HEALTHCARE EXPENDITURE AND ECONOMIC GROWTH: THE KENYAN CASE (1970 – 2016).

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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

Given that a large chunk of the National Budget is allocated to the health care sector (31.3 Billion of the 2016/7 National Budget) it is important to establish whether it is of any consequence to output. There exists a gap in finding a link between total healthcare expenditure and economic growth in Kenya. This study seeks to establish and estimate the relationship between health care expenditure and economic growth for the period 1970 to 2016. The research design used here is historical and the data used is longitudinal. Secondary data on the GDP, total health care expenditure, gross capital formation, secondary school enrollment and labour force data is collected and following Solow (1956) an economic growth model was specified. The data is analysed using EVIEWS software. The test for multicollinearity shows that education as the efficiency factor is highly correlated with the rest of the variables hence it is dropped from the model. The Johansen cointegration test results show that the variables are not cointegrated. An OLS Model is specified. It is found that healthcare expenditure is positively and significantly related to economic growth as measured by real GDP.

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LIST OF ABBREVIATIONS

GDP – Gross Domestic Product.

HIV/AIDS –Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome.

HRI – Human Resource Investment.

ILO – International Labour Organization.

IMF – International Monetary Fund.

KES – Kenyan Shilling.

OLS – Ordinary Least Squares.

PPF – Production Possibilities Frontier.

RGDP – Real Gross Domestic Product.

USD – United States Dollar.

WHO – World Health Organization.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This section provides a foundation for this study. The background information gives a definition and elaboration of the key concepts and provides a contextualization of the study. The problem statement highlights the research gap and links it to the study area. This section also contains the research objectives, research questions and a significance section that identifies the potential beneficiaries of this study.

1.2 Background of the Study

Economic growth refers to the increase in the inflation adjusted market value of the goods and services produced in an economy over time. It is conventionally measured as the percentage increase in real Gross Domestic Product (GDP) usually in Per Capita terms (International Monetary Fund [IMF], 2012).It typically refers to the growth in potential output, that is, production at full employment as opposed to the study of economic fluctuations around a long term trend. The basic determinants of growth are the accumulation of physical and human capital, driven by research and development activity, trade policy and effects of financial market conditions on economic efficiency. (Chang & Ying, 2006)

Total healthcare expenditure covers the provision of healthcare (both preventive and curative), family planning activities, nutrition activities and emergency aid designated for health. It measures the final consumption of health goods and services plus capital investment in healthcare infrastructure. It includes both public and private sources (including households) on medical goods and services, on public health programs and on

administration (World Health Organization [WHO], 2012). This study assumes that health expenditure is a gross investment in human capital and follows the usual characteristics of investment in the Solow Growth Model.

Barro (1996) comments that health is a capital productive asset and an engine of economic growth. Using this argument, we can consider health as a determinant of human capital. Likewise, Mushkin (1962) indicates that human capital formation requires spending on health and education, based on the argument that people develop themselves when they invest in these assets and that they will earn a future return on them. Grossman (1972), as well as Hamoudi and Sachs (1999) argue that there is a cycle of simultaneous impact between health and wealth. Bloom and Canning (2000) explain that healthy individuals are more efficient at assimilating knowledge and, in consequence, obtain higher productivity levels. They assert that macroeconomics acknowledges the contribution of human capital to economic growth, but their empirical studies define human capital investment solely in terms of schooling. However, when the production function model of economic growth is extended to include health, their main result is that good health has a positive, sizeable and statistically significant effect on aggregate output.

Adults in poorer economies are more likely to be afflicted with health problems, some of which stem from early childhood, and the functional consequences of ill health are likely to be felt through the life cycle (Strauss & Thomas, 1998). Healthier workers are more productive and earn higher wages. They are less likely to be absent from work because of illnesses (or illnesses in their family). Illnesses and disability reduce hourly wage substantially, having a particularly strong effect on the economies of developing

countries such as Kenya, where most of the workforce is engaged in manual labour. Healthier workers also live for longer which incentivizes savings. The savings booms in the East Asian "tiger" economies in the last quarter of the 20th century were largely driven by rising life expectancy and greater savings for retirement (Bloom, Canning & Weston, 2004).

On the other hand, economic growth results in increased healthcare expenditure leading to better health care and innovations in medical technology, leading to an increase in life expectancy and a decrease in infant mortality rate, which are key indicators of the health situation in a country.

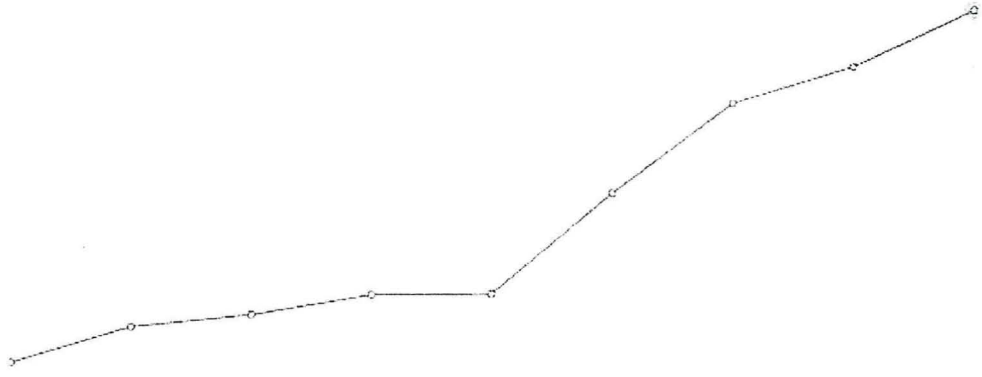

Figure 1.1: Per Capita Healthcare Expenditure in Kenya between 2006 & 2014

Source: World Bank (2016)

As shown in Figure 1.1, the per capita health care expenditure in Kenya has been following an upward trend over the years. It grew form KES 3,000 to KES 7,800 between 2006 and 2014.

In the Financial year 2016/7, 4.5 billion was allocated to lease medical equipment; 14.6 billion was allocated for National hospitals, 1.7 billion for Research, 6.5 billion for training and 4 billion to miscellaneous activities such as AIDS control and portable clinics. "During the medium-term planning period, the sector emphasis will be on strengthening of health systems particularly focusing on high impact interventions and priority investment areas. To accelerate this process, the sector will focus on progressive improvement of governance frameworks, health infrastructure, human resource for health, social health protection and access to quality and affordable medicines and medical supplies across the country. This will ensure achievement of the necessary standards and norms required for effective and comprehensive health service delivery." (Ministry of Health, 2016)

Given that the health sector accounts for a sizeable amount of the public purse in Kenya, and, if public investment in health infrastructure and innovations yields benefits in terms of higher productivity and economic growth, then those benefits should be evaluated.

1.3 Problem Statement

This study seeks to establish and explain the relationship between health care expenditure and economic growth. Particularly, it seeks to analyze the effects of healthcare expenditure on economic growth, as an investment in human capital.

One of the key studies carried out in Kenya is on the determinants of healthcare expenditure. It concludes that, a unit change in GDP results in a 0.011 unit change in Public Health Expenditure while a unit changes in external funding results in a 0.304 unit decrease in Public Health Expenditure. Population age structure and technological progress are also significant (Rono, 2013).

Another study examines the effects of economic growth on health care expenditure. It finds that healthcare in Kenya is a necessary good and has an elasticity of 0.024 % to GDP per Capita (Nyamwange, 2012).Further, a study has been done on human capital development and economic growth in Kenya (1981-2011)by Oloo (2009). The study, focusing on the combined expenditure of the health and educational sector, finds a positive relationship between the two. Even then, it does not isolate the specific effects of healthcare expenditure on economic growth.

There exists a gap in finding a link between total healthcare expenditure and economic growth in Kenya. Nyamwange (2012) in his study evaluated the impact that economic growth had on healthcare expenditure. The study confirmed the Wagner Law of Increasing Extension of State Activity (1883), by showing that with increasing economic growth comes an increase in the scope of government and its subsequent expenditure. However, there exists a gap in establishing and estimating the impact of total health care expenditure on economic growth in the Kenyan context. Does total healthcare expenditure have an effect on economic growth? To what extent does total healthcare expenditure affect economic growth? These are the questions that this study intends to answer in the Kenyan context.

1.4 Research Objectives

1. To establish the relationship between total health care expenditure and economic growth in Kenya.
2. To estimate the extent that total healthcare expenditure affects economic growth in Kenya.

1.5 Research Questions

1. What is the relationship between total health care expenditure and economic growth in Kenya?
2. To what extent does total health care expenditure affect economic growth in Kenya?

1.6 Significance of the Study

The government as a major stakeholder in the health sector could use the findings of this research in policy formation. The findings could serve as a basis for key decision makers in determining the optimal level of healthcare expenditure necessary to achieve targets for economic growth.

This study could be useful to stakeholders in formulating and planning areas of intervention and support. It could be used as a basis to negotiate for additional funding and financial support in the health sector.

Further, this research will be added to the growing body of knowledge in the area of health care expenditure effects on economic growth and open up opportunities for further research. It will serve as a source of reference material for future researchers interested in related topics.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section contains the theoretical review, the empirical review, the conceptual framework and the research gap. The theoretical and empirical reviews provide scholarly viewpoints on terms and concepts, and highlight the relevant findings from previous research. The research gap section reiterates the gap in literature that the paper seeks to address. The conceptual framework shows the relationship between the dependent and independent variables.

2.2 Theoretical Review

Behrman (1990), sought to answer some important questions regarding the nature of human resources and their role in the process of the society's development. This is due to the fact that the definition of Human Capital Development had been extended to include a fairly broad group of investments encompassing areas such as health, nutrition, home environment of the children, and the production as well as the diffusion of knowledge. He addressed the following question: Given that many developing countries would like to change their comparative advantage from low-skill-labour intensive to relatively high-skill-labour intensive goods and services, to what extent could individuals justify an activist public policy that would accelerate the rate of relevant human resource investments over and above what would occur in the normal course of development?

Behrman (1990) perceived the 'normal' amount of human resource investments to be the one that would presumably come about as a result of private maximizing decisions made in response to market prices in an environment of no market failure. He developed

analytical frameworks to investigate the presence of gains in efficiency to be had by following an activist human resource investment (HRI) policy. The static framework, based on the standard tools of analysis such as a production possibilities frontier (PPF) and the corresponding Edgeworth box's 'efficiency locus', was used to set the stage for the dynamic analysis of an appropriate HRI policy. In the dynamic context, the essential argument was that at the macro level, economic growth could be represented by an outward shift of the PPF. In principle, HRI could favorably affect the nature of such shifts as well as the economy's speed of adjustment to the new PPF. Its major finding was that the existing empirical evidence did not justify any significant activist HRI policy and amounts to a voice of caution urging scholars to research further before committing substantial resources to any policy.

Bloom and Sachs (1998) in their paper "Geography, Demography and Economic Growth in Africa" sought to illustrate the core issue of healthcare expenditure, human capital and economic growth by looking at the traditional killer malaria, and the epidemic killer HIV/AIDS. "Lessons from vector-borne diseases such as malaria no doubt shed light on other endemic infectious diseases such as yellow fever (transmitted by the mosquito Aedesaegypti), leishmanaisis (transmitted by the sand fly), trypanosomiasis (transmitted by the tsetse fly), schistosomiasis (transmitted by snails), and various helminth (worm) infestations, such as onchocerciasis (river blindness), roundworm, and hookworm" (p. 229). They found that the estimated time lost due to both malaria itself and time spent nursing sick family members lay between the range of one to five days of productivity loss due to adult illness, and one to four days loss per sick child. They found that it also reduced the return on investment on education since

children were forced to miss school and disease was believed to diminish long-term cognitive performance.

HIV/AIDS, perhaps the most daunting health problem currently hanging over Africa's economic future, given the heavy indirect costs embodied in loss of income and output, tends disproportionately to afflict working-age adults, given its mode of transmission. It was found to cause an average reduction of GDP per capita growth of 0.25 percentage point per year in Tanzania and Malawi using macro simulation models (Bloom & Sachs, 1988).

Bloom, Canning and Weston (2004) were interested in the effect that vaccination had on economic growth. These impacts stemmed from the fact that immunization protected individuals not only against getting an illness per se, but also against the long-term effects of that illness on their physical, emotional, and cognitive development. For example, by stunting physical growth, childhood diseases could curtail opportunities for carrying out manual labor during adulthood. In developing countries, where manual work was frequently the only option, physical handicaps were particularly damaging. Cognitive development may also be affected by vaccine-preventable disease. Measles, for example, could cause brain damage or impair learning abilities, with severe impacts on a child's life prospects.

The trio asserted that there were several channels through which health improved wealth. The first was through its impact on education. Healthier children have better school attendance which increases their ability to learn while in class. Deworming programs, iron supplementation and other such health interventions lead to a significant

reduction in school absenteeism. Curing whipworm infection, meanwhile, had been found to lead to improved test scores.

The second channel is through health's impact on productivity. Healthier workers are generally more energetic and mentally robust, while having fewer absent days. Moreover, workers in healthy communities do not need to take as much time off to take care of sick relatives. Workers that did not suffer poor health in their childhood have larger bodies which has been found to have large impacts on long term productivity. Further, a one-year increase in life expectancy improved labor productivity by 4 per cent.

The third means by which health was found to improve wealth was through its effect on savings and investment. Given that healthier people expect that they will live longer, they have a greater incentive to save for their retirement. They also have longer productive years and are therefore able to work more and save more. This provides a larger capital base for entrepreneurs to draw on for purposes of investment, and the effect is translated into the economy through increased incomes and greater job creation which facilitates more employment opportunities. The emergence of East Asian "tiger" economies was partly due to the savings boom in the last quarter of the 20th Century, which was fuelled by raising life expectancy and greater savings for retirement.

Finally, Bloom et al. (2005) asserted that health boosts economies via a demographic dividend. The provision of better health care and dietary improvements has led to a rapid transition in many developing countries from high to low mortality rates. This transition has led to a decline in fertility rates since mothers bear fewer children as they are expected to survive. Therefore the boom in young dependent as mortality falls is met by

a fall in fertility rates. This means that parents can channel their resources in nurturing fewer children, leading to increased prospects of getting a good education and receiving efficient health services. When this boom generation reaches working age, there is a swell in the ratio of workers to dependents. If this is met by a policy environment favourable to job creation, it can boost the economy.

As mentioned before, previous theoretical work on growth had often stressed the role of education as a contributor to human capital but had tended to neglect the role of health. Barro (2013) developed a framework to incorporate the concept of health capital. One of the key features of the analysis was the two way causation between health and wealth. While better health leads to improved economic growth in various ways, economic advancements encourage further accumulation of health capital. The model take s into account the direct impact that health has on productivity. That is, for a fixed number of labour hours, quantity of physical capital and worker schooling and experience, an improvement in health has a positive effect on worker's productivity.

As shown in Figure 2.1, in addition to this direct effect, an improvement in health lowered rates of mortality and disease and thereby decreased the effective rate of depreciation on human capital; that is, on schooling and health itself. Through this channel, an increase in health raised the demand for human capital and thereby had a further, indirect positive effect on productivity.

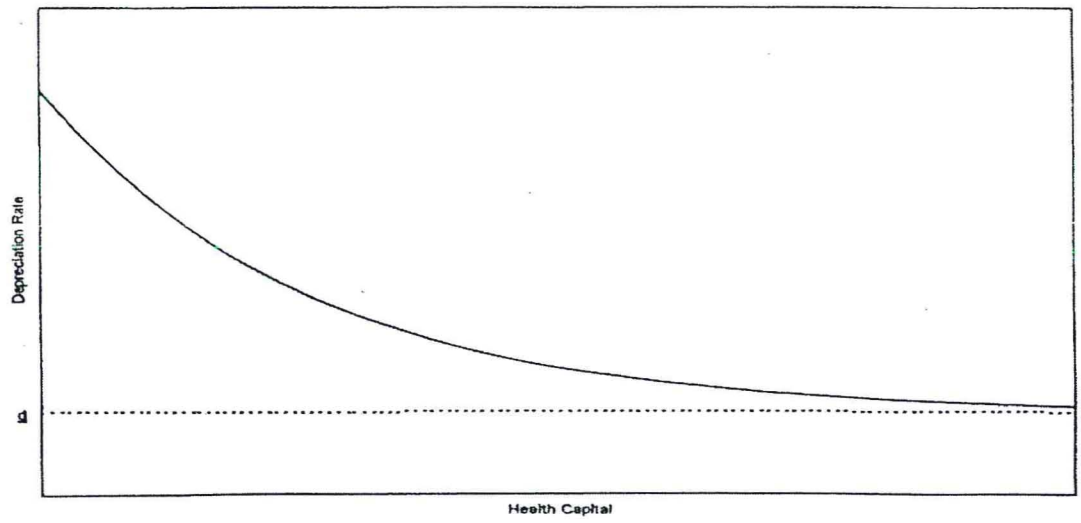

Figure 2.1: Human Capital Depreciation vs. Health Capital

Source: Three Models of Health and Economic Growth (Barro, 1996).

2.3 Empirical Review

The positive effect of health on economic growth is identified either in exogenous growth models during the transition to the steady-state or in endogenous growth models. Sustained growth depends on levels of human capital whose stocks increase as a result of better education, higher levels of health and new learning and training procedures. In the empirical discussions, macro and micro studies analyze whether different health indicators are positively linked to different dimensions of economic growth. Many of the studies use different proxies to measure the health of a given country, with the most common being: life expectancy, infant mortality rate, a health index or expenditure on health care.

Soukiazis and Cravo (2007) based on panel data approach for a sample of 77 countries for the period 1980-2000, came up with the following findings. From the health

variables, infant mortality exhibits the expected inverse relationship with income, and appears to be significant in the fixed and random effects regressions. A fall of 1% in the infant mortality leads to a 0.13-0.20% increase in income per capita for the 77 countries samples. Life expectancy shows to have the expected positive effect which is only significant in the random effects regression.

Gallup, Sachs and Mellinger (1998) lend credence to the hypothesized positive relationship between health and economic growth. They use life expectancy at birth to proxy for the health of the overall population and find that there exists a strong relationship between health care at the initial level and economic growth.

Abbasa and Foreman-Peck (2007) used the co-integration technique to estimate the effect of human capital on the economic growth of Pakistan in the period 1961 to 2003. In this study, health expenditure as a percentage of GDP was used as a proxy for human capital. They found an increasing return to physical and human capital specifically in the case of investing in health sector.

Kurt (2015) used the Feder-Ram model to estimate the effect of health expenditure on economic growth in Turkey between 2006 and 2013. It was found that the direct impact of health expenditure on output was positive in all equations. In other words, spending by the government on health as an expenditure item has a positive effect on output and causes increases in both aggregate demand and expenditure.

In the same vein Lustig, (2006) uses data from 1970-1995 on mortality rates and life expectancy for different age groups as health indicators, in order to study the direct relationship between health and growth in Mexico. His study observes that approximately one-third of long term economic growth in Mexico is attributable to

health. He considered health to be an asset that possessed both an intrinsic and instrumental value. It is a source of well-being and has high value the world over.

In their study on government health expenditure and economic growth in Nigeria, taking time series data from 1970-2008 and using co-integration and error correction methods to analyze the relationship between government expenditure and economic growth and using the OLS method Abu and Usman (2010) came up with the following findings regarding government expenditure on health: a 1% increase in expenditure on health in the previous year leads to approximately 0.06% increase in economic growth. This provides evidence to the theory that an increase in government expenditure on health raises the health status and productivity of the people, thereby promoting economic growth.

Wang (2011) explored the causality between health-care expenditure and economic growth for 31 countries through the estimation of panel regression and quintile regression equations over the period 1986-2007. Panel regression analysis testified that expenditure growth positively contributed to economic growth.

Biswaji and Mukhopadhyayn (2012) in their study on public spending on education, health care and economic growth in selected countries of Asia and the Pacific based on a dataset of the 12 countries and the normalized co-integrating equation through the estimation of an appropriate Vector Error Correction (VEC) model found that healthcare spending contributed to GDP growth in Bangladesh, Nepal, the Philippines, Singapore and Sri Lanka.

Temitope & Bola (2013) in their study on the effect of health investment on economic growth in Nigeria, using an endogenous growth model found that the health investment

had a positive sign by implication, a 1% increase in health investment caused about 0.04% increase in the real output. The long run effect was obtained through the normalization of the co integrating equation.

By employing a multiple regression technique based on a modified neo-classical Solow Model, Oni (2014) estimated the impact of health care expenditure on economic growth. He found that1 percent increase in the health expenditure leads to about 71 percent increase in the real GDP. This could be as a result of an enhanced public expenditure policy of Nigeria which had contributed positively to real output growth in Nigeria.

Based on these findings, this study sought to establish and evaluate the relationship between Healthcare Expenditure and Economic Growth in Kenya.

2.4 Research Gap

There exists a gap in determining the impact of health care expenditure on economic growth, with Kenya as the country in focus. The studies that have been done in Kenya either measure the combined effects of expenditure in the health and education sectors (Oloo, 2009), or the effects of economic growth on healthcare expenditure (Nyamwange, 2012). This study therefore seeks to fill in this gap.

2.5 Conceptual Framework

The dependent variable in this study was the economic growth while the independent variables were health expenditure, labour force, secondary school enrollment and capital formation. Economic growth was measured using real gross domestic product and total health care expenditure was measured as the public (government) spending on health represented by a percentage of GDP in the country as reported on World Bank Open

Data. Figure 2.2 shows the hypothesized relationship between health care expenditure and economic growth. Increased health care expenditure has a positive effect on economic growth.

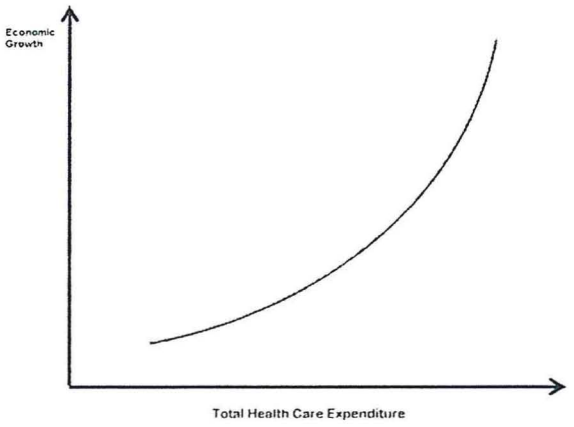

Figure 2.2: Total Healthcare Expenditure vs. Economic Growth

Source: World Health Organization (2012)

The labour force will be measured as the people ages 15 and older who meet the International Labour Organization (ILO) definition of the economically active population. The size of the labour force has a positive relationship with real gross domestic product. This has been shown in research done by Duval, Eris & Furceri (2010) on Labour Force Participation Hysteresis in Industrial Countries. Secondary school enrollment will serve as the proxy for education. This also has a positive relationship with the real gross domestic product as shown by Hanushek and Woesmann (2010), in their paper Education and Economic Growth. Gross capital formation consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of transport ways,

including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress". This is measured in USD.

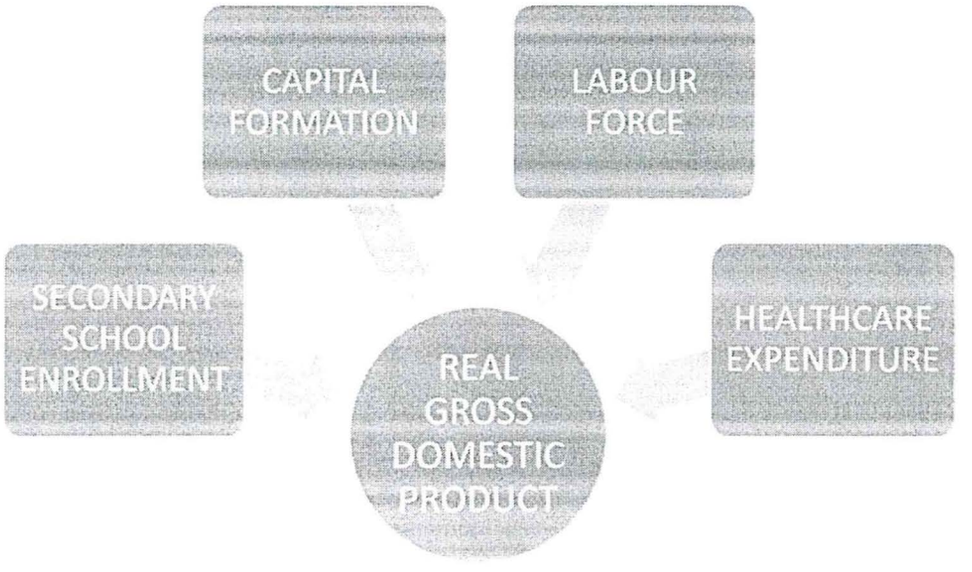

Figure 2.3: Conceptual Framework

Figure 2.3 shows that the real gross domestic product is the dependent variable, while secondary school enrollment, capital formation, the labour force and health care expenditure are independent variables that are determinants of RGDP.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This section addresses the issues that relate to the methodology of the study with emphasis on the choice of the research design and strategies, data requirement and sources, nature and types of data collected, data processing and parameters to be estimated. The section also specifies the model.

3.2 Research Design

The research design used here is historical. The purpose of a historical research design is to collect, verify, and synthesize evidence from the past to establish facts that defend or refute a hypothesis. The study uses this design since its main aim is to establish the relationship between (and estimate the effect of) health care expenditure and (on) economic growth.

Longitudinal data is used since the study requires that we describe patterns of change and helped establish the direction and magnitude of a causal relationship. Measurements are taken on each variable over two or more distinct time periods.

3.3 Population and Sampling

The population used here was the entire Kenyan populace. The sample used was as availed by the Kenya National Bureau of Statistics through its census processes.

3.4 Data Collection

Data on the GDP, health care expenditure, gross capital formation, secondary school enrollment and labour force was collected. This data, which was entirely secondary, was

collected from the Ministry of Finance Library, Ministry of Education Library, the Kenya National Bureau of Statistics, the Central Bank of Kenya Bulletins and the World Bank Open Data Sources. The time series data covered the periods between 1970 and 2015. The measurement of the variables is as shown in Table 3.1.

Table 3.1: Operationalization/Measurement of Study Variables

Variable	**Type**	**Measurement**
Economic growth	Dependent variable	Aggregate Real Gross Domestic Product in Billion USD
Healthcare expenditure	Independent variable	Total health care expenditure by the government as a percentage of GDP.
Capital formation	Independent variable	Changes in inventories and acquisitions less disposals of valuables for a unit or sector, in USD
Labour force	Independent variable	Total labor force comprises people ages 15 and older who meet the International

		Labour Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed.
Education (Secondary school enrolment)	Independent variable	Total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age. It is calculated by dividing the number of students enrolled in secondary education by the population of the age group which officially corresponds to secondary

		education, and multiplying by 100. In Kenya the official secondary education age band is 15-18 years.

3.5 Data Analysis

Based on the Keynesian framework which postulates that an increase in government expenditure had a positive effect on economic growth, the methodology sought to analyze the relationship between health care expenditure and economic growth. Following Solow (1956), an economic growth model was specified as:

$$Y_t = f(K_t, A_t, L_t) = K_t^{\alpha}(A_t L_t)^{1-\alpha} \quad (1)$$

Y_t; Aggregate Real Output

A_t; Efficiency Factor

L_t ; Labour Force

K_t; Capital Stock

Odusola (2002) offered a rectification of the model adopted by Olobokun and Bakare (2011), given that human capital contributed positively to economic growth.

$$Y_t = K_t^{\alpha} H_t^{\beta}(A_t L_t)^{\sigma} \quad (2)$$

H_t; Human Capital

For purposes of measurement, the study proxies the human capital variable with health care expenditure, since improvements in healthcare programs through adequate financing schemes enhances human capabilities. Secondary school enrolment was used as the efficiency factor since as earlier stated, education made human capital more efficient.

The natural log transformation of equation (2) yields:

$$lnY_t = \alpha lnK_t + \beta lnH_t + \sigma ln(A_t, L_t) \quad (3)$$

This study employs cointegration in analyzing the relationship between human capital expenditure and economic growth as adopted by Obudunmi, Saka and Oke (2012).

Based on Engle and Granger principle, there is an underlying long-run relationship between two cointegrated variables if the two variables X_t and Y_t are non-stationary in their first differences, then they are I(1) variables so that their linear combination would be:

$$Z_t = X_t - \lambda Y_t \quad (4)$$

If λ exists such that Z_t is I(0), then Y_t and X_t are said to be cointegrated. This implies that they share similar stochastic trends and they never diverge too far from each other.

3.5.1 Unit Root Test

To test for cointegration, the first step was to apply the unit root test. The study adopts the Augmented Dicky-Fuller (ADF) test statistic. The ADF is:

$$\Delta y_t = a_o + \delta y_{t-1} + a_2 + \sum_{i=1}^{p} \beta \Delta y_{t-1} + \mu_t \quad (5)$$

Where y_t is the variable under consideration, and

$$E(\mu_t) = 0 \quad (6)$$

3.5.2 Cointegration Test

To avoid Engle and Granger's two step estimating and testing for the presence of multiple cointegrating vectors, the study used the Johansens's procedure. This avoids carrying the new error term introduced in the first step estimation into the error correction mechanism.

The Johansen approach relies on the relationship between the rank of matrix and its characteristic roots and estimates the long run relationship between non-stationary variable using the maximum likelihood procedure. This approach based on the rank of the coefficient matrix Π of the equation. The test equation is of the form:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Delta X_{t-2} + .. + \Gamma_{k-1} \Delta X_{t-k} + \mu + \varepsilon_t \quad (7)$$

The null hypothesis for r cointegrating vector in this case is that Π has a reduced rank, r<k where $X_t = k \times 1$ vector of I(1) variables of $\Gamma_1, \Gamma_2 \ldots \Gamma_{k-1}$. Π is k×k matrices of unknown parameters and contains information about the cointegrating relationship. The reduced rank condition has an implication that the process $\Delta X_t$is stationary and $X_t$is non-stationary. If Π is of full rank, all elements of X are stationary, if the rank of Π=0, there is absence of stationary conditions and so no cointegrating vectors, and if Π is between r and k, the X variables are cointegrated and there exists r cointegrating vectors. The trace and maximum Eigen test statistic in the Johansen approach are respectively given by:

$$\lambda_{trace} = -N \sum ln(1 - \lambda_t) \quad (8)$$

$$\lambda_{max(r,r+1)} = -N \sum \ln(1 - \lambda_{t-1}) \quad (9)$$

3.5.3 Ordinary Least Squares

After establishing the level at which all independent variables are stationary, the study estimates the coefficients of the variables using the Ordinary Last Squares Method.

On the basis of equation (3), the estimating equation is derived:

$$lnY_t = \phi + \alpha lnK_t + \beta H_t + \delta A_t + \gamma lnL_t + \varepsilon_t \quad (10)$$

$$lnRGDP = \beta_0 + \beta_1 lnK_t + \beta_2 lnL_t + \beta_3 H_t + \beta_4 E_t + \varepsilon_t \quad (11)$$

Where:

K_t; Capital formation

$RGDP$; Real gross domestic product

L_t; Labour force

H_t; Healthcare expenditure

E_t; Education

The natural logs of some of the variables namely real gross domestic product, capital formation and labour force are taken to control for the variability among the observations and this was represented by the "ln". ε_t is the stochastic term. β_0, β_1, β_2, β_3, and β_4 are coefficients of elasticities. The priori economic expectations are: $\beta_0>0$, $\beta_1>0$, $\beta_2>0$, $\beta_3>0$, $\beta_4>0$

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.0 Introduction

The purpose of this study is to establish and explain the relationship between health care expenditure and economic growth in Kenya for the period 1970-2016. Particularly, the study seeks to analyze the effects of healthcare expenditure on economic growth as an investment in human capital. Aggregate real output (GDP) as a measure of economic growth is modelled against four variables namely capital stock, labour force, and healthcare expenditure (as a proxy for human capital), and secondary school enrolment (as a proxy for education which is the efficiency factor) based on the economic growth model specified by Solow (1956).

4.1 Descriptive Statistics

The results in Table 4.1 provides the descriptive statistics of the variables namely; real gross domestic product, capital stock, health care expenditure, labour force and education for the period 1970 to 2016.

Table 4.1: Descriptive Statistics

	GDP(US$)	Healthcare Expenditure (% GDP)	Labour force(Total labour force)	Education (Gross Enrollment Ratio in %)	Gross Capital Formation
Mean	17,000,000,000	4.216132	10262547	41.49489	122398.8
Median	8,360,000,000	4.254611	9891812	40.46000	56505
Maximum	65,400,000,000	5.953396	18376842	72.80452	508453
Minimum	1,600,000,000	2.147744	5271399	16.64333	16613
Std. Dev.	17,900,000,000	0.860679	3955543	15.79004	122901.6
Skewness	1.519428	-0.50496	0.429755	0.467155	1.463556
Kurtosis	4.070249	3.599273	2.002778	2.491994	4.612511
Observations	47	47	47	47	47

The results indicate that the mean real GDP for the period is 17 billion USD whereas the maximum and minimum values were 65.4 billion USD and 1.60 billion USD respectively and had a standard deviation of 17.9 billion USD. The average capital formation for the study period is 1.223988 billion USD with a maximum of 5.08453 billion USD and a minimum of 1.6613 billion USD. The standard deviation is 12.29016 billion USD. The average healthcare expenditure for the period as a percentage of GDP is 4.216132%; the maximum is 5.953396% while the standard deviation is 0.860679. The average labour force measured for the period is 10,262,547 where the maximum labour force size is 18,376,842 with a minimum of 5,271,399 and standard deviation of 3,955,543. The average gross enrollment ratio in percentage for the study period is calculated as 41.49489% while the maximum and minimum are 72.80452% and 16.64333% respectively with a standard deviation of 15.79004%.

4.2 Trend Analysis

This section provides graphical representation of the movements and changes of the variables under study over the study period, 1970 to 2016.

4.2.1 Trend in Real GDP

Figure 4.1 indicates that the real GDP for the period has been on an increasing trend with some fluctuations observed for the period 1983 to 2004 and sharp increase for the period 2005 to 2016. However, a large drop in the real GDP was observed in 2011.

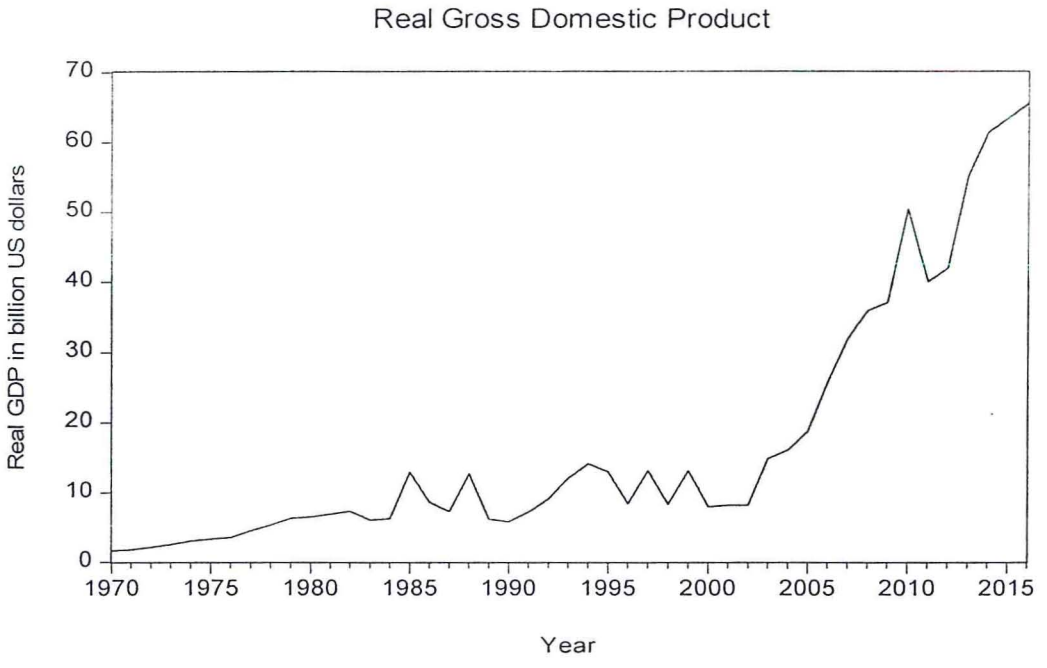

Figure 4.1: Trend in Real GDP

Kenyan economy has posted a mixture of patterns in terms of growth in real Gross Domestic Product (GDP) as depicted by peaks and trough since independence. Kenya recorded an average growth rate of 6.5% in real GDP over the period 1964-1967 which was exceptional considering that Kenya is a developing country (CBK, 2002). However, this growth momentum was slowed down by the first oil crisis of 1972 and as a result GDP growth rate decelerated to below 4 percent during the early 1970s. Following the unexpected coffee boom of 1976 and 1977, GDP growth rate averaged 8.2% (GOK, 1994).

During the most early 1980's, GDP growth rate remained below 5 percent and fell to below 1 percent in 1984. This was largely attributed to severe drought of that year. Agriculture was the most affected; its contribution to GDP fell to -3.9 percent. However, there was an economic recovery in 1985-1986 when growth rate 4.8 percent and 5.5

percent respectively were recorded. This was attributed to favorable weather conditions, government budgeting discipline and improved managerial principle (GOK, 1994). GDP growth rate continued to slide in the 1990's falling to 0.2 percent in 1993. Dismal performance of the economy during this period was attributed to decline in real output and value added in agriculture due to below average amount of rainfall; sluggish growth in aggregate private domestic demand and foreign exchange shortages leading to reduced imports of intermediate goods as well as suspension of donor aid (GOK, 1994)

After the economy registered a disappointing performance in the 1990's and early 2000, it resumed growth momentum again and there was a consistent increase in GDP growth rate from year 2002. The economy grew at a rate of 7.0 percent in 2007. However, this growth momentum was slowed by post-election violence of 2008, and the economy grew at a rate of 1.7 percent.

4.2.2 Trend in Healthcare Expenditure

Figure 4.2 shows that there have been consistent fluctuations in the level healthcare expenditure as a percentage of GDP for the period 1970-2016 with periods of sharp increase as well as decrease.Despite the increase in cost of living, the total government allocation to the social sector (i.e. health and education) was not as substantial as expected. According to the Ministry of Finance -Kenya, budgetary allocations to the social sector (health and education) increased from Kshs 189.9 billion in financial year 2009/2010 by only 70 billion(approx., 1 shilling per person) to Kshs 259.9 billion in 2011/2012. This allocation is only 10% of total GDP capacity. In particular the health sector received Kshs 51.9 billion in the financial year 2011/2012 –that is 1% of GDP

outlay in 2011, a figure that has brought many contentious issues by the ministries heading health in Kenya (Nyamwange, 2012).

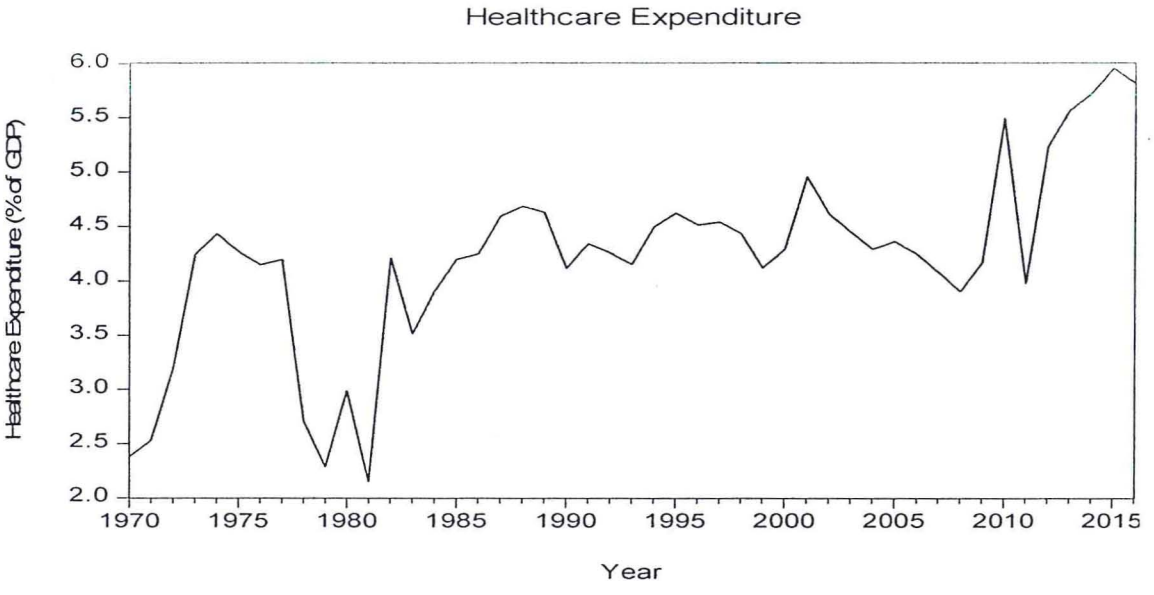

Figure 4.2: Trend in Healthcare Expenditure

4.2.3 Trend in Total Labour force

Figure 4.3 shows that the total labour force in the country had been increasing with small declines for the period 1970 to 1984 as well as for the period 2002 to 2015. However, the labour force had been consistently fluctuating for the period 1985 to 2001.

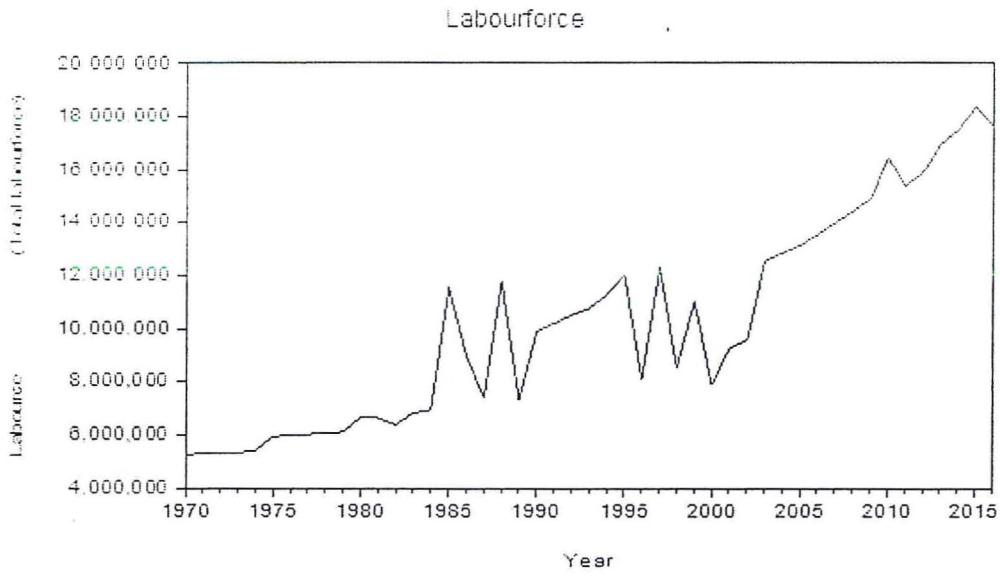

Figure 4.3: Trend in Total Labour Force

4.2.4 Trend in Education

Figure 4.4 clearly shows that secondary education gross enrollment ratio as a measure of education had been on an upward trend with small declines for the period 1970 to 2016.This trend could be attributed to Free Primary Education and Free Day Secondary Education which are part of Vision 2030, and have produced a dramatic response. For instance, since 2003, primary school enrollment has increased by nearly 3 million pupils (a 46% increase), while the number of schools grew by 7,000 (a 38% increase). Free Day Secondary Education has produced equally dramatic effects: enrollment more than doubled between 2003 and 2009(USAID, 2012).

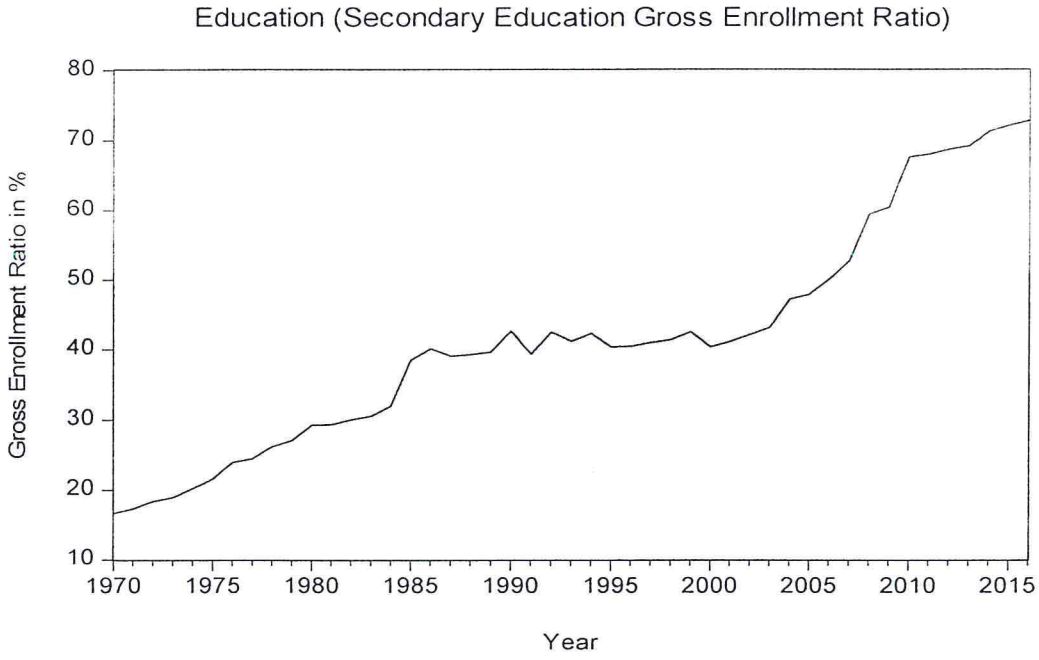

Figure 4.4: Trend in Education

4.2.5 Trend in Capital Formation

Figure 4.5 shows the trend for capital formation for the study period 1970 to 2016. The figure depicts that there had been an upward trend in capital formation for the period 1970 to 1984. However, there had been fluctuations in capital formation for the period 1985 to 2002 followed by a consistent sharp increase in the 2003 to 2008 followed by a sharp decrease in 2009 and 2010 after which a sharp increase was witnessed in 2011 followed by a sharp decrease in 2012.

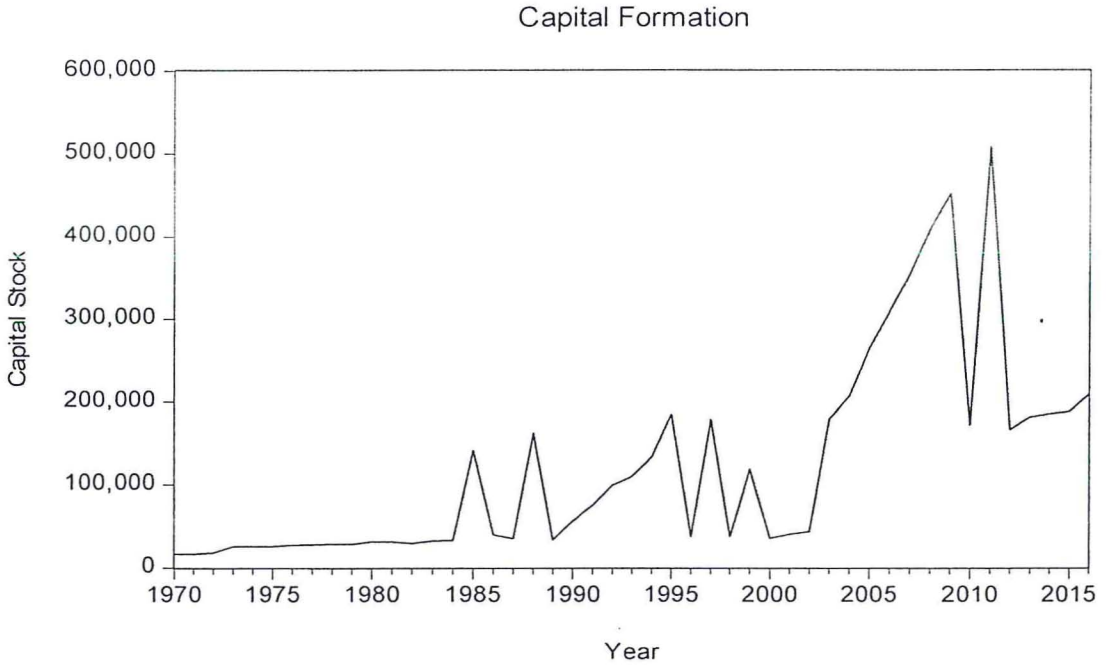

Figure 4.5: Trends in Capital Formation

4.3 Estimation Tests

4.3.1 Normality Tests

Table 4.2 below presents the results for the test for normality of the variables used in the study.

Table 4.2: Normality tests

	LOG GDP	LOG LABOURFORCE	LOG CAPITAL	LOGHEALTHCARE EXPENDITURE	LOGEDUCATION
Skewness	0.216049	0.002103	0.242737	-0.504957	0.467155
Kurtosis	2.390702	1.701272	1.664960	3.599273	2.491994
Jarque-Bera	1.092657	3.303142	3.951951	2.700647	2.214882
Probability	0.579072	0.191748	0.138626	0.259156	0.330403
Observations	47	47	47	47	47

The Jarque-Bera test for normality is thus used to determine whether the variables were normally distributed or not. The null hypothesis in this case is that the variables are not significantly different from a normal distribution. The Jarque-Bera probability value of

all the variables in this case is greater than the critical 5 percent and thus they are insignificant implying that the variables were normally distributed.

4.3.2 Multi-collinearity Tests (Pearson Correlation)

Pearson bivariate correlation is used to check for Multicollinearity between the variables under the study. The results are presented in Table 4.3.

The results indicate that the variables have positive correlation. It is clear that labour force and real GDP are positively correlated (0.753272). This correlation is found to be significant at 5% level of significance given that the (p=0.0000) is less than 0.05. Capital formation is also found to be positively correlated with real GDP (0.823451) and this correlation is significant at 5% level of significance ((p=0.0000). Healthcare expenditure is also found to be positively correlated with real GDP (0.611028) and the relationship between the two variables is significant (p=0.0000). It is found that there is multicollinearity between education variable which was as the efficiency factor with all the other variables hence it is dropped. The results are presented in Appendix 1. There is no Multicollinearity between the rest of the variables based on the cut off of 0.7.

4.4 Unit Root Tests

Prior to testing for a causal relationship and co-integration between the time series, the first step is to check the stationarity of the variables used in the model. The aim is to verify that the series has a stationary trend, and, if non-stationary, to establish orders of integration. The study uses the Augmented Dickey-Fuller (ADF) test to test for stationarity. The null hypothesis for the ADF test is that there is a unit root meaning that the data is non-stationary. The rejection criterion is that if the ADF statistic is greater

than the critical values at 1%, 5%, and 10% level of significance, then the null hypothesis is rejected. The test results of the unit roots (intercept only) are presented in Table 4.3 which indicates that LOGGDP, LOGCAPITAL and HEALTHCAREEXPENDITURE are non-stationary (i.e. presence of unit roots) at 1%, 5% and 10% levels of significance. LOGLABOURFORCE is stationary at all levels. This calls for first differencing of the non-stationary variables.

Table 4.3: Unit Root Tests-Level

Variable name	**ADF test**	**1% Level**	**5% Level**	**10% Level**	**Comment**
LOGGDP	-0.78005	-3.58474	-2.92814	-2.60223	Non Stationary
LOGCAPITAL	-2.48334	-3.58474	-2.92814	-2.60223	Non Stationary
LOGLABOURFORCE	-4.07341	-3.58851	-2.92973	-2.60306	Stationary
HEALTHCARE EXPENDITURE	-2.10668	-3.58474	-2.92814	-2.60223	Non Stationary

Table 4.4 shows the Unit root results after first difference. All variables become stationary at first difference.

Table 4.4: Unit root tests-First Differencing

Variable name	**ADF test**	**1% Level**	**5% Level**	**10% Level**	**Comment**
LOGGDP	-9.49262	-3.58474	-2.92814	-2.60223	Stationary
LOGCAPITAL	-9.73988	-3.58851	-2.92973	-2.60306	Stationary
HEALTHCAREEXP ENDITURE	-9.50058	-3.58474	-2.92814	-2.60223	Stationary

4.5 Cointegration Tests

After establishing whether the series is stationary in levels or first-difference (and if the series are integrated of the same order), then Johansen's procedure is used to determine whether there exists a cointegrating vector among the variables (Johansen, 1988). The study seeks to establish whether the non-stationary variables are cointegrated. Differencing of variables to achieve stationarity leads to loss of long-run properties. The concept of cointegration implies that if there is a long-run relationship between two or more non-stationary variables, deviations from this long-run path are stationary. In testing for cointegration two methods are usually used; two step Engle Granger test and Johansen cointegration test. This study used Johansen cointegration test since it is more accurate and superior to Engel Granger test of cointegration. Johansen results as shown in Table 4.5 indicate that there is no cointegration as indicated by the p values which were greater than 0.05. This implies that the variables in the model estimating GDP do not converge to equilibrium in the long run (i.e. no long run relationship between real GDP and the independent variables).

Table 4.5: Johansen Co-Integration test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.406826	46.98639	47.85613	0.0602
At most 1	0.262356	24.00665	29.79707	0.2001
At most 2	0.205883	10.61773	15.49471	0.2361
At most 3	0.010730	0.474672	3.841466	0.4908

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

4.6 Discussion of the OLS Model

Given that all the variables are found to be stationary in the first difference, an Ordinary Least Square Regression is run in the first difference.

The results in table 4.6 show the findings. The constant takes a coefficient of 0.0313592 (t-ratio=1.2583> t-critical=1.68023). The size of the labour force is a significant variable (t-ratio=5.737> t-critical=1.68023) and so is capital expenditure (t-ratio=6.171> t-critical=1.68023). Finally, healthcare expenditure is also found to be a significant variable in determining the economic growth (t-ratio=4.431> t-critical=1.68023).

Table 4.6: Ordinary Least Squares in the First Difference.

Dependent Variable: d_LOGGDP
Method: Least Squares
Date: 11/30/16 Time: 15:34
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable Name	Coefficient	Std. Error	t-ratio	p-value	
CONSTANT	0.0313592	0.0249217	1.2583	0.2160	
d_LOGLABOURFORCE	0.0900602	0.0156969	5.737	0.0095	**
d_HEALTHEXPENDITURE	0.0541907	0.0122298	4.431	0.0002	**
d_LOGCAPITALFORMATION	-0.121251	0.019648	-6.171	0.0008	**

Critical value = 1.68023

Mean dependent VAR	0.081221	S.D. dependent VAR	0.119385
Sum squared residuals	0.498993	S.E. of regression	0.114592
R-squared	0.874803	Adjusted R-squared	0.728672
F(5, 38)	1.734353	P-value(F)	0.150302
Rho	−0.034540	Durbin-Watson	2.057555

From the results in Table 4.6, the optimal model is given as below and this presents the long run model.

d_LOGGDP = 0.0313592 + 0.0900602d_LOGLABOURFORCE + 0.0541907 d_HEALTHCAREEXPENDITURE + 0.12125d_LOGCAPITALFORMATION

From the model above, a 1% increase in labour force size results to a 0.09% increase in GPD, holding all other variables constant. A 1% increase in capital formation also leads to a 0.12125% increase in GDP. A 1% increase in the health care expenditure leads to a 0.05567% increase in the GDP. This figure is arrived at by taking the exponential of the *d_HEALTHCAREEXPENDITURE* coefficient given that we did not transform it logarithmically.

4.7 Post-Estimation Tests

4.7.1 Normality of the Residuals

The Doornik-Hansen test for multivariate normality (Doornik & Hansen 2008) is based on the skewness and kurtosis of multivariate data that is transformed to ensure independence. Its null hypothesis is that the underlying data is normal.

Table 4.7: Doornik-Hansen test

Doornik-Hansen test	
Chi-square(2)	12.538
	[0.0019]

From the results in table 4.7 the research study fails to reject the null hypothesis, and conclude the underlying data is normal.

4.7.2 Auto Correlation

Serial correlation tests re run in order to check for correlation of error terms across time periods. Serial/auto correlation is tested using the Breusch-Godfrey serial correlation LM test. The null hypothesis is that no first order serial /auto correlation existed. The p value of 0.2086 indicates that the study does not reject the null hypothesis and concludes that serial correlation does not exist. These results are presented in Table 4.8.

Table 4.8: Test for Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.434802	Probability	0.2086
Obs*R-squared	6.742147	Probability	0.1381

4.7.3 Heteroscedasticity of Residuals

Ordinary least squares (OLS) assumption stipulates that the residuals should have a constant variance (i.e. they should be Homoscedastic). This study used the ARCH LM test to test for heteroscedasticity. The Autoregressive Conditional Heteroscedasticity test is the condition that one or more data points in a series for which the variance of the current error term is a function of the actual sizes of the previous time periods' error terms: often the variance is related to the squares of the previous innovations. Its null hypothesis that there is no ARCH, while the alternative hypothesis is that is that, in the presence of ARCH components, at least one of the estimated coefficients must be significant.

Table 4.9 shows the results of the ARCH test.

Table 4.9: Test for ARCH

Test for ARCH of order 1

Equation 1:

	Coefficient	Std. Error	t-ratio	p-value
α(0)	0.00814021	0.00387677	2.100	0.0419 **
α(1)	0.288221	0.149843	1.923	0.0614 *

H_0: No ARCH effect is present

Test statistic: LM = 3.55911

with p-value = P(Chi-square(1) > 3.55911) = 0.0592196

From the test, this study refuses to reject the null and concludes that no ARCH effect is present and that the residuals are therefore homoscedastic.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of the findings of the study, conclusions; recommendations based on the study findings as well as suggested areas for further research.

5.1 Summary of Findings

Trend analysis shows that economic growth as measured by the real GDP for the period had been on an increasing trend with some fluctuations observed for the period 1983 to 2004 and sharp increase for the period 2005 to 2016. Further, the analysis shows that the total labour force in the country has been increasing with small declines for the period 1970 to 1984 as well as for the period 2002 to 2015. The level of secondary education gross enrollment ratio as a measure of education had been on an upward trend with small declines for the period 1970 to 2016. The analysis also reveals that there has been an upward trend in capital formation.

The study variables are found to be normally distributed as indicated by the Jarque-Bera probability values ($p>0.05$). Similarly, unit root tests indicate that the variables except labour force are non-stationary at level and became stationary at first differenceat 1%, 5% and 10% levels of significance for each case. The variables were also tested for the presence of Heteroscedasticity and the results indicated that the variables are Homoscedastic ($p>0.05$). Results for the test for serial correlation also indicate that the error terms across observations are uncorrelated ($p=0.2086$). Johansen cointegration test was conducted to check for cointegration among the variables. The Johansen results

indicate that there is no cointegration as indicated by the p values which are more than 0.05.

The first objective of the study is to establish the relationship between total health care expenditure and economic growth in Kenya. Based on the correlation analysis, healthcare expenditure is found to be positively correlated with real GDP (0.0541907) and the relationship between the two variables is significant (p=0.0000). This implies that there is a positive relationship between healthcare expenditure and economic growth in the country as measured by real GDP. Hence, an increase in the total healthcare expenditure in the country leads to an increase in the level of economic growth. Capital formation and labour force are also found to have a positive relationship with economic growth in the country.

The second objective of the study is to estimate the extent that total healthcare expenditure affects economic growth in Kenya. The results of the Ordinary Least Square Model indicated that d_HEALTHCAREEXPENDITURE is a significant variable in explaining d_LOGGDP given that the p value associated with the beta coefficient is less than 0.05 (beta coefficient= 0.054197; p-value=0.0002). Further, for every 1% increase in health care expenditure there is a 0.05567% increase in the output of the country.

The results also showed that d_LOGLABOURFORCE is a significant variable in explaining economic growth as measured by real Gross Domestic Product i.e. d_LOGGDP in the long run given that the p value associated with the beta coefficient is less than 0.05. The coefficient of d_LOGLABOURFORCE is 0.0900602 (p=0.0095). A 1% increase in labour force size therefore causes a 0.0900602% increase in the d_RGDP. The results further indicated that d_LOGCAPITALFORMATION is a

significant variable in explaining economic growth as measured by RGDP i.e. d_LOGGDP in the long run given that the p value associated with the beta coefficient is less than 0.05 (β=0.1212125, p=0.0008). A 1% increase in capital formation leads to a 0.1212125% increase in RGDP.

The findings of this study agree with that of Oni (2014) whom by employing a multiple regression technique based on a modified neo-classical Solow Model estimated the impact of health care expenditure on economic growth and found that 1 percent increase in the health expenditure led to about 71 percent increase in the real GDP.

The findings also support that of Abbasa and Foreman-Peck (2007) who used the co-integration technique to estimate the effect of human capital on the economic growth of Pakistan in the period 1961 to 2003 where health expenditure as a percentage of GDP was used as a proxy for human capital. They found an increasing return to physical and human capital specifically in the case of investing in health sector. This implied that healthcare expenditure not only affected the human capital but also the total labour force in the economy which influenced economic growth.

5.2 Conclusions

This study concludes that there is no cointegration among the variables in the long-run as shown by the Johansen cointegration test results. The results of the Ordinary Least Squares Model fitted to determine the relationships indicated that labour force, capital formation and healthcare expenditure were positively and significantly related to economic growth in the long run as measured by real Gross Domestic Product in billion US dollars i.e. d_LOGGDP. The study therefore concludes that healthcare expenditure, labour force and capital formation have significant effects on economic growth in

Kenya. As such, it is crucial for the government to increase the level of healthcare expenditure in the country which also influences the size of labour force and capital formation in the country.

5.3 Recommendations

This study recommends that the Kenyan government should consider increasing the amount of the total budget allocated to the health sector in order to improve accessibility and affordability of healthcare services to its citizens. There is also a need to commit adequate resources towards containing the spread of diseases such as HIV/AIDS and Malaria which are a big health burden.

This study also finds that it is necessary for the government to strive towards attaining the recommendations of the Abuja Declaration where it was agreed upon that 15% of the GDP of African Union countries is to be committed to the health sector. The government needs to device new ways of soliciting more funds from donors and other development partners to commit specifically to the health sector.

There is also a need to address the issue of corruption within the health sector to ensure that funds committed to the healthcare function are used for the betterment of healthcare services provided and not siphoned off.

Given that healthcare in Kenya has been described as a normal necessary good, policy makers should consider lobbying for healthcare to be included as a necessary benefit to all employees under PAYE income, and especially to civil servants individual incomes, as a separate regime from NHIF.

5.4 Limitations of the Study

Since the study was based on secondary data only, the accuracy of the results depended on the accuracy of the data collected as provided in the various data sources used.

5.5 Suggestions for Future Research

The study recommends that further investigation into the factors influencing the current healthcare expenditure be undertaken as well as an in-depth study on the link between human capital and healthcare expenditure should also be undertaken.

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Appendix 1: Multicollinearity Test

Covariance Analysis: Ordinary
Date: 11/24/16 Time: 18:19
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments
Balanced sample (listwise missing value deletion)

Correlation

Probability	LOG GDP	LOGLABOURFORCE	LOGCAPITAL	HEALTHCAREEXPENDITURE	EDUCATION
LOGGDP	1.000000				

LOGLABOURFORCE	0.753275	1.000000			
	0.0000	-----			
LOGCAPITAL	0.823451	0.673685	1.000000		
	0.0000	0.0000	-----		
HEALTHCAREEXPENDITURE	0.611028	0.476846	0.510927	1.000000	
	0.0000	0.0008	0.0003	-----	
EDUCATION	0.964911	0.735622	0.828439	0.678550	1.000000
	0.0000	0.0000	0.0000	0.0000	-----