 Conclusion

From the findings of this study, it can be concluded as follows:

The proportion of higher education expenditure is still small in Kenya to have significant short-run effects on GDP. The labor force participation resulting from investment in higher education does not cause GDP in the short-run. Thus as an expenditure, higher education spending does not have significant increase in GDP growth, although as part of overall productive equation, higher education expenditure contributes significantly to long-run change in GDP growth rate.

Notably, higher education expenditure together with labor force participation rate have long- run positive effects on economic growth owing to graduates joining the labor force and effects of research output from universities which have long term effect on development.
The rate of depreciation of assets and productive equipment lowers the long-run effects of capital formation on economic growth. The level of inflation eats into the effectiveness and efficiency yielded from higher education spending by increasing labor costs and discouraging investments thus slowing the economic growth in the long-run.

5.4 Policy Recommendations

From the findings of this study, the following policy recommendations are proposed;

i. The government should increase the proportion of spending on higher education to promote high quality training, research and infrastructure in order to encourage broad based impacts in the short and long-run as well as shorten the payback periods.

ii. Implement stringent policy and legal guidelines relating to depreciation to ensure capital equipment imported into the country have long lifespan as depreciation affects economic growth negatively in the long-run.

iii. Design and implement responsive monetary policies to control inflation that reduces the long-run impact of higher education spending on economic growth.

5.5 Suggestions for Further Research

This study focused on analyzing the relationship of higher education expenditure and economic growth in Kenya using time series data of 1986-2016 where higher education expenditure was modeled together with three other variables. To extend the relevance of the finding of this study, future research should also explore the following:
First, study relationship of higher education spending and economic growth using a broader period time series, factoring more variables.

Secondly, an extended research to assess the graduates output, quality of workforce and how they affect economic performance in Kenya.

Thirdly, comparative relationship of government spending on higher education in comparison to secondary and primary education on economic performance to paint a holistic picture on the entire education system.
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### APPENDIX

**Time Series Data**

<table>
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<th>Year</th>
<th>Higher Education spending as a percentage of GDP (EDUEXP)</th>
<th>Labor force Participation Rate (LFPR)</th>
<th>Real GDP Growth Rate (RGDP)</th>
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*Sources: KNBS economic Surveys (Various), World Bank Datastat, International Labor Organization (ILO), Central Bank of Kenya*