The Impact of Total Public Expenditure in Education on Economic Growth in Kenya

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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ABSTRACT

This paper examines the effect of additional public expenditure in education on economic growth in Kenya. At the onset it was hypothesized that additional education expenditure would lead to economic growth since the latter hypothesis is backed by the theory of human capital. This study utilizes the Vector Error Correction Model (VECM) to determine if additional public expenditure in education causes GDP growth in the Kenyan context. The study finds that there exists a long run relationship between education expenditure and economic growth. Further, it is found that education expenditure is a significant determinant of GDP growth after controlling for certain factors. Based on these findings, it may be of use to research further on the type of education expenditure that yields the best results be that recurrent or capital expenditure. Additionally further research could delve on the impact of public expenditure in education at the different levels of education (primary, secondary and tertiary).

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CHAPTER ONE: INTRODUCTION

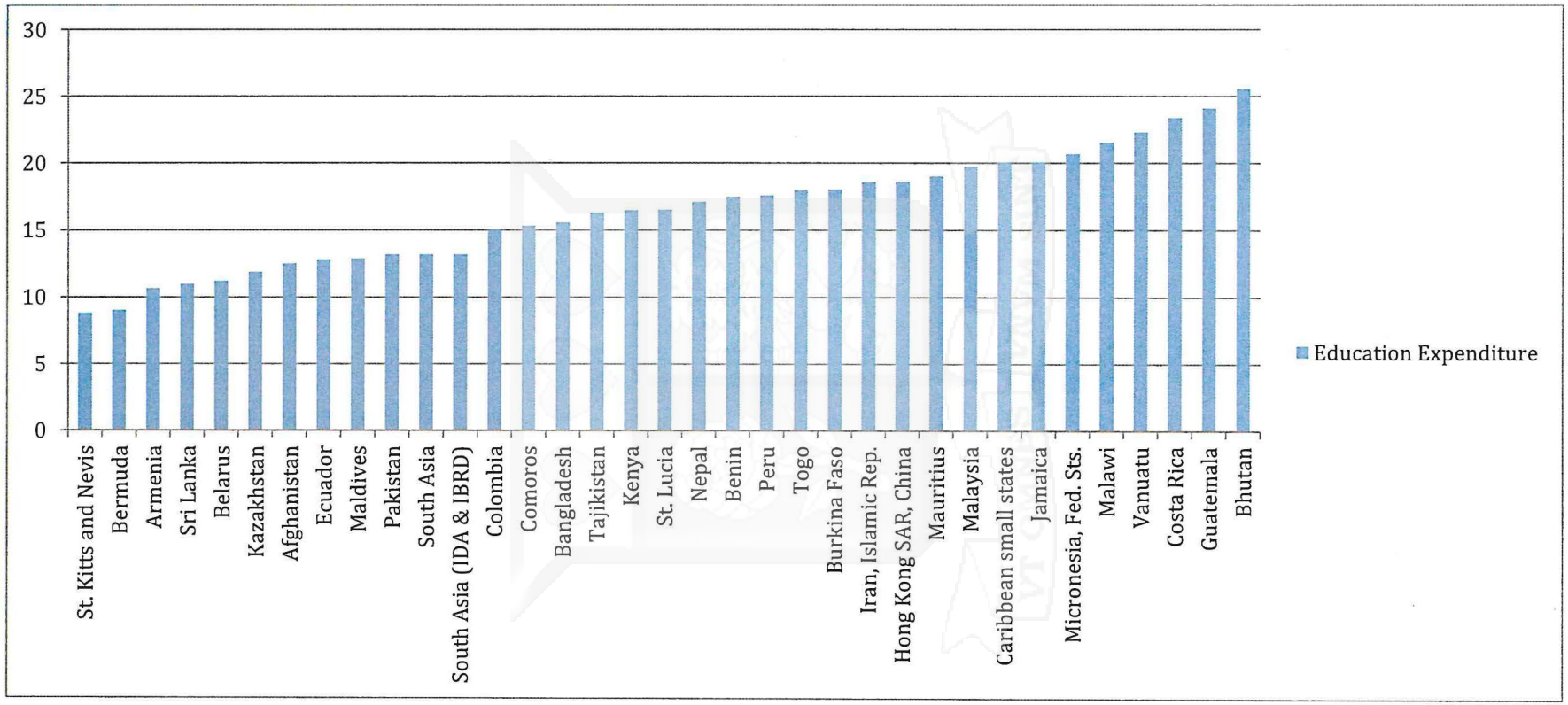
1.1 Background of the Study

Economic growth is defined by the International Monetary Fund (2012), as the monetary value of all final goods and services produced within a given jurisdiction for a certain period of time and it is usually measured using the Gross Domestic Product (GDP). GDP has become one of the most important tenets in modern economics. Since its introduction, governments around the world have consistently aimed at increasing GDP year in year out. Many researchers including Barro (1991) and Grier and Gordon (1989) have since inquired about the determinants of GDP as well as how governments can achieve economic growth. The findings show that GDP is influenced by a myriad of factors including the level of education of a populace, their life expectancy, fertility rates, inflation, government consumption, the regulatory, legal and political environment as well as the terms of trade within the country.

Echevarria (1997) stated that the diverse apportionment of resources in different sectors of the economy caused about 22% of the variation of economic growth across economies. Over the years, various economists have suggested that the development of a particular sector in an economy yeilds economic growth. For example, Bagehot (1873) argued that financial development lead to economic growth. Feder (1983) on the other hand found that the apportionment of resources to high productivity exports lead to economic growth. Matsuyama (1992) contends that productivity in the agricultural sector of an economy causes economic growth in closed economies whereas the relationship is inverted for open economies. Dritsakis (2004) argued that investment in international tourism facilitated economic growth. Moreover, Lucas (1988) contends that investment in education yeilds economic growth. This study investigates the latter claim.

Total public education expenditure varies greatly across countries Figure 1 clearly depicts the variability of this data for a cross section of countries as of 2015. Hirsch, (1960) suggests that the disparities in education expenditure portrayed below may be explained by variables including financial status, the scope and quality of education as well as the ratio of primary to secondary schools.

Figure 1: Public Education Expenditure Across countries (2015)



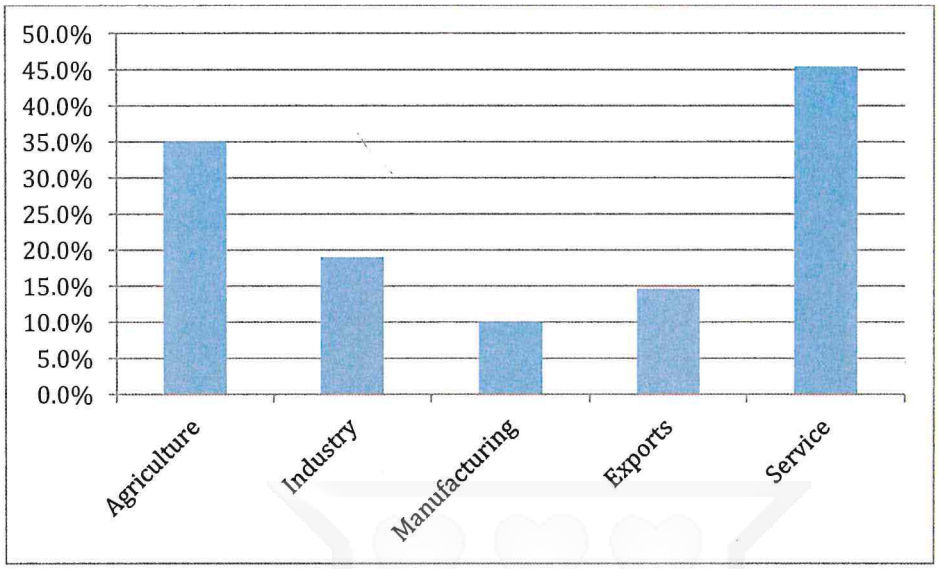
Data source: (The World Bank Group, 2017)

Public education expenditure is important for an economy as it catapults economic growth. Biggs Dutta (1999) stated that public education expenditure is essentially an investment in the economy. Education is a significant determinant of income and as such, leads to economic growth. The findings of Biggs Dutta (1999) are further affirmed by the theory of human capital. Smith (1776) founded the theory of human capital and defined it as "the acquired and useful abilities of individuals" that could be harnessed to create value. The concept was later "revived" by Schultz (1961). Shultz suggested that just like physical capital, governments could invest in human capital in order to foster economic growth. The underlying logic is that investment in human capital improves the capabilities and productivity of a populace thus enabling them to create a higher economic value. Shultz (1961), proposed that investment in human capital meant investment in health, education and internal migration. Following his research, Mushkin (1962) found that building human capital only required investment in health and education. As the concept of human capital has evolved over time, it has come to focus mainly on investment in education as proposed by Lucas (1988) and Barro (1991). These researchers found that an investment in education improved technological progress and innovation thus resulting in the acheivement of economic growth.

1.1.1 The Kenyan Percpective

Kenya gained independence in 1963. The GDP that year amounted to about 926.6 million dollars (The World Bank Group, 2017). Since then, the country has experienced steady growth and the GDP has grown by 68% to an aggregate value of 63.4 billion dollars in 2015. The Kenyan economy has transformed over the years from a largely agrarian based economy to a service oriented economy. Between 2006 and 2013, 72% of economic growth was driven by the service indusry (The World Bank Group, 2016). Figure 2 below shows the sectorial attribution of GDP as of 2016.

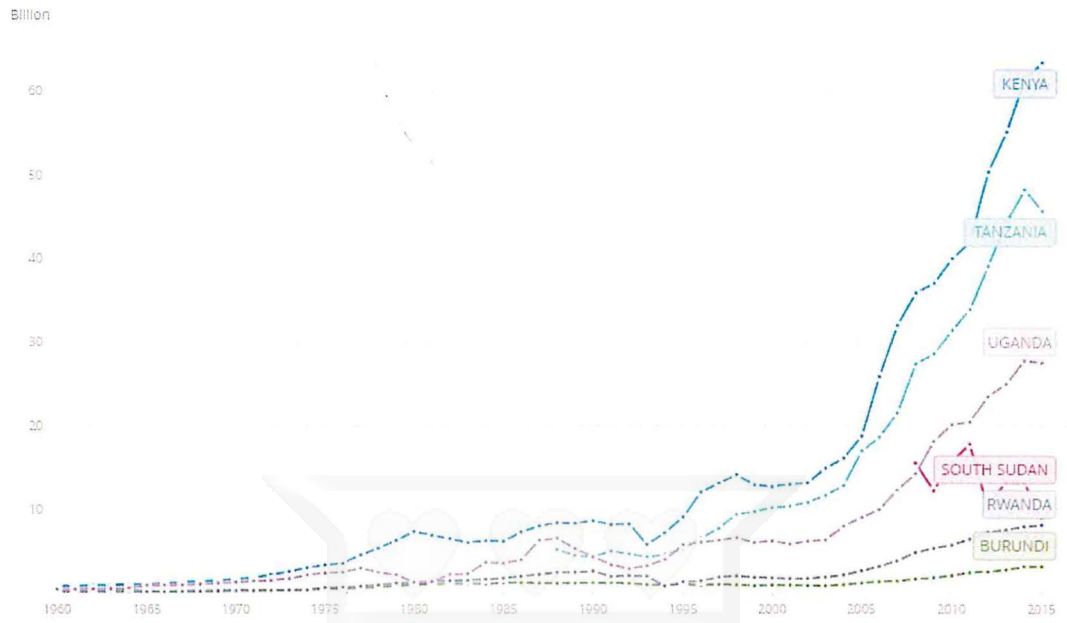
Figure 2: Sectorial Attribution of GDP in Kenya (2016)



Source: The World Bank (2017)

Kenya's rapid growth resulted in the country being considered a lower middle income country in the year 2014 with a GDP amounting to 61.4 billion dollars. Data from the World Bank (2017) shows that Kenya's GDP has grown consistently over the years outperforming it's regional counterparts. Figure 1.2 below shows this trend clearly.

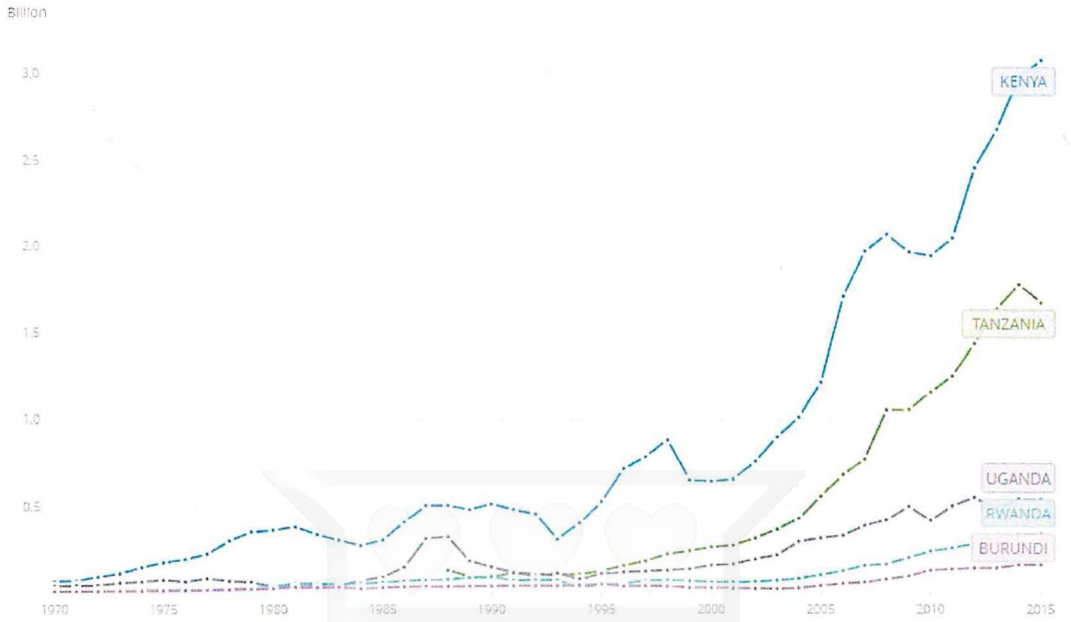
Figure 3: GDP of the East African Community (EAC) Countries in Dollars



Source: The World Bank (2017)

The number of students participating in the education system at the various levels of education (primary, secondary and tetiary) has dramatically increased in Kenya over the years. The latter variable is measured by the gross enrolment rates. Primary education enrolment rates have grown from 62.8% in 1970 to 109% in 2015; likewise, secondary enrolment rates have increased from 16.6% to 60.4%. and lastly, tetiary enrolment rates have grown from 0.89 to 4% (The World Bank Group, 2017). The large increase in enrolment rates particularly at the primary and secondary levels of education is largely attributead to government expenditure. In 2003, Kenya implemented the Free Primary Education policy (Oketch, Maurice, Ngware, & Ezeh, 2010). The adoption of the policy lead to an increase in total public education expenditure by 142 million dollars that year. Since then, education expenditure has increased by 178 million dollars on average each year. In retrospect, government expenditure on education has increased by about 50% between 1970 and 2015. According to World Bank (2017) Kenya spends more on education in comparison to its EAC counterparts. Figure 4 clearly depicts the latter.

Figure 4: Total Education Expenditure of the EAC Countries ($)



Source: The World Bank (2017)

1.2 Problem Statement

The economic pillar of Kenya's Vision 2030 targets a GDP growth of 10% as from the beginning of 2012 (Government of the Republic of Kenya, 2007). The GDP growth rate was 5.8% in 2016 and is expected to decelerate to 5.5% in 2017 (The World Bank, 2017). As proposed by Lucas (1988), the discrepancy in the above statistics warrants an increase in public education expediture. The World Bank (2017) has shown that public expenditure on education has increased by 178 million dollars annually since 2004. However does this incremental expenditure translate to economic growth?

The theory of human capital regards public education expenditure as a public investment. International Monetary Fund (2015) elaborates that public investment should catapult economic growth. However, the literature on the impact of education expenditure on economic growth is conflicting. Some researchers including Barro (1991) find that education expenditure is an insignificant determinant of economic growth where as other researchers such as Lucas (1988) find that education expenditure is paramount to economic growth. What is the nature of the same relationship in the Kenyan context? This study aims to establish the relationship between public expenditure in education and economic growth in Kenya between 1990 and 2015.

Previous studies have examined the same relationship in African countries including Uganda, however there is no literature that documents the same relationship in Kenya between 1970 and 2012.

1.3 Research Objectives

To establish the relationship between total public expenditure on education and economic growth in Kenya

1.4 Research Questions

What is the relationship between total public expenditure on education and economic growth in Kenya?

1.5 Significance of the Study

The findings of this study will be particularly beneficial for the Kenyan government since it is a major stakeholder in the educational sector in Kenya. The findings of this study may be used as a basis for making informed decisions on matters concerning optimal public expenditure on education. Policy makers in the ministries of Finance and Education may use this study as a point of reference in budgetary allocations. Moreover, this study may be used as a point of reference for future studies in this field of research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Literature Review

2.1.1 Economic Growth Theories

Economic growth and its determinants have been heavily studied in economics. However, dispite the various discussions around this area, the fundamental model describing economic growth has generally remained the same. The fundamental variables of the model are land, labour and capital. Malthus (1798) theorized the importance of labor in achieving economic growth. The theory maintains that an increase in the population size reduces the GDP per capia. The Malthusian model was based on the idea that a population grows exponentially subject to limited natural resources such as land and food. The latter limitation thus implies that population growth is exponantial but limited to the "carrying amount" supported by the natural resources available. Therefore economic growth is consequently limited by the available natural resources. The Malthusian theory defined the steady state of economic growth as the level at which population growth was at zero. The Malthusian model also predicts that the population growth rate increases with an increase in income levels. However, Weil (2009) explains that recent trends show quite the opposite- countries with the highest incomes have the lowest population growth rates.

The Solow model suggested by Robert Solow (1956) also recognised the importance of labour but focused on population growth rather than size as well as the interaction of labour with capital. The model elaborated that capital accumulation was the reason why levels of income varied across countries. Solow explained that the levels of capital were in turn influenced by the levels of investment and depreciation of capital. The steady state in the Solow model was defined as the level at which investment was equal to capital stock depreciation. The model also recognized the importance of technological progress, arguing that physical capital and labour cannot be the only determinants of economic growth. The Solow model suggests that long-run economic growth is determined by technological progress as well as population growth, both of which are exogeneous variables. The latter is also the weakness of his model since the primary factors that determine long-run economic growth are not accounted for within the model.

Economists including Nelson and Phelps (1966) attempted to improve the Solow model by determining the sources of technological progress endogeneously. Nelson and Phelps (1966) suggested that the level of education of a populace determines their ability to adapt to technological change. It follows that a population with a higher level of education or human capital is able to adapt to technological change thus, achieve economic growth. Romer (1990) built on this idea and suggested that education not only determines the adaptability to technological change but also fosters technological change. Romer argued that technological change was a result of research and development whose prerequisite is educational attainment. Lucas (1988) also advocated for the importance of human capital in fostering economic growth and created an endogenous model that was based on the choices of utility maximizing representative agents. The agents in the model had control over their level of consumption (which alludes to investment in physical capital) as well as their allocation of time between working and acquiring skills (which alludes to human capital development). Lucas assumed that the level of technological progress remained constant and that population growth was exogeneous. The model suggested that human capital was linearly related to economic growth and had constant returns to scale.

2.1.2 Public Expenditure Theories

Theories of public expenditure include Adolf Wagner's law of increasing state activity, the Peacock Wiseman hypothesis and the principle of maximum social advantage. Adolph Wagner's law of increasing state activity contends the increase in size of governments with increasing economic development (Peacock and Scott, 2000). Adolph Wagner noticed consistent growth in the size of government and claimed that the increase would affect different branches of government differently. It would however, include the expansion of traditional services (defined as defense, law and order) as well as "newer" functions (defined as education, welfare services and changes in the structure of the economy). Koop and Poirier (1995) find that the law implies that the income elasticity of government expenditure is greater than one. The latter suggests that demand for government expenditure increases at a higher rate than the increase in income caused by a growing economy. Peacock and Scott (2000) critique the theory on the basis of it's upper limit. Although Wagner realised that an upper limit did exist since the relationship cannot hold to perpetuity, the limit was not defined in theory. The latter is deemed to be the weakness of the theory.

The Peacock and Wiseman hypothesis claimed that public expenditure over normal periods was constant and that social "displacements" such as war would cause spikes in tax tolerance and public expenditure (Lampman, 1962). The hypothesis pays little attention to cost of services or demand for services by the population, claiming that these factors were not expected to change. Lampman (1962) critisises the hypothesis stating that the data used by Peacock and Wiseman showed incresed public expenditure in between periods of war however, these increases were not explained by the hypothesis.

The principle of maximum social advantage was proposed by Hugh Dalton and it contends that public finances should be spent on operations that maximise the social benefit (Downs, 1957). The theory is based on two main tenets, marginal social sacrifice and marginal social benefit. Marginal Social Sacrifice (MSS) may be interpreted as the loss in utility resulting from the payment of an additional unit of tax whereas, the Marginal Social Benefit (MSB) may be regarded as the additional benefit resulting from an additional unit of public expenditure. The theory recognises that MSB is decreasing in nature since a population derives less satisfaction with each additional unit of public expenditure. Dalton's condition posits that the maximum social advantage is achieved when MSS is equal to MSB (Dalton, 2003).

2.2 Empirical Literature Review

Empirical literature on the impact of education on economic growth may be subdivided into two, based on the type of data the research studied (those that utilized time series data and those that used panel data). Researchers that studied time series data include Loening (2005), Jenkins (1995), Asteriou and Agiomirgianakis (2001), Monteils (2002), Musila and Belassi (2004) as well as Gopalakrishna and Rao (2012). Loening (2005) sought to find the relationship between human capital and economic growth using the error correction methodology in Guatamala between 1951 and 2002. The main varibles in this study were physical capital investment, average years of schooling at the three levels of education as a proxy for human capital and the economically active population as a proxy for the labor force. The study found that the relationship between education and economic growth was positive and significant and infact, human capital accounted for about 50% of economic growth in Guatamala. Loening (2005) however comments that the results of the study are significantly different in comparison to the

rest of Latin America and attributes this to the fact that the methodology did not account for the deterioration of physical capital quality over time. A further cristicism of the study is the fact the average years of schooling is a weak proxy for human capital since it doesn't infer anything about the quality of education. Similarly, Jenkins (1995) found that there exists a significant and positive relationship between human capital and economic growth in the United Kingdom over the period from 1971 to 1992. Both papers found that human capital improves the productivity of a workforce thus consequently increasing economic growth.

Asteriou and Agiomirgianakis (2001) used cointergration to study the same relationship in Greece. The study used enrollment rates and GDP as the main variables and found a positive relationship between the two. Further, the research found that there exists a dual causality relationship between higher education and economic growth. That is, economic growth causes a higher investment in higher education and an increased investment in higher education leads to economic growth.

Musila and Belassi (2004) studied Uganda between 1965 and 1999. Cointergration was used to determine the long run effect of total public education expenditure and error correction was used to determine the short run effect of the same. The paper used investment in phyicical capital, education expenditure and the stock variable of labor force over time. The study found that education expenditure has a positive and significant effect on long run and short run economic growth.

Monteils (2002), used linear regression to investigate the relationship between investment in education and economic growth. Monteils (2002) studied the latter relationship in the context of the French economy between 1800 and 2000.The study found a negative relationship between human capital and economic growth.This means that an increase in the level of educated people in France led to a decrease in economic growth. This finding is contradictory to the theory of human capital.

Gopalakrishna and Rao (2012) focused on the dual causality relationship between human development and economic growth in India. That is, on one hand human development causes economic growth and simulataneously, economic growth causes human development. Human development as used in this study was synonymous to human capital. The paper found that public expenditure had a more significant

influence in cultivating human development than economic growth. The paper goes on to discuss how some expenditure allocations such as expenditure in basic education are more effective at achieving human development than others. With regards to the link from human development to economic growth, the paper further reinforces the importance of education on achieving technological progress and labour productivity. It however warns that human development alone is not sufficient to catupult economic growth and that there must also be opportunities for the labour force as well as physical capital in order to stimulate economic growth.

Researchers including Gemmell (1996), Barro (1991), Francis and Iyare (2006), as well as Judson (1998). Gemmell (1996) studied a panel of developed and less developed countries and found a positve relationship between human capital and education . Further, the study found that secondary education was positively and significantly related to economic growth in OECD countries.

Barro (1991) studied 98 countries over the period from 1960 to 1985. The study regressed GDP on primary and secondary school enrollment rates, initial levels of income, fertility rates and government expenditure. In the study, government expenditure was split into consumption expenditure and public investment expenditure. The study defined public investment expenditure as spending in education and defense where as consumption expenditure was defined as total government expenditure excluding public investment. The paper found that government consumption expenditure was negatively correlated with economic growth and that public investment had a positive but insignificant effect on economic growth contrary to human capital theory that places human capital at the center of economic growth. The research also finds a positve and significant relationship between enrollment rates and economic growth. However, the results of this study were not satisfactory since it did not include tertiary education. The findings above suggests that the most effective use of government expenditure on education would essentially increase enrolment rates since there is a direct, positive and significant relationship between enrolment rates and economic growth.

Francis and Iyare (2006) utilised vector error correction and cointergretion techniques to determine the nature of the relationship between education expenditure and per capita Gross National Income (GNI). The study focused on Jamaica, Barbados and Trinidad

and Tobago between 1964-1998.Contrary to most research, the paper found that an increase in per capita GNI causes an increase in the levels of education and not the other way around. Only the results from Jamaica supported the common notion that education is a driver of per capita GNI.

Judson (1998) created a model based on the uniform distribution to investigate the relationship between education and economic growth and determine if the allocation of education expenditure mattered. The paper found that an increase in levels of education, following human capital theory, increased productivity but at a diminishing marginal rate. This suggests that the allocation of education expenditure could yeild different results depending its the allocation. The paper suggests that a larger allocation to basic education yeilds higher levels of human capital and therefore economic growth than a larger allocation at higher levels of education. This means that investment in primary education is more efficient at achieving economic growth as compared to investment in secondary or tetiary education. It's important to note however that some sort of balance should be achieved.

2.3 Research Gap

Empirical tests of the relationship between public education expenditure and economic growth are inconclusive. Some researchers including Gopalakrishna and Rao (2012) found that an increase in government expenditure lead to a subsiquent increase in economic growth. However, other researchers such as Devarajan, Vinaya and Heng-fu (1996) found that economic growth and public education expenditure were negatively correlated. Limited reserch has been done in the African context. A significant study in Africa (Uganda) was carried out by Musila and Belassi (2004) as elaborated above. However, inspite of their research, there exists a gap on the empirical relationship between public expenditure in education and economic growth in Kenya moreso in the period between 1970 and 2012.

CHAPTER THREE: METHODOLOGY

3.1 Research Design

The research was quantitative in nature and utilized a descriptive research design. A descriptive research design was appropriate for this study since the goal of the paper was to establish the nature of the relationship between public education expenditure and economic growth.

3.2 Population and Sampling

The study focused on the Kenyan economy due to the availability of data and the trends in education expenditure that were noted in figure 4. The variables utilised in the study were recorded annually. The sample consisted of the variables noted in table 1 collated between 1970 and 2013 from the Kenyan population. The sample period was chosen based on the availability of data. Reliable data on population in Kenya was only available as from 1970.

3.3 Data Collection

Data used in this study was secondary data collected from The World Bank Open Data Sources. Table 1 below elaborates the macroeconomic variables in the research and the manner in which they were included in the model (as dependent or independent variables). The main variables of the study were GDP, capital formation, labour force and total public expenditure on education. Historical values of these variables were used to infer the relationship between education expenditure and economic growth. The research used time series data since the subject of the study was a single country-Kenya.

Table 1: Variables of the Study

Variable	Type	Measurement
Real GDP	Dependent variable	Gross Domestic Product in Billion USD
Gross Capital formation	Independent variable	Outlays that constitute additions to fixed capital in USD plus the net changes in inventories.
Population	Independent variable	Refers to the residents of a country
Total Public Education Expenditure	Independent variable	Average expenditure per person on the operating activities involved with providing education to a populace.

3.4 Theoretical Model

This research utilized the aggregate Cobb Douglas economic growth model below (Cobb and Douglas, 1928):

$$Y_t = f(K_t, A, L_t) = AK_t^{\alpha} L_t^{\beta} H_t^{\gamma} \quad (1)$$

Where,

Y_t : Real GDP,

A: Technological progress (which is assumed to be constant)

K_t: Stock of physical capital

L_t: Labour force

H_t: Human capital.

Human capital was assumed to be equivalent to the aggregate level of education and the aggregate level of education was assumed to be directly proportional to the total public education expenditure. Therefore, the level of human capital was assumed to be equal to the total public education expenditure; that is;

$$H_t = E_t$$

Where,

E_t: Total public education expenditure.

$$Y_t = AK_t^{\alpha} L_t^{\beta} E_t^{\gamma} \quad (2)$$

Constant returns to scale was not required for this model. That is β+α is not necessarily equal to 1. This study was interested in economic growth, the log of equation (2) was therefore preferred. The equation was therefore transformed into the equation below:

$$Ln\,(Y_t) = Ln(A) + \alpha Ln(K_t) + \beta Ln(L_t) + \gamma Ln\,(E_t) \quad (3)$$

Because technological progress is assumed to be constant, the final form of the model was as below:

$$Ln\,(Y_t) = \varphi + \alpha Ln(K_t) + \beta Ln(L_t) + \gamma Ln\,(E_t) \quad (4)$$

Where φ is a constant that will be estimated along with the parametersα, β and. γ.

3.5 Justification of the Model

The Cobb-Douglas production function was developed by Charles Cobb and Paul Douglas in 1928. The cobb-douglas production function was most appropriate for this study since it incorporated the fundamental determinants of economic growth discussed in the literature review (technological change, labour as well as physical and human capital). Moreover, the elasticities in the function allows the research to determine the marginal relationship between the independent variables (specifically public education expenditure) and economic output through the introduction of the natural logarithm.

3.6 Estimation Procedure

3.6.1 Stationarity Tests

The empirical methodology of this research begun by testing the variables for stationarity. Stationarity is an important property in estimation since stationary data gives a clearer trend of time series data and as such allows for more accurate models and predictions to be made. Data is said to be stationary if its mean and variance are found to be time invariant. The Augmented Dicky Fuller (ADF) test and the Philip's Peron (PP) test were used to test for stationarity and determine the order of integration of each of the variables. The null and alternative hypotheses for the unit root tests (ADF and PP) were as follows:

H_o: The data has a unit root and therefore is non stationary

H_a: The data does not have a unit root and therefore is stationary.

If the absolute value of the test statistic was greater than the critical value then the null hypothesis was rejected thus the data set was stationary and the opposite held. This test may also be interpreted using the p-value. If the p-value of the is greater than the level of significance then we accept the null hypothesis.

3.6.2 Lag Selection

The second step involved determining the number of lags in the model. The Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schartz Information Criterion (SIC), and Hannan-Quinn information criterion (HQ) tests were used to determine the number of optimal lags for the model. The latter was in accordance to Cheung and Lai (1993). The null and alternative hypotheses for the LR test were as follows:

H_o: The lagged variable is insignificant

H_a: The lagged variable is significant

The null hypothesis was rejected if the calculated LR was greater than the Chi-Squared distribution and vice versa. With regards to the information criteria (FPE, AIC, SIC and HQ tests), the smaller the value the better the selected number of lags is at predicting the model.

3.6.3 Cointegration Tests

The third step involved testing for cointegration. Engle and Granger (1987) state that two variables X_t and Y_t are cointergrated if $X_t - \alpha Y_t = Z_t$ where α is such that Z_t is an

I(0) stationary process. That is, there exists a stationary explanatory variable, Z_t that explains the relationship between the two variables. The Johansen cointegration test was used for this study. The test is comprised of 2 tests; the trace test and the maximum eigen value test. The null and alternative hypotheses for these tests were as follows:

H_o: The number of cointegrating equations $r = x$

H_a: The number of cointegrating equations $r \neq x$

The null hypothesis was rejected if the calculated trace or maximum eigen value was less than the critical value.

3.6.4 Estimation

The relationship between education expenditure and economic growth may be bi-directional, the VAR estimation was therefore the most appropriate time series model for this investigation. In the event that no cointegration was found between the variables, then the standard VAR estimation procedure would have been used. However, since the data was found to be cointegrated, the Vector Error Correction Model (VECM) was applied to establish the long run and short run relationship between public education expenditure and economic growth.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Descriptive Analysis

Table 2 below summarises the descriptive statistics of the variables used in this study; that is, the GDP, education expenditure, capital formation as well as the population.

Table 2: Descriptive Statistics

	GDP(BN)	EE(BN)	Population(MN)	CF(BN)
Mean	39.44	0.80	25.32	2.65
Median	37.57	0.48	24.63	1.59
Standard Deviation	21.79	0.83	9.71	2.76
Minimum	5.37	0.06	11.25	0.32
Maximum	84.97	3.22	43.69	11.31

From table 2 above, it is clear that GDP averaged at 39.44 billion dollars over the sample period. The median reported relatively the same figure suggesting that the data was relatively evenly distributed. The large standard deviation indicates the variability of the data. The latter is affirmed by the large difference between the maximum and minimum values. Further, government education expenditure averaged 0.80 billion dollars. The latter figure has varied significantly over the past 44 years as is evident from the large dispersion between the minimum and maximum values. It is also evident that the data was not evenly distributed since the mean and the median are significantly different. Moreover, the population averaged 25.32 million, with the median being relatively similar thus suggesting that the data was relatively symmetrical. The relatively low standard deviation suggests that the data was clustered around the mean. On the other hand, the spread between the maximum and minimum values suggests that outliers were present in the data. Finally, capital formation averaged 2.65 billion dollars

with the median value being significantly different. The data was therefore not evenly distributed and the large standard deviation and spread between the maximum and minimum values suggest that the data for the period was very variable.

4.2 Stationarity Tests

As outlined in the methodology, 2 tests were carried out to ascertain the presence of stationarity, the ADF test, Philip's Peron. All tests were carried out at a 5% significance level. Table 3 below, summarises the results of the tests.

Table 3: Unit Root Test Results (d= 0)

Variable	P-Value (ADF)	ADF Test	P-Value (PP)	PP Test
LNGDP	0.999***	Non-Stationary	1.000***	Non-Stationary
LNEE	0.901***	Non-Stationary	0.876***	Non-Stationary
LNCF	0.999***	Non-Stationary	0.999***	Non-Stationary
LNPOP	0.954***	Non-Stationary	1.000***	Non-Stationary

***indicates significance at the 1 level%.

A second unit root test was carried out on the variables testing if they were integrated to order one. Both the ADF and the PP were carried out and table 4 below summarizes the results of the second test that included the differenced variables. The tests found that all variables were integrated of order one. The latter means that the Johansen cointegration test is therefore applicable.

Table 4: Unit Root Test Results (d=1)

Variable	P-Value (ADF)	ADF Test	P-Value (PP)	PP Test
LNGDP	0.015***	Stationary	0.001***	Stationary
LNEE	0.000***	Stationary	0.000***	Stationary
LNCF	0.001***	Stationary	0.000***	Stationary
LNPOP	0.008***	Stationary	0.005***	Stationary

***indicates significance at the 1 level%.

4.3 Lag Selection

It is unconventional in economics to use more than three lags in the estimation of a model. The latter is because the marginal impact of the change of one variable on another is unlikely to persist beyond three years. As a result, a restriction of 3 lags was imposed when carrying out the lag selection tests. Various test statistics were considered to arrive at the optimal lag structure. Table 5 below summarises the results from the lag selection tests. The statistics a majority of the tests indicate that only 1 lag is significant in the model thus only one lag was used in the study.

Table 5: Lag Selection Results

No. of Lags	LR	FPE	AIC	SC	HQ
0	NA	6.21-07	-2.94	-2.76	-2.88
1	303.09*	3.29 e-11	-12.79	-11.89*	-12.49*
2	21.56	3.71e-11	-12.72	-11.09	-12.17
3	24.94	3.18e-11*	-13.00*	-10.64	-12.20
Selected Criteria	1	3	3	1	1

*indicates the selected criteria

4.4 Cointegration Tests

Tables 6 and 7 below summarise the findings of the Johansen cointegration tests. It was found that there was at least one cointegration relationship between the variables.

Table 6: Johansen Cointegration (Trace Test) Results

Number of Cointegrating Equations	Trace Statistic	5% Critical Value	P-Value	Reject Null Hypothesis?
0	54.61	47.86	0.00	Yes
At most 1	23.65	29.80	0.22	No
At most 2	7.38	15.49	0.53	No
At most 3	0.08	3.84	0.78	No

Table 7:Johansen Cointegration (Maximum Eigen Value Test) Results

Number of Cointegrating Equations	Maximum Eigen Value	5% Critical Value	P-Value	Reject Null Hypothesis?
0	30.96	27.58	0.02	Yes
At most 1	16.27	21.13	0.21	No
At most 2	7.30	14.26	0.45	No
At most 3	0.08	3.84	0.78	No

The normalized cointegrating equation found to be as below:

$$LNGDP = 2.077 + 1.01LNEE + 0.259\,LNCF + 0.324\,LNPOP$$

The presence of the cointegration relationship suggests a long run relationship exists between the variables above. As expected, the independent variables were found to be positively related to GDP. The cointegration equation suggests that a 1% increase in education expenditure is likely to cause a 1.01% increase in economic growth. These findings are consistent with the findings of Musila and Belassi (2004), Hussin *et al* (2012) as well as Sabah and Siddiqi (2013) who found positive long run relationships between education expenditure and economic growth. The findings of this study are however in contrast to those of Asteriou and Agiomirigianakis (2001) whose research found that the relationship between education expenditure and economic growth is dual causal. The results of this study however suggest only one long term relationship where education expenditure is an independent variable and economic growth is a dependent variable.

4.5 Vector Error Correction Model

Since the results in table 6 and 7 above suggest that there exists a cointegrating relationship amongst the variables, we may proceed to estimate the model using the Vector Error Correction Model as annotated below.

$\Delta \ln GDP_t = \alpha_0 + \sum_{i=0}^{3} \beta_i \Delta X_{t-i} + \gamma_1 \Delta \ln GDP_{t-1} + \rho \varepsilon_{t-1} + \mu_t$

Where;

Δ: first difference operator

ε_t: estimated residual from the selected Engle and Granger cointegration equation

X_t: vector of exogenous variables (LNEE, LNCF and LNPOP)

ρ: the speed of adjustment

The estimated VECM is found to be as below.

$$D(LNGDP) = -C1[\,LNGDP(-1) + 1.01LNEE(-1) + 0.26LNCF(-1) + 0.32LNPOP(-1) + 2.08] + C2D(LNGDP(-1)) + C3D(LNEE(-1)) + C4D(LNCF(-1)) + C5D(LNPOP(-1)) + C6$$

The coefficients to the latter model were found to be as below:

Variable	Coefficient	P-Value
Speed of adjustment	-0.16	0.2079
GDP (-1)	0.004	0.9861
Education Expenditure (-1)	0.32*	0.0919
Capital Formation (-1)	0.19	0.3917
Population (-1)	0.08	0.9080
Coefficient	0.06***	0.0070

*and ***indicate significance at the 10% and 1% level respectively.

The speed of adjustment to the long run equilibrium is found to be insignificant in this study. The insignificance of the coefficient doesn't mean that the model will not tend to equilibrium, it simply means that it will take a longer time period to achieve equilibrium. The latter is further evidenced by the low coefficient. The VECM sheds light on the long run and short run relationship of the variables. The results of the VECM suggest that the education expenditure from the previous period is positively related to the current GDP. Further, the results indicate that if education expenditure from the previous period increases by 10%, GDP growth in the current period would increase by 3.2%. These findings are consistent with Musila and Belassi (2004) and Hussin *et al* (2012) who found positive and significant relationships between education expenditure and economic growth in the short run. Hussin *et al* (2012) elaborates that increased education expenditure increases the quality of education. The quality of education in turn improves the efficiency and productivity of the labour force thereby causing economic growth. These findings are however differ from those of Musaba *et al* (2013) as well as Wadad and Kalakech (2009). Wadad and Kalakech (2009) found a negative and significant short term relationship between education expenditure and

economic growth where as Musaba *et al* (2013) found that there was no significant relationship between education expenditure and economic growth in the short run.

4.6 Diagnostic Check

4.6.1 Serial Correlation

Testing for serial correlation is done using the Breusch-Godfrey Serial Correlation LM Test. It is an iterative process that checks for relations of the error term to its previous values. The null and alternative hypotheses of this test are as follows:

H_o: There is no serial correlation

H_a: There is serial correlation

Table 8: Serial Correlation Test Results

Breusch-Godfrey Serial Correlation LM Test	
P-Value	0.79
Result	No serial correlation in the error term

Table 8 above summarises the results of the test. Since the p-value is larger than 5%, we fail to reject the null hypothesis. That is, there is no serial correlation

4.6.2 Heteroscedasticity

The test for heteroscedasticity tests if the post estimation error term has a constant variance or not. The test used for this is the Breusch-Pagan-Godfrey heteroscedasticity test which is a Lagrange multiplier test. The null and alternative hypotheses are as follows:

H_o: There is no heteroscedasticity

H_a: There is heteroscedasticity

Table 9: Heteroscedasticity Test Results

Breusch-Pagan-Godfrey heteroscedasticity Test	
P-Value	0.10
Result	No heteroscedasticity in the error term

Since the p-value is larger than 5%, we fail to reject the null hypothesis. That is, there is no heteroscedasticity.

4.6.3 Normality

The Jarque Bera test was used to test for the normality of the regression error term. The test is based on the difference of the skewness and kurtosis of the series from that of the normal distribution. The null and alternative hypotheses of the test are as follows:

H_o: The residual is normally distributed

H_a: The residual is non-normally distributed

Table 10: Normality Test Result

Jarque Bera Normality Test	
P-Value	0.40
Result	Error term is normally distributed

Table 10 above summarises the findings of the Jarque Bera normality test. Since the p-value is greater than 5%, we fail to reject the null hypothesis thus the error term is normally distributed.

CHAPTER FIVE: CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Conclusions

This study sought out to determine the impact of total public education expenditure on economic growth in Kenya between the years 1970 to 2013 using cointegration analysis and the VECM estimation procedure. Through cointegration analysis, the study found that there exists a positive long run equilibrium relationship between the between education expenditure and economic growth. The VECM estimation also revealed a positive short term relationship between education expenditure and economic growth. The speed of adjustment in the VECM was found to be relatively small thus the model tends to the long run equilibrium very slowly.

5.2 Policy Recommendations

The results of this study indicate that the Kenyan government should increase its expenditure in public education since it has been found to be a significant determinant of GDP growth. Since the government has already established free primary and secondary education, they should increase expenditure in the sector by improving the quality of education. Improving the quality of education would catapulting even higher gains in GDP growth. Moreover, issues concerning corruption need to be curbed so as to ensure the efficiency of public education expenditure. The latter could be done by ensuring that personnel at all levels of government budget for and administer the public education funds efficiently.

5.3 Recommendations for Further study

Additional research could delve into establishing the impact of education expenditure at the different levels of education on GDP growth in Kenya. Moreover, additional research could be carried out to identifying the impact of different types of public education expenditure that is recurrent and capital expenditures on GDP. Further, additional research could look into the impact of private education expenditure on GDP growth.

5.4 Limitations of the Study

The data set only had 44 observations due to a limitation in data. The parameter estimates would have been more precise if more observations were available since biasedness is a large sample property. Moreover, the data collected was secondary data thus the accuracy of the estimated parameters is also dependent on the accuracy of the

collected data. Finally, the total population was used as a proxy for the total labour force due to the lack of adequate data on the labour force in Kenya. Population growth does not necessarily translate into the growth of the labour force thus the study may be limited to that regard.

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