EFFECTS OF HUMAN CAPITAL ACCUMULATION ON ECONOMIC GROWTH IN KENYA

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A RESEARCH DISERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE COURSE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE IN COMMERCE DEGREE (ECONOMICS AND INVESTMENT) IN THE SCHOOL OF BUSINESS KCA UNIVERSITY.

2017

DECLARATION

I declare that this dissertation is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this contains no material written or published by other people except where due reference is made, and author duly acknowledged.

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I do hereby confirm that I have examined the master's dissertation of **PAUL MOKI.** And have certified that all revisions that the dissertation panel and examiners recommended have been adequately addressed.

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ABSTRACTS

The importance of Human Capital accumulation for both social development and at individual level has been acknowledged in both developing and Developed Countries. Human Capital theorists have listed benefits ranging from indirect, invisible and non-quantifiable. Education enhances individual knowledge and skills for a higher productivity, better employment and more so getting higher salary and prestige. The Country's human capital in production process is a function of the Volume and quality of education administered at the Primary, secondary, college levels and government expenditure in the education system. As a result, the government's allocation of resources to education is of utmost importance in determining its human capital stock. This study posits that the four human capital accumulation factors, Specific Level Primary HCA, Specific Level Secondary HCA, Specific Level Tertiary HCA and Government Expenditure on Education all affect economic growth. The Government Expenditure on Education has been identified as propelling the highest impact on the GDP growth rate. Given this information, policy makers can therefore consider opportunities for enhanced budgetary allocations aimed at building Human capital that results in well skilled labor that propels economic activity and efficiency in the output, opening up opportunity for entrepreneurship and attracting investment in the Country.

KEY WORDS: Human Capital Accumulation, Economic Growth and Government Expenditure.

ACKNOWLEDGEMENT

Praise and Glory is to the Almighty God who guided and provided all the resources and means that contributed to the success of the study. I sincerely extend my gratitude to my Supervisor Dr. George K. Kosimbei for the devoted time he accorded me and working tirelessly to ensure that I have my final dissertation in time. I also extend my gratitude to the KCA University staff and fellow students for having accorded me a conducive environment to pursue my studies.

My special thanks go to my beloved wife Ruth Museng'ya, my children; Grace Mutheu, Gloria Mwende and Esther Ndanu for sincere encouragement and support.

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DEDICATION

I dedicate this work to my wife Ruth and Children; Grace, Gloria and Esther for their support, encouragement and contribution towards my education. You are just a great comfort to my life!!

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ABREVIATIONS

GDP	Gross Domestic Product
GER	Gross Enrolment Rates
HCA	Human Capital Accumulation
IMF	International Monetary Fund
KNBS	Kenya National Bureau of Statistics
MENA	Middle and North Africa
OECD	Organization for Economic Cooperation and Development
UNESCO	United Nations Educational Scientific and Cultural Organization

TERMS AND DEFINITIONS

Economic Development	Sustained, concerted actions of communities and policymakers that improve the standard of living and economic health of a specific locality, (Todaro 2011)
Human Capital Stock	The stock of knowledge, habits, social and personality attributes, including creativity, embodied in the ability to perform labor so as to produce economic value, (Becker 1963).
Gross Domestic product	An aggregate measure of production equal to the sum of the gross values added of all resident, institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs), (OECD, 2001)
Economic Growth	The increase in the inflation-adjusted market value of the goods and services produced by an economy over time (IMF, 2012)
Gross enrolment rates	The total enrolment within a country "in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group corresponding to this level of education, (UNESCO 2005).

CHAPTER ONE
INTRODUCTION

This Chapter is intended to look into background of the study, statement of the problem, objectives and research questions, significance and the scope of the study.

1.1 Background to the Study

Harbison (1973), referred to Human capital development or formation as a continuous and deliberate process of obtaining necessary knowledge, skills and experiences that are used to create economic value and driving sustainable development of a Country. Rastogi, (2002) defined human capital as 'knowledge, attitude, behavior and competency, inbuilt in an individual. Okojie, (2005), defined human capital to refer to the skills and abilities of human resources of a Nation and accumulation of human capital as the process of learning as well as increasing the number of personnel who have the education, experience and skills that are essential for economic development and growth of a country's economy. Ejere (2011) opined human capital as a human element in the production process; and comprises of combined competencies or skills, knowledge and abilities of the workforce. He further stated that, of all factors of production, only human beings have competence of learning, changing or adapting, in addition to being innovative and creative. The significance and relevance of human capital development in the achievement of meaningful and sustainable economic development and growth has been widely accepted in various studies.

Economic development is defined as sustained and furtherance of mutual course by policymakers and communities that enhance the economic health and standard of living of a specific locality (Todaro 2011). The definition by Todaro is wide and encompasses increase in living conditions, improvement of the citizens free and one's needs and belief and a just society. He alludes that economic development is accurately measured by Human Development Index

which takes into account life expectancy and the literacy rates which in turn has direct effect on productivity and may cause Economic Growth.

Human capital concept dates back to the classical school of thought in 1776, then a scientific theory, but its incorporation into economic analysis and research started receiving attention as a contributor in economic growth in 1950's, (Fitzsimons 1999). The concept further was given much attention when the application of evidence on economic research to concerns raised on economic growth and income distribution revealed major defects not only in our interpretation of each but also in our way of thinking about the distribution of income, (Fitzsimons, 1999). Human Capital Accumulation (HCA) refers to "the skills, knowledge, competences and other qualities embodied in individuals that are relevant to economic activity, (OECD 2001). The definition is broad since it is not confined to education, but it includes all investment in human that are made to enhance their skills and may include parental education, schooling, learning-by-doing and on the job training (acquiring skills through work experience) or other activities that help people put their skills to productive use, (OECD 2001).

Human capital formation is a necessity for a country's political and socio-economic transformation. Among the widely accepted causal factors capable of making impressive performance of economy in most of the developed and newly industrializing Nations is ensuring continuous commitment to development of human capital (Barro, 1991). According to World Bank, (1995), the absence of substantial investment in human capital development in any country, sustaining economic growth and development would only be a mere wish, never a reality. Adebayo and Oladeji (1996) observed that human resources are not just means but also, more critical, to the ends that must be served to achieve economic progress and therefore a critical variable that deserves development in order to accelerate the process of economic

growth. They further argued that, the wealth and prosperity of countries depend on development of people and their full commitment and determination to apply their energies and talents.

Many studies have been conducted to explain the influence of Human Capital Accumulation (HCA) on economic growth. However, the findings have not been convincing enough to link HCA to Economic Growth hence pointing towards continuing need for further research on this area of study. The motivation for increased efforts to attract more enrollment in education has been geared towards creation of stock of human capital due to general belief that HCA has several positive effects which includes, technology transfers, skills in management, technical know-how in domestic market and international production networks, introduction of new procedures and processes, employee training, access to markets and productivity gains, (Alfaro & Chanda, 2002). This calls for a clear understanding of HCA phenomenon to provide a platform against which its effect on sustained economic growth can be evaluated.

Based on the discussion above, Human capital has a critical role in economic growth and poverty reduction. From a macroeconomic perspective, it facilitates technological innovations, improves labour productivity; increases returns on capital, and makes growth more sustainable, hence resulting to poverty reduction. At a microeconomic view, education enhances possibilities of being employed hence increasing earnings, (Romer, 1986). In respect to the above, Human Capital which is acquired through education system makes people to have the ability and efficiency in transforming capital, raw materials into finished goods and services, (Psacharopoulos & Patrinos 2004). Enhancement of human capital is critical for development of its intrinsic value as a development objective in its own right, not only because of its instrumental value but as a catalyst of economic development due to its skills in coordination of other factors of production without itself being consumed. Furthermore, it has been emphasized

that the key differences in the levels of socio-economic development among countries can be attributed greatly not very much to endowments of natural resources and physical capital stock but purely to the quantity and quality human resources (Dauda, 2010). Shaari and Sankay, (2010) opined human beings as the key element of modernization, for they alone, can build political, social organizations, mine natural resources and accumulate capital.

Despite the concept of human capital being clearly defined, its measurement is difficult for it is not practical to observe individual skills, and also harder to formulate a metric that is comparable across individuals and countries hence resulting to several proxy measures of human capital in the empirical literature. Some of these proxy measures include; output approach which refers to school enrollment rates, scholastic attainments, adult literacy, and average years of schooling, (Barro & Lee, 1993); Cost approach, which refers to total costs incurred for one to obtain knowledge, (Jorgenson & Fraumeni 1989) and finally Income approach which is closely connected to benefits accruing to individuals as a result of each individual's attainment of education and training investment, (Mulligan & Sala-i-Martin 1995). While literacy rate is an important measure of proportion of the population who can read and write, it fails to explain how skilled level of the workforce or education attainment can be measured. This study will thus adopt the output approach and specifically the Gross enrollment rate as a measure of human capital because it can measure the entire workforce and it can be comparable across countries, (OECD 2001). HCA depreciate, just like physical capital, as people forget what they have learned, and also certain abilities deteriorate with age or become obsolete, (Conrad, 2011). Even though this method measures the existence of human capital depreciation directly, it fails to indicate whether the skills obsolescence negatively affects a worker's probability to remain employed or productivity in the job (Allen J. & A. De Grip 2004). This study will not factor in

the depreciation of human capital and also the study will not include the effect of brain drain on human capital accumulation which also leads to depreciation of human capital stock because of limitation of failing to measure the negative effect on worker's productivity and it is not comparable across countries.

Gupta (1987) observed that gender disparities in South Asia are higher among females than males due to gender discrimination. Some of the discriminations were noted in the study as a result of preference of educating sons against daughters in Punjab despite the region's relative prosperity. Further, gender disparities were caused by various intertwined reasons ranging from cultural beliefs, discrimination, economic conditions as well as biological differences, (Gupta 1987). However, this study will not attempt to include human capital on gender lines because research will revolve on the ideal of "sameness" that assumes gender equality as a matter of achieving equal treatment and equal opportunities (Walby (2005). This implies that each gender has equal role to play in contributing to economic growth in Kenya.

This study identifies Gross Domestic Product (GDP) as an appropriate measure of economic growth against which the effect of HCA will be measured. When the GDP of an economy increases in reference to the previous period (usually one year), the economists refer to this position as economic growth. The word "economic development," on the other hand, means much more. It refers to enhancement of several pointers among them, literacy rates, poverty indices, and life expectancy among others, (Todaro 2011). GDP as an instrument of measuring Economic development ignores key aspects such as social justice or freedom, quality of environment and Leisure time. Since GDP is not a sufficient definition of Economic development, the study will strictly address the changes in HCA vis-à-vis the changes in Economic Growth as measured by the GDP.

1.1.1 Education in Kenya

Before the coming of the Europeans, societies in Africa had lined up traditional systems of education whose prime goal was to train and nurture individuals to fit into their societies as useful members. This type of education provided knowledge and skills which was treated as a socializing agent and effectively transmitting cultural values from one generation to another. In this respect, the society has been keen in trying to improve the level of education hence appreciating the impact of education in an economy and its contribution to Economic growth. Kenya on attaining independence prioritized education as a critical factor to economic growth following a huge shortage of human capital at independence. A great emphasis on education was borrowed from a successful Conference of African States on "Development of Education in Africa" in 1961 at Addis Ababa organized by United Nations Educational Scientific and Cultural Organization (UNESCO), UNESCO (1961). Several commissions were formed in an endeavor to achieve a robust economic growth among them; The Ominde commission (1964) which recommended a system of education suitable for the need of the Kenyan requirement for take-off from colonial government. The Gachathi Report, GoK (1976) formed to address the weaknesses of the Ominde commission among them being lack of capacity and flexibility to respond to the changing aspirations of the government, labour market needs, and individual Kenyans in terms of new technologies, new skill and the attitude towards work, (Owino 1997). Mackay report, GoK (1982) made a recommendation to change the system of education from 2-7-4-2-3 to 8-4-4 which was seen by many to have the necessary content to promote widespread sustainable (self) employment in an effort to address the weaknesses in the Ominde commission and observations made by the Gachati report.

Despite high growth in enrolment and Government expenditure, the Kenya government has continued to place more emphasis in education so that it can achieve a GDP growth rate of 10% as its projection in the Vision 2030. Among the key areas the government has been prioritizing in order to attain the desired goal is the Human Capital Accumulation (HCA). This has been evidenced by the way the government has constantly been giving education a priority through its yearly budget by the fact that the National budget allocation on education has been receiving more funds in comparison with other Ministries. In 2015/2016 budget, ksh 154 billion (12.63%) was allocated to Education, the second highest after Ministry of Transport and Infrastructure which was allocated kshs 298 Billion (24.45%) mainly due to ongoing construction of Roads and Standard Gauge Railway (SGR). With Kenyans appreciating the value of education, more universities have been opened with each university opening satellite campuses in all major towns in order to make every Kenyan in need of education to enroll with little inconvenience. Currently there is legislation in force requiring some elective positions such as Gubernatorial and Presidency to be occupied by people with University education and also some organizations have made policies defining the education level of occupants of particular positions with majority attracting University graduates.

1.1.2 Government Expenditure on education

Government Expenditure relate to any expenditure made by national, regional and local governments and such spending is in the form of future acquisitions, investments, and transfer payments (Landau, 1985). Future investments are long term in nature and determine the future of a country's economic performance and may encompass investment in railways, airports, roads and Medical research among others. Mitchel, (2005) affirmed the findings of Keynes, (1953) that government expenditure acts as an effective tool to stimulate aggregate demand and

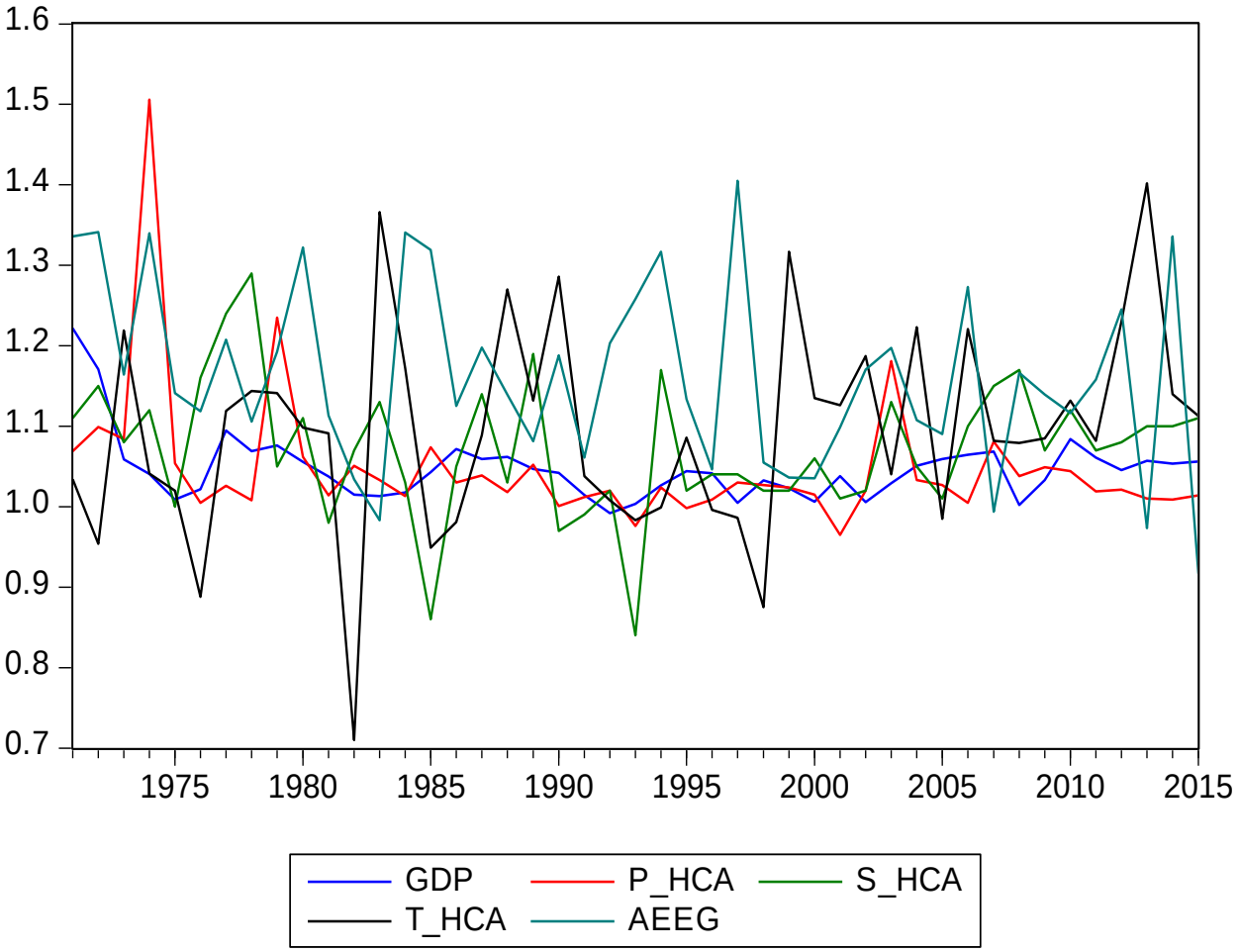
consumption, and in turn leads to higher production and faster recovery for an economy from recessions and bring about crowded impacts on private sector. Acquisitions also referred to as general government spending may include military procurements, government salaries, education expenditure, importation of goods, among others (Mitchel, 2005). Classical economists, on the other hand, posit that increased government spending accelerates an economic contraction by shifting resources from the productive private sector to the unproductive public sector (Gorodnichenko, 2010).

Government expenditure plays a key role in running efficiently the country's economy. The government spending is highly appreciated from a fact that some goods or services cannot be provided by free market economy and where such goods or services are provided, may be of sub-standard quality or insufficient to meet the demand. Such goods or service are aimed at aiding the less-privileged in society in ensuring that they are able to receive their basic needs among them education, health, defense, policing, transport infrastructure, pollution controls among others (M'Amanja & Morrisey, 2005). Kenya's reforms in the education sector among them the introduction of free primary education in 2002 and free secondary education in 2008 has catalyst government expenditure in education. The expenditure on education will continue to increase as the number of enrolment in both primary and secondary schools continue to increase, (Olorunfemi, 2008).

The government expenditure may be measured in three ways namely; government gross investment and consumption expenditures which entails measuring government expenditure on services and goods that are incorporated in the Gross Domestic Product (Brunner, 1992), government current expenditures which measures amounts spent by the government on current period activities (Gorodnichenko, 2010) and total government expenditures (Rebelo, 2011). This

study will use total government expenditure and specifically the total expenditure on education which is part of the variable of interest.

Figure 1: Economic Growth, Specific Human Capital Enrolment, Government Expenditure on Education.



Source: Authors' compilations from World Bank, and various publications, Statistical abstracts, Economic Survey both available at Kenya Bureau of Statistics and also at Ministry of Finance Library.

The trends in Figure 1 show that growth rate in enrolment in Primary, Secondary, Tertiary education and government expenditure is higher in comparison to the growth rate in real GDP. The trend displayed is that economic growth is not matching the rate at which HCA and

government expenditure is growing hence calling for investigative questions as to whether HCA and government expenditure in Kenya provides the right skills/ technology and quality expenditure respectively to inject into the economy to achieve the desired growth.

1.2 Statement of the Problem

Kenya has continuously been investing heavily on education by providing free primary education hence triggering increase in basic school enrollment which has also created a multiplier effect on higher education enrollment (Avenstrup et al., 2004). However, despite the increase in enrollment and hence increase in HCA and government expenditure, Kenya's economic growth rate has not been commensurate with the rate at which human capital has been growing as stated in the previous section.

Going by the findings of the studies so far done, it is not possible to have a generalized position on the exact influence that HCA has on economic growth. This is because these studies among them; Ballot et al. (2001) on impact of human capital on Swedish and French firms, Papalexandris and Nikandrou (2000) on effect of Human Resource management on Greek firms, Lee (2010), using data conducted on 75 countries, explore the effects of education on economic growth, were done in different countries under different economic and political stages. In addition, most studies do not put into consideration stage of economic development which varies even for the various developing countries, (Risikat, 2009).

In Kenya, the empirical studies on the linkages between economic growth and human capital have been mostly cross sectional and include developed and developing economies (Oladoyin 2010). Among the cross-sectional studies featuring Kenya were that of Judson R (1998), who applied expenditure on labour force as measure of Human capital and observed that Human capital has impact on Economic growth. Jones G. and Schneider W. J (2006) by applying Intelligence Quotient (IQ) as a measure of Human capital affirmed the findings Judson R (1998).

However, there are some studies which though not focusing solely on the relationship between economic growth and Human Capital, have used education as one of the variables of interest in their studies. Otieno, (2016) used average expenditure on education per person for employed people as a measure of Human capital and opined that expenditure on education affects economic growth.

Many other contextual studies have been carried out to examine various components of economic growth. Similarly, several empirical studies have examined the relationship between Human capital and government expenditure and economic growth in Kenya. However, none of these studies has explored the relationship between specific Levels of Education and government expenditure on education on economic growth. Therefore, the main research question that the study seeks to address is: what is the effect of specific Levels of Education and government expenditure on education on economic growth in Kenya?

1.3 Objectives of the Study

In view of the foregoing belief, this study seeks to establish any relationship between economic growth and the HCA. Against this understanding the objectives of this study can therefore be stated as follows:

i. To determine the effect of Specific Level Primary HCA on economic growth in Kenya.
ii. To establish the effect of Specific Level Secondary HCA on economic growth in Kenya.
iii. To determine the effect of Specific Level Tertiary HCA on economic growth in Kenya.
iv. To establish the effect of Government Expenditure on Education on economic growth in Kenya.

1.4 Research Questions

i. Does Specific Level Primary HCA affect economic growth in Kenya?

ii. Does Specific Level Secondary HCA affect economic growth in Kenya?

iii. Does Specific Level Tertiary HCA affect economic growth in Kenya?

iv. Does Government Expenditure on Education affect economic growth in Kenya?

1.5 Significance of the Study

This study is beneficial in a number of ways to different interest groups;

1.5.1 Policy Makers

The Ministry of education may use the findings of this study to formulate HCA policies in particular regarding regulation on HCA stock in line with the changing demand of education in different sectors in the economy. The study may in addition support at a policy level, the design of an incentive scheme aimed at attracting citizens to invest in HCA.

1.5.2 Local and International Investors

Local and International Investors may use the findings of this study to strategically position themselves in determining the level of HCA necessary for the growth in production and mitigation of any future business risk.

1.5.3 Scholars

The findings will offer a reference material to Kenyan researchers wishing to study the effect of HCA on economic growth in Kenya. At an international level it may also add to the body of knowledge that has been put forward on HCA as a reference material in establishing generalizations for the future.

1.5.4 Donor Community

The findings will offer a reference to the donor community involved in financing education and other informal training to the local community.

1.6 The Scope of the Study

The objective of this study is to critically evaluate the effect or impact of human capital development on economic growth in Kenya, using annual data. This study will cover the Kenyan economy over a period of 45 years from 1971 to 2015. It is foreseeable that there may be a difficulty in obtaining the requisite data on Specific Levels of HCA and Government expenditure on education in Kenya over the last Five decades. This therefore justifies the choice of 45 years as an appropriate period for this study. It is also worth noting that the economic indicators being analyzed in this study, GDP, HCA (HCA Primary, HCA Secondary, and Tertiary HCA) and Government Expenditure on Education are also influenced by several other factors which are not the subject of this study. The modeling of the problem will therefore take care of any possible omitted variable bias in the data analysis. For instance, the changing political environment, general global economic trends have all been held constant for purposes of modeling in this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This part gives a summary account of the studies previously done on the effect of HCA on economic growth. The first part will give a general overview of the theoretical literature on HCA without a sharp focus on its effects on the economy. The second part looks at the specific empirical studies that have sought to explain any relationship between HCA and economic growth and concludes with a summary of how the studies were conducted and the findings in each case.

2.1.0 Theoretical Literature

The present chapter explains the motivation behind Human Capital Accumulation as it is manifested in various theories. It attempts to give a theoretical justification for Governments and Individuals to make decision to engage in HCA investments.

2.1.1 Human Capital Theory

Spring (1998) traces the beginning of HC theory back to the 19th century when many of the United States were convinced that the corporate model of education would provide external efficiency in relation to labour market, and in addition ensure equal opportunity. Human capital theory suggests that individuals and society derives economic advantages from investments in people, (Scott R. S. 1996). The general idea of human capital, or "hard core" of the human capital research program, is the notion that people expend on themselves in different ways, not for the purpose of present enjoyments, but for the purpose of future non-pecuniary and pecuniary returns (Mark, 1976). He mentions some of the diverse ways of expenditure to include expenditure in health, education, job search, information retrieval, migration, and in-service

training that may be regarded as investment rather than consumption, whether under-taken by society on behalf of its members or by individuals on their own behalf. The determinant of what knits these phenomena together is not the question of who undertakes what, but rather the fact that the decision maker, whoever he is, looks forward to the future for the justification of his present actions, (Mark, 1976).

The Human capital (HC) has been included in the growth theory that captures the endogenous substitution of physical capital with that of human capital as the best substitute factor for growth in transition from Industrial Revolution to modem growth. Abramovitz (1993) argued that technological progress in the nineteenth century was heavily biased towards physical capital and it was only until the twentieth century, when the physical capital bias weakened, and the shift was towards intangible (human and knowledge) capital. According to Moav and Galor (2003), the adoption of human capital development to replace physical capital changed the qualitative effect of inequality on development process. Physical capital accumulation during Industrial Revolution was seen as the key player and as a source of economic growth hence creating inequality in development process by channeling resources to individuals with high marginal propensity to save (Moav & Galor 2003).

2.1.2 The Ben-Porath Model Theory

The pattern of human capital investment advocated by Ben-Porath (1967) is one of high investment at the start of an individual's life followed by lower investments later on. The original Ben-Porath model involved the use of other inputs in the production of human capital and finite horizons, binds early on in the life of the individual, and the interval during which it can be construed as full-time schooling. After full-time schooling, the individual starts working while at the same time continues to accumulate human capital which can be construed as spending time

in training programs or allocating some of his time on the job to learning rather than production. The effect of Ben-Porath model is twofold. First, it stresses that schooling is not the only way in which individuals can invest in human capital and there is continuity between schooling investments and other investments in human capital. Second, it suggests that in societies where schooling investments are high we may also expect higher levels of on-the-job investments in human capital, Neal and Rosen (2000). The model introduces a useful way of reasoning about the lifecycle of an individual, which starts with higher investments in schooling, and then there is a period of "full-time" work but this is still accompanied by investment in human capital hence increasing earnings. The increase in earnings takes place at a slow pace as the individual ages. The increase in earnings by individuals result to increased markets for services and goods produced in the economy by the individuals thus contributing to economic growth.

2.1.3 Theory of Public Expenditure Growth

This theory was invented by Musgrave on his research on changes in the income elasticity of demand for service provision by government in the three ranges of per capita income. He opined that at the lowest levels of per capita income, demand for service provision by government approaches its lowest level. This according to Musgrave, such earning is attached to fulfilling basic needs. He states that as per capita income rises above the minimum levels of low income, the demand for services supplied by public sector such as education, expenditure, transport and health starts to rise, hence making government to rise spending on them. He posit that at high levels of per capita income, commonly in developed economics, the growth rate in public sector tends to decline as the more basic needs are being satisfied (Musgrave, 1969)

Musgrave (1989) observed that as developing countries industrialize, the portion of public sector in national economy grows continually. The theory states that there is relationship

between economic growth and expansion of government activities; thus, resulting to government sector growing rapidly than the economy. Thus, all kinds of government regardless of their level of political status (war or Peaceful), and size, point to the same tendency of rising public spending. Thus, Musgrave's law affirms that, as per capita income of an economy grows, the proportionate size of public spending grows along with it. As the economy grows, it will trigger increase in number of urban centers and its associated social evils such as; crime, that requires government intervention, to reduce such activities to the lowest minimum. Large urban centers also require internal security, keep law and order. The government's intervention in provisions of service has cost implication, leading to rise in public expenditure in the economy.

This theory implies that growth in government capital outlay can translate into positive economic growth as well resulting to growth in recurrent government spending. However, growth in recurrent expenditure does not bring about significant growth in the economy. This also implies that the causal effect of economic growth on government capital spending is more significant when compared with government recurrent expenditure.

2.2 Empirical Literature Review

Various studies have been carried out to establish the relationship between Specific Levels of Human capital accumulation, Government Expenditure on economic growth. Different researchers have used different explanatory variables to establish this relationship.

2.2.1 Primary Education

Abbas and Peck (2008) examined how economic growth relates to human capital in Pakistan based on data collected between, 1960-2003. The results showed that human capital is positively associated to economic growth. Similar findings were also arrived at by Akram, et al. (2008). Johnson (2011) in his evaluation of Nigerian human capital formation and growth of

economy affirmed the findings of Abbas and Peck (2008) that human capital is positively associated to economic growth.

Petrakis and Stamatakis (2002) while using a cross-country regression with a relatively small sample size applied to three categories of states: Under-developed, developed and advanced. They observed that the correlation between education and growth vary with respect to a state's level of development. Thus, their findings revealed that Primary education is more important in less developed States, while higher or tertiary education is relevant in advanced States. Their results confirmed earlier similar findings obtained by Gemmel (1996) in his research on the three levels of education that for the three categories of human capital only primary and secondary schooling are most apparent on growth in developing Nations, while the effect of tertiary level being felt at Developed states. Mingat and Tan (1996) while using a sample of 113 Nations found that advanced education has a positive and statistically significant effect only in the category of developed Nations, whereas primary education has positive impact in under-developed and secondary education showing positive impact in developing. Zaman (2012), in a sample of 100 countries concluded that there is a weak relationship between human capital and economic growth. Tchalim, (2015), in assessing specific contribution of various education levels to economic growth for the period 1980-2012, found that only primary education has significant impact on growth of the economy.

In contrast, Quenum, V.C. (2011), analyzed the relationship between HC and economic growth using data collected from West African Economic and Monetary Union (WAEMU) countries and found that human capital has a significant negative effect on economic growth. Amassoma and Nwosa, (2011) in their study on the causal link between Investment in human

capital and growth of Nigeria's economy to uphold development in Africa at large between 1970 and 2009, found causality between development of human capital and economic growth.

2.2.2 Secondary Education

Abbas (2001), based on data from two countries, Sri Lanka and Pakistan, he opined that primary level has a negative influence on economic growth, whereas secondary and advanced education showed a positive and statistically significant influence on economic growth in both States. Benhabib, Spiegel & Papageorgiou (2003), in applying cross-country regression they found that primary education is a key contributor mainly to the production of final output, whereas tertiary education contributes to the innovation and adoption of technology. Gyimah, Paddison and Mitiku (2006) in their research on the three levels of education concluded that all levels of education have a positive and statistically significant effect on the growth of per-capita income in African Nations. Lee (2010) in a data conducted on 75 countries from the period between 1960-2000 on population aged 15 years and above in 1960 observed that education helps to accelerate growth in a cross-section of economies.

Lin (2006) in a case of Taiwan affirmed the findings of Gyimah, et al. (2006) that primary, secondary and tertiary, have a positive influence on economic growth. Pereira and Aubyn, (2009) in a study of a single country, Portugal, concluded that both primary and secondary education have a positive influence on GDP, whereas higher education has a small negative effect. Loening, Bhaskara & Singh (2010), in a study of specific HCA levels on a case of Guatemala, affirmed that primary education is more critical when compared to secondary and tertiary education. Shaihani, et al. (2011) in case study of Malaysia growth found that secondary education has a positive and statistically significant coefficient in the short run, while the primary and tertiary exhibit negative and statistically significant results. Asteriou and

Agiomirgianakis (2001) while applying Lucas (1988) model on data from period 1960-1994 found that the increase in enrolment rates in primary, secondary and higher education positively impacted the GDP in Greece. Villa (2005) in his study on the influence of the three levels of education on growth for a single country, Italy, results indicated that higher and secondary education both have a positive influence on economic growth, with primary showing no significant impact. Adawo (2011) in evaluating the contributions of specific levels of education to economic growth in Nigeria found that Primary education had positive effects on growth while both Secondary and tertiary education were found to dampen growth.

2.2.3 Tertiary Education

Blechinger and Pfeiffer (1998) using survey data for the German manufacturing sector to explore the links between employment growth, technological change and labour force skill structures found that innovative firms experienced the highest growth rates and such firms tended to employ more and highly skilled workers. Papalexandris and Nikandrou (2000) in a study of Human Resource management on Greek firms found that, where training was treated as a continuous lifelong learning process, it had considerable effect on the growth of firms, while Chi (2008) in a study based on China, opined that higher education has a positive and larger effect on GDP growth than primary and secondary education. Zhang and Zhuang (2011), examined China's economic growth based on composition of human capital and established that higher education plays a more important role than primary and secondary. Their findings also stressed that the composition of human capital is important on regional economic growth hence relevant to the level of development, and concluded that the more the provinces are developed, the more the provinces benefit from tertiary education as compared to less-developed ones who heavily rely on primary and secondary.

In a study on the effect of the three levels of education on growth and using a sample of Asian countries, it was opined that primary and secondary level have a significantly positive effect on economic growth, while tertiary education returning negative effect, (Mc Mahon, 1998). Jorgenson et.al (2003) in a study on the catalyst of growth of United States economy for a period between 1977-2000, discovered that economic growth for the US was dominated by investment in advanced education and information technology.

However, despite the positive contribution to economic growth, there is also evidence to the effect that the link between HC and growth is causal. Bils & Klenow (2000) established that reverse causation running from higher economic growth to additional education is as equally important as the causal effect of education on growth across-countries. Kui (2006), using annual data for China from 1978 to 2004 established that economic growth was the cause of higher education. Chaudhary, Iqbal & Gillani, (2009), examined the relationship between higher education and economic growth in Pakistan for the period 1972 to 2005. The results obtained revealed unidirectional causality creeping from economic growth to higher education. Mohsen M, (2013), examined causal relationship between education and growth in a data involving 11 oil exporting countries for the period 1970-2010. The results indicated that there is strong causality from economic growth and oil revenues to education in the oil exporting countries in both short and long run.

2.2.4 Government Expenditure on education

Donald and Shuanglin (1993) studied the differential effects of different levels of expenditure on economic growth for 58 sampled countries. They observed that government expenditure on education and defense had positive effect on economic growth and that of welfare was insignificant and negative. Blankenau, Simpson and Tomlijanovich (2004) applying data

from 1960 to 2000 obtained from 23 countries sought to justify that education expenditures are key to sustaining growth. They analysed the relationship between expenditures, taxation, and growth. Their findings showed that the relationship exists between public expenditure and economic growth for Advanced Nations.

In a study of growth and human capital in Nigeria and applying industrial production as the dependent variable and using independent variables as total expenditure on health and total expenditure on education, the results showed that that percentage change in total expenditure on education increased industrial production by 6.892% in the long run, (Oleyami 2012). The test in the long run confirmed that the government expenditure on education sustained a long run and positive correlation with industrial production. The findings affirms the priori expectation of being positive confirming that positive changes (increase) in expenditure on education result to increase in industrial productivity and by extension stimulates economic growth. The findings affirmed earlier similar findings by Babatunde and Adefani (2005) and Adamu (2002).

Hussin, Muhammad and Razak (2012) applying Vector Auto Regression (VAR) technique on time series data from 1970- 2010 found out that economic growth cointegrated with government expenditure on education, fixed capital formation, labour force participation and labour in Malaysian. The findings affirmed that government expenditure on education, capital and work force participation to a greater extent affect long run economic growth. Moomaw et al. (2002). Bensi et al. (2004) in their research on the effect of Government expenditure on education concluded that educational expenditures have positive relationship with per capita income contrary to Jones' (1990) works on data obtained from 1969 to 1974 that showed educational spending has a significant negative association with change in per capita income. Wanjala and Belassi (2004) examined the impact on government spending on education on real

GDP in Uganda while applying time series techniques from data obtained for the years 1965 to 1999. They observed that average expenditure on education per worker is positively correlated with economic growth. The Likelihood test of their model revealed that education expenditures had weakly exogenous leading to a conclusion that education expenditure drive economic growth in Uganda.

Kalio (2000) examined the effect of different components of government expenditures on GDP growth using OLS method for a sample of data obtained from 1970-1992 on Kenya. The study concluded that government expenditure on education, defense, and agriculture had a positive effect on GDP growth and that of health and transport and communication were negatively related to economic growth. Oluwatobi and Ogunrinola (2011) in their study on the relationship between economic growth and human capital development in Nigeria concluded that government recurrent expenditure on health, capital expenditure on education had influence on economic growth.

2.3 Literature Gap

The first portion of the literature review highlighted basic theories that were used to support the effects of Human Capital Accumulation and public expenditure on Education on growth of the economy. The researcher discussed three theories; the Human Capital Theory, The Ben-Porath Model and Musgrave theory of public expenditure growth. From these theories, we have different views of the effect of Human Capital and public expenditure on education on growth. According to Human capital theory, individuals and society derives economic advantages from investments in people. According to Ben-Porath's view, where investment in schooling is high, Societies anticipate more of on-the-job investments in human capital. Musgrave's theory posit that at high levels of per capita income, commonly in developed

economics, the growth rate in public sector tends to decline as the more basic needs are being satisfied.

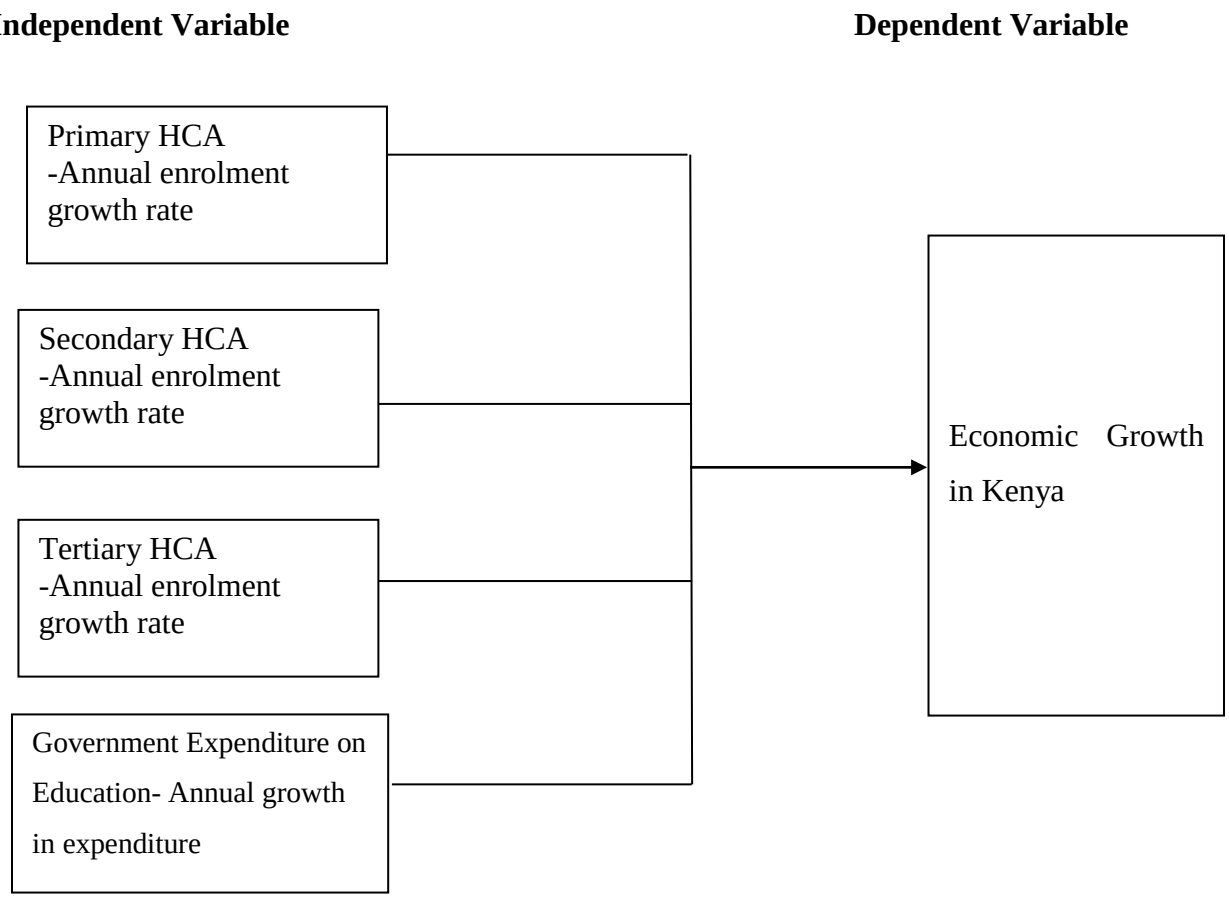
From the empirical literature reviewed, various findings have also contradicted each other. Some of them relate economic growth increase to government's expenditure on education and specific Levels of Human Capital and while others attribute negative economic growth to government's expenditure on education and specific Levels of Human Capital as well. Other findings as well attribute growth in government's expenditure on education and specific Levels of Human Capital to economic growth. It is worth noting that the differences in the outcome of these findings could be as a result of the different exploratory variables used in different combinations and different contexts. But what remains for sure is that government's expenditure on education and specific Levels of Human Capital has a great impact on the economic growth of a country.

As revealed from the literature reviewed, different exploratory variables lead to different outcomes in the study of economic growth and specific Levels of Human Capital and government expenditure on education. All these studies were done in different contexts. However, none of those reviewed was based on Kenyan context as most of similar studies done in Kenya are not documented and therefore not traceable. These studies hardly gave policy recommendations and implications. A study on economic growth and specific Levels of Human Capital and government expenditure on education becomes even more useful when the researcher provides policy recommendations at the end of the study.

2.4 Conceptual Framework

The specific objectives are represented below in abstract form in Figure 2. The figure shows the relationship between the independent variables (Primary HCA, Secondary HCA, Tertiary HCA and Government Expenditure) and the dependent variable Economic Growth.

Figure 2: Conceptual framework



2.5 Operationalization of Variables

Table 1: Summary of The Model Variables and Their Descriptions

Variable name	Measure	Data source and period
Economic Growth (dependent variable)	Average annual growth rate of real GDP per capita	Statistical Abstracts, Economic Survey of Kenya from Kenya Bureau of Statistics and world bank,1971-2015
GEXP rate (Independent variable)	Growth rate of the Annual expenditure on Education	Statistical Abstracts and Economic Survey of Kenya from Kenya Bureau of Statistics, 1971-2015.
HCA Primary (Independent variable)	Growth rate of the primary school Enrollment	Statistical Abstracts and Economic Survey of Kenya, 1971-2015.
HCA Secondary (Independent variable)	Growth rate of secondary school Enrollment	Statistical Abstracts and Economic Survey of Kenya, 1971-2015.
HCA Tertiary (Independent variable)	Growth rate of tertiary Enrollment	Statistical Abstracts and Economic Survey of Kenya, 1971-2015.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Research Methodology is the systematic, theoretical analysis of the procedures applied to a field of study (Kothari 2004). This chapter will give a brief description of the methodology used in analyzing the data. It will state the Research design, Population, data type and source, Data analysis, Time series properties and Estimation techniques.

3.2 Research Design

A research design provides a structure of investigation and a blueprint of data collection, measures and analysis. It ensures that the research results are reliable, valid and credible. This study adopted a causal research design to determining the effect of specific levels of Human Capital accumulation and Government Expenditure on Economic growth in Kenya. The study adopted the design since the research seeks to determine whether specific levels of Human Capital accumulation and Government Expenditure affect economic growth. Time series secondary data for the variables and the lagging macroeconomic variables are used.

Time series secondary data for the human capital accumulation and the economic growth rate are used.

3.3 Population

Population is an aggregate or totality of all the objects, subjects or members that conform to a set of specifications (Polit & Hungler 1999). The population for this study shall be data on Human Capital accumulation on each specific level of education (Primary, Secondary and Tertiary), Government expenditure on education and GDP from the period 1971-2015.

3.4 Data Type and Source

Independent variables for the analysis were annual primary school enrolment growth rate, secondary school enrollment growth rate, tertiary institutions enrolment growth rate and annual education expenditure growth rate. The dependent variable on the other hand was the country's economic growth rate.

This study has relied on secondary data obtained from the following sources; (i) World Bank Reports (1971-2015), (ii) Economic Survey of Kenya, and (iii) Statistical Abstracts both published by the Central Bureau of Statistics. Data on Economic Growth was obtained from World Bank. Data on the Specific Level enrollment (primary, Secondary and Tertiary) was obtained from The Economic Survey of Kenya at The Ministry of Finance library. Data on Government expenditure was obtained from statistical Abstracts available at the Kenya Bureau of Statistics and also at The Ministry of Finance library. The set of data on the variables that have been studied are assembled in a Check List in Appendix A.

3.5 Data analysis

Time series analysis was employed for the study to explain the nature of the relationship between the variables. To test for stationarity of the data, Augmented Dickey Fuller Test (ADF), Phillip Peron's test and correlograms were employed. To test for long run equilibrium among the variables, Cointegration test was undertaken. Cointegration separates short and long-term relationship among variables and helps determine the number of cointergrating vectors. Impulse response Vector Auto-Regression (VAR) was employed to generate the impulse response functions that were used to establish the effects of lagging macroeconomic variables on GDP growth. Variance decomposition analysis is then used to explain the proportion of the variance in the GDP growth as a result of its own shock and shocks of the other variables. The method

allocates weights to each identified shock in the equation at every time period for a particular variable (Odour, 2008).

Eviews software is used in the analysis and generation of results. Tables and graphs are used to present the results of the analysis.

3.6 Time Series Properties

Time series analysis is crucial in empirical modeling of the relationship between the macroeconomic variables and the stock market return. The non-random behavior of the time series data could undermine the usefulness of the standard econometrics methods if it was applied directly without considering time series properties of the data (Russel & Mackinon, 1993; Gujarati, 1995). Stationarity tests, Cointegration tests and error correction mechanism are therefore carried out.

3.6.1 Stationary Tests

Being time series data, there was need to test for stationarity. Stationary series have finite variance, transitory innovations from the mean and a tendency to return to its mean value as opposed to non-stationary series (Gujarati & Porter, 1999). Thus, there was need to ensure that the variables to be estimated had their means and variances as constants independent of time. This is the case with stationary series. If OLS is used to estimate the relationships of variables of a non-stationary series, there is the likelihood to have misleading inferences which appear either as spurious regressions or inconsistent regression problems. Conventional tests of hypothesis based on statistics computed from such variables are likely to be biased towards rejecting the null hypothesis even when it should in reality be accepted.

Augmented Dickey Fuller unit and Philip Perrons root tests were used to test for stationarity. These are the most efficient and simplest test for stationarity. These tests take into account the possible autocorrelation in the error process.

The left-hand side variables are lagged (ΔXt) as additional explanatory variables so as to approximate the autocorrelation (augmentation). This improves the statistical fit of the equation and r is more efficient with added information. The basic equation used in the PP test remains the same as the one used in the ADF test. ADF is expressed in the form of

$\Delta X_t = \mu + rX_{t-1} + \partial T + \Sigma^{k}_{i=L} r_i \Delta X_{t-i} + \varepsilon_t$ …………………………………………… (3.1)

The number of lags (K) for ΔX_{t-1}should be relatively small to save the degrees of freedom, but large enough to allow the existence of autocorrelation in the error term. The hypotheses are:

H0: Variables are not stationary

H1: Variables are stationary

Whereby, the rejection of H_0 for the alternative hypotheses indicates stationarity of the variables. There is also danger of over differencing in the ADF and care needs to be exercised.

3.6.2 Co-Integration and error correction mechanism

Trends whether stochastic or deterministic result into spurious regression results, un-interpretable t-values and other statistics have too high goodness of fit which make results difficult to evaluate. The remedy will be to stationarise the data by differencing. Differencing, however, leads to loss of long run properties as the model in difference has no long run solution. This will be remedied by measuring variables in the level form while maintaining stationarity with short run (impact effect) and long run properties simultaneously incorporated by the use of the error correction mechanism (ECM) or feedback mechanism in the Cointergration analysis.

Cointergration solves the problem associated with the loss of information associated with detrending or by the attempts to address the stationarity through differencing as in the growth rate models such as used by (Odedokun, 1993). It rejects spurious regression results but at the same time accepts correlation between non-stationary series where correlation is structural rather than spurious. This Cointergration analysis was developed by among others Granger, (1986) and Engle & Granger, (1987). Non-stationary variables are said to be cointergrated if they have a long run relationship amongst themselves in which deviations from their long run path are stationary that is two or more variables could be non-stationary but have their differences (or their linear combination) stationary. By definition, therefore variables are said to be cointergrated if a linear combination of these variables assumed lower order of Cointergration. The variables are themselves non-stationary but must be of the same order of integration individually. It is their linear combination which is integrated of a lower order. Where Cointergration is rejected, then there will be no long run relationship between the non-stationary series and thus there will be no information in α coefficient in equation 3.2 below. Imposition of ECM, will be rejected by the data and the solution will be to specify the model in another form in which no long run relationship appears.

If $Y_t \sim I(a)$ and $X_t \sim I(b)$ and their linear combination is
$\varepsilon_t = Y_t - \alpha X_t I(a-b)$ then Y_t and X_t are cointegrated. This can be specified as;

$$Y_t = \alpha X_t + \varepsilon_t \quad \text{..... (3.2)}$$

Where

Y_t is the regress and X_t is the regressor, α is the parameter to be estimated and ε is the mean-zero error term.

If Y_t and X_t are non-stationary but their differences (ΔY_t *and* ΔX_t) are stationary, then only the short run effect will be captured by running a regression on the following equation.

$\Delta Y_t = \alpha \Delta X_t + \varepsilon_t$…… (3.3)

But if in (3.2), $Y_t - \alpha X_t$ is stationary, then their lag ($Y_{t-1} - \alpha X_{t-1}$) can be augmented into (3.4) as an explanatory variable such that we have an ECM_t represented by

$\Delta Y = \alpha \Delta X_t + ø\ (Y_{t-1} - \alpha\ X_{t-1}) + \varepsilon_t$ …… (3.4)

Equation (3.4) simultaneously incorporates both the short run and the long run solution and has an error correlation mechanism when ø is negative.

3.6.3 Granger-Causality

A general specification of the Granger causality test in a bivariate (X, Y) context can be expressed as:

$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \ldots\ldots + \alpha_i Y_{t-i} + \beta_1 X_{t-1} + \ldots\ldots.. \beta_i X_{t-i} + \mu$ …… (3.5)

$X_t = \alpha_0 + \alpha_1 X_{t-1} + \ldots\ldots + \alpha_i X_{t-i} + \beta_1 Y_{t-1} + \ldots\ldots.. \beta_i Y_{t-i} + \mu$ …….. (3.6)

In the model, the subscripts denote time periods and μ is a white noise error. The constant parameter α represents the constant growth rate of Y in the equation (3.5) and X in the equation (3.6) and thus the trend in these variables can be interpreted as general movements of Cointergration between X and Y that follows the unit root process. We can obtain two tests from this analysis: the first examines the null hypothesis that X does not Granger-cause Y and the second test examines the null hypothesis that Y does not Granger-cause X. If we fail to reject the former null hypothesis and reject the latter, then we conclude that Y changes are Granger-caused by a change in X (Gul and Ekina, 2006). Unidirectional causality will occur between two variables if either null hypothesis of equation (3.5) or (3.6) is rejected. Bidirectional causality exists if both null hypotheses are rejected and no causality exists if neither null hypothesis of equation (3.5) nor (3.6) is rejected, Duasa (2007).

3.7 Estimation Techniques

The estimation process shall involve determining what variables fit in the model to describe the relationship between the variables. Vector Error Correction Model analysis, impulse response functions and variance decomposition analysis are undertaken.

3.7.1 Vector Error Correction Model (VECM) analysis.

Based on Fu, Taylor and Yucel (2003) and Sims (1972 and Sims (1980), the study adopted a VECM model to estimate simultaneous shocks to more than one variable and used that to investigate unexpected and equivalent structural shocks.

Vector Error Correction Model (VECM) analysis was employed to achieve the four objectives of the study. Use of VECM in the study was on the justification that it is a model that can test for both long run and short run effects. The study mainly considered independent variables in the VECM since the main focus was on the human capital and its effects on economic growth rate.

The general vector error correction model with deterministic trend is given as follows

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + \mu + \varepsilon_t \quad \text{..... (3.7)}$$

Where, y_t is a (n *x 1*) vector of the n variables of interest, i.e. Annual growth rate of Real GDP, annual growth rate of P_HCA, annual growth rate of S_HCA, annual growth rate of T_HCA and annual growth rate of AEEG, μ is a (n *x* 1) vector of constants, Γ represents a (n *x* (*k*-1)) matrix of short-run coefficients, ε_t denotes a (n *x 1*) vector of white noise residuals, and Π is a (n *x* n) coefficient matrix. If the matrix Π has reduced rank ($0 < r < n$), it can be split into a (n *x* r) matrix of loading coefficients α, and a (n *x* r) matrix of co-integrating vectors β. The former indicates the importance of the co-integration relationships in the individual equations of the system and of the

speed of adjustment to disequilibrium, while the latter represents the long-term equilibrium relationship, so that $\Pi = \alpha\beta'$. *k* is number of lags, *t* denotes time and Δ is a difference operator.

3.7.2 Impulse Response Analysis

Stock (2001) argued that impulse responses are geared towards estimating the link between the current and past error term of the variable under investigation. Impulse response analysis relates the current value of the error-term to the future values of X_t or similarly, the current and past values of the error-term to the current values of X_t. The analysis enables one to investigate the effect of one-time shock to one of the innovations on the current and future values of the endogenous variable.

3.7.3 Variance Decomposition

Having investigated the effect of one-time shock to one of the innovations on the current and future values of the endogenous variable, the variance decomposition separates the variation in an endogenous variable into the VECM components. Odour (2008) posited that forecast error variance decomposition technique is appropriate if the study seeks to determine proportion of variance which was due to its own unique as well as other identified shock since it allocates weights to every shock identified in the system. In the short run, the shocks due to own are high but the variance due to other variables increase with time horizon.

This study conducted variance decomposition to determine the proportions of the shocks in economic growth rate that were due to human capital investment and thus determine their effect on economic growth rate in Kenya.

CHAPTER FOUR

ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the findings, analysis and discussions of the research. Descriptive analysis is first analyzed and presented in tables and graphs. The regression analysis is also carried out and tests for linear assumptions are undertaken. Being time series data, stationarity test and Johansen Cointegration test are undertaken after which the error correction model is presented and discussed.

4.2 Descriptive Analysis

We started off by undertaking a descriptive analysis of the data as show in table 2 below. We observe that the average GDP growth rate for the 45-year period was 5.0% with a minimum rate of -1% and a maximum of 22%. The average growth in enrollment for primary school was 5% with a lowest growth of -3% and the highest growth rate of 51%. The study also show an average growth for secondary school of 7%. The minimum was -16% and the highest growth was 29%. Enrollment in tertiary institutions had an average growth of 9% with the lowest growth at -29% and the highest growth of 40%. The average growth in government expenditure on education stood at 16% with a minimum of -8% and a maximum of 40%.

Table 2: Descriptive Analysis

	GDP	P_HCA	S_HCA	T_HCA	AEEG
Mean	1.05	1.05	1.07	1.09	1.16
Median	1.04	1.03	1.07	1.09	1.14
Maximum	1.22	1.51	1.29	1.40	1.40
Minimum	0.99	0.97	0.84	0.71	0.92
Std. Dev.	0.04	0.08	0.08	0.13	0.12
Skewness	2.22	4.06	-0.21	-0.09	0.17
Kurtosis	9.97	21.66	4.18	3.82	2.33
Jarque-Bera	128.25	776.65	2.93	1.30	1.05
Probability	0.00	0.00	0.23	0.52	0.59
Sum	47.12	47.12	48.27	49.25	52.32
Sum Sq. Dev.	0.07	0.31	0.31	0.75	0.60
Observations	45	45	45	45	45

4.3 Regression Analysis

We assume a regression model below:

$$Y_t = \beta_0 + \beta_1 x_{1,t} + \beta_2 x_{2,t} + \beta_3 x_{3,t} + \beta_4 x_{4,t+} \acute{\varepsilon}_{,t} \quad (4.1)$$

Where:

Y= GDP growth rate,

x_1= P_HCA (Annual primary school enrolment growth rate),

x_2=S_HCA(Annual secondary school enrolment growth rate),

x_3=T_HCA(Annual Tertiary enrolment growth rate),

x_4= AEEG(annual expenditure on education growth rate),

$\acute{\varepsilon}_{i,t}$= error term

Table 3: Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.754	0.124	6.106	0.000
P_HCA	0.010	0.075	0.136	0.892
S_HCA	0.163	0.072	2.260	0.029
T_HCA	0.008	0.046	0.174	0.863
AEEG	0.085	0.054	1.575	0.123
R-squared	0.166	Mean dependent var		1.047
Adjusted R-squared	0.082	S.D. dependent var		0.041
S.E. of regression	0.039	Akaike info criterion		-3.536
Sum squared resid	0.061	Schwarz criterion		-3.335
Log likelihood	84.549	Hannan-Quinn criter.		-3.461
F-statistic	1.986	Durbin-Watson stat		1.071
Prob(F-statistic)	0.115			

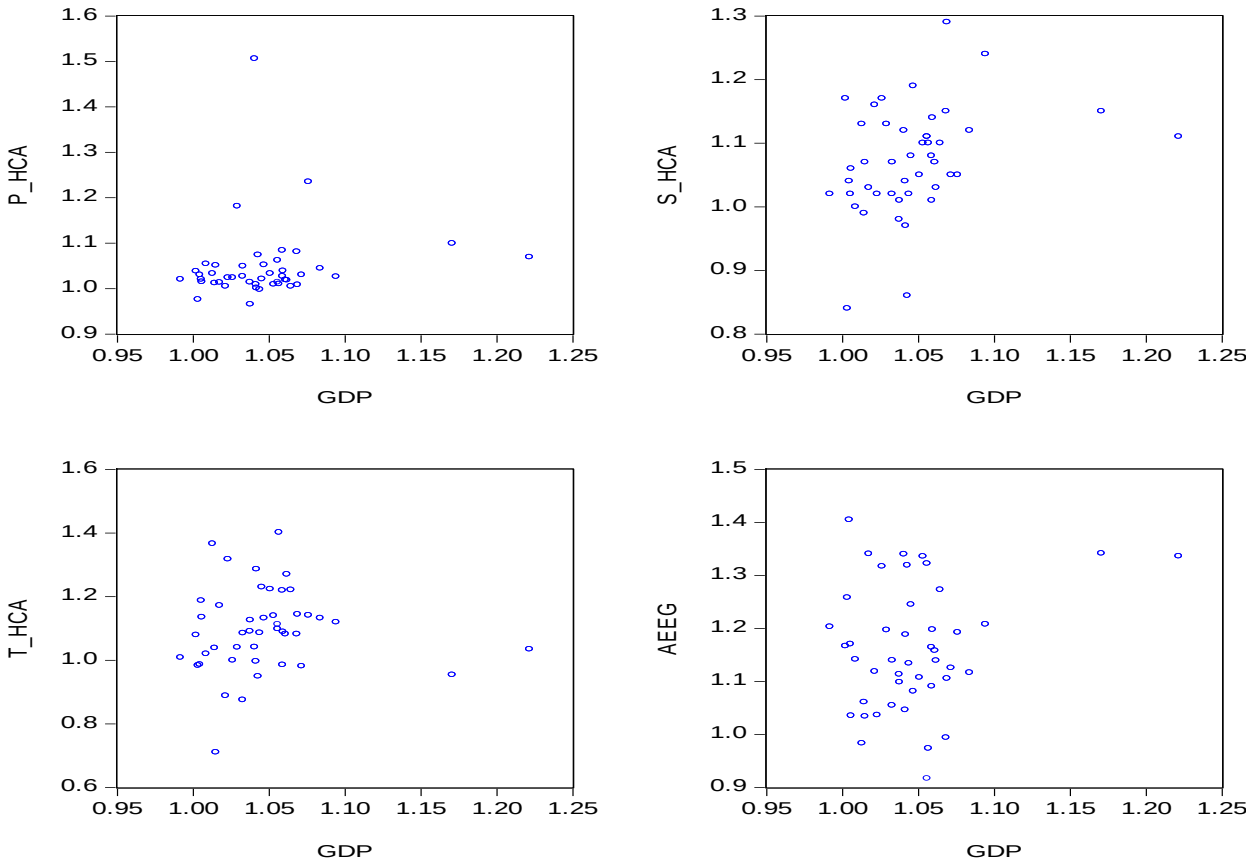
Table 3 shows that only secondary school enrollment had a significant impact on GDP growth rate as the p-value was less than 5%. All the other three variables have a p-value greater than 5% and therefore insignificant. This contradicts empirical evidence from the previous literature as discussed in chapter two.

The study therefore discusses the aptness of the model by testing for the classical linear model's assumptions that: there is a linear relationship between the dependent variable and the independent variables, the error terms are random and normally distributed, the residuals are homoscedastic and there is no serial correlation among the residuals.

4.3.1 Scatter Plot diagram

To test for linearity of the dependent variable and the independent variable line plots was used and the results are shown in Figure 3 below.

Figure 3: Scatter Plot diagram

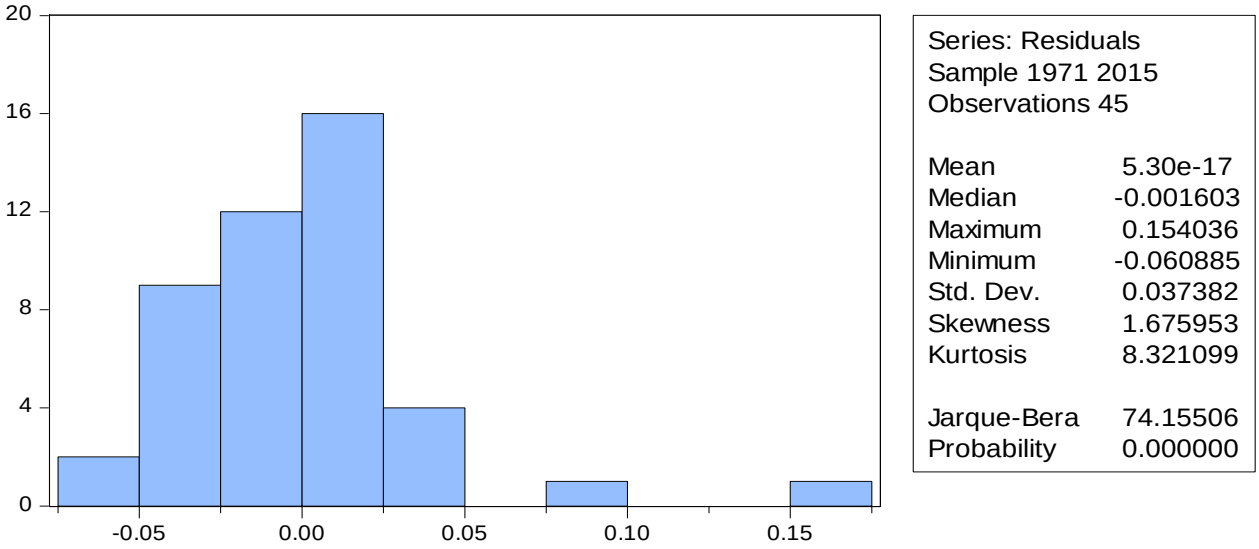


The scatter plot depicts a low level of linearity between the GDP growth rate and the two-independent variable secondary enrollment and annual expenditure in education. However, there was no linearity with primary school enrolment and tertiary enrolment growth.

4.3.2 Normality Test

To test for normality of the residuals, histogram-normality test was used, and the results are as shown in Figure 4 below.

Figure 4: Normality Test



The Jarque Bera statistics is less than 5% level of significance and therefore reject the null hypothesis of normality of the residuals.

4.3.3 Serial Correlation

Breusch-Godfrey Serial Correlation LM Test was used to test for serial correlation of the residuals and the results are as shown in Table 4. The null hypothesis is that there is no autocorrelation.

Table 4: Breusch-Godfrey Serial Correlation Lm Test

F-statistic	3.647258	Prob. F(1,39)	0.0635
Obs*R-squared	3.848468	Prob. Chi-Square(1)	0.0498

The results show that the p-value is less than 5% level of significance as the tests reject the null hypothesis that there is no autocorrelation. We therefore fail to reject the alternative and conclude there is autocorrelation.

4.3.4 Homoscedasticity

White test was used to test for homoscedasticity of the residuals and the results were as shown in Table 5.

Table 5: Heteroskedasticity White Test

F-statistic	1.618054	Prob. F (14,30)	0.1312
Obs*R-squared	19.36032	Prob. Chi-Square (14)	0.1516
Scaled explained SS	55.99557	Prob. Chi-Square (14)	0.0000

The results show that at 5% level of significance, the null hypothesis that there is no Heteroskedasticity is rejected ($p<0.05$). We therefore accept the alternative hypothesis that there is Heteroskedasticity.

Based on the inadequacy of the linear assumptions, we therefore resolved to use time series analysis.

4.4 Time Series Analysis

In this section we undertake diagnostic tests such as stationarity tests, Cointegration tests and error correction mechanism to examine the time series properties of the data.

4.4.1 Stationarity Test

To test for stationarity, we perform Augmented Dickey Fuller Test (ADF). Results in Table 6 shows that all the variables were stationary at levels and therefore the null hypothesis that there is presence of unit root was rejected. Therefore, it can be concluded that GDP growth rate, primary school enrollment growth rate, secondary school enrolment growth rate, tertiary enrolment growth rate and annual education expenditure growth rate were all stationary at levels.

Table 6: Unit Root Test at Levels

Variable	Test at levels	ADF Test		
		T statistic	Critical Value at 5%	P value
GDP	Constant	-5.648221	-2.929734	0.0000
P_HCA	Constant	-5.813756	-2.929734	0.0000
S_HCA	Constant	-5.656376	-2.929734	0.0000
T_HCA	Constant	-6.789849	-2.929734	0.0000
AEEG	Constant	-7.369811	-2.929734	0.0000

4.4.2 Lag Selection

Enders (1995) stated that it is important to define the optimal number of lags as such to eliminate the chances of error terms misspecification before undertaking Cointergration test. Several techniques are used to determine the optimal number of lags among them being LR, FPE, AIC, SC and HQ. As shown in Table 7, LR and AIC suggest that optimal lags was 2 while FPE, SC and HQ had no lag.

Table 7: Results for Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	249.3806	NA	6.08e-12*	-11.6372	-11.43030*	-11.56134*
1	272.0557	38.87176	6.86E-12	-11.5265	-10.2853	-11.0715
2	300.2479	41.61697*	6.21E-12	-11.67847*	-9.40295	-10.8444
3	317.4808	21.336	1.03E-11	-11.3086	-7.99876	-10.0954
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Akaike information criterion is used to select the optimal lag length and therefore from the table above we select an optimal lag of 2.

4.4.3 Cointergration Test

To examine whether the variables were cointergrated we conducted the Johansen Cointergration test. If variables are not stationary, they tend to drift from each other and cointergrated though they will always tend to remain proximate to each other. Johansen Cointergration test was selected since it's a multivariate autoregressive approach and it has chances of dealing with more than one cointergrating factors. The test also separates long run equilibrium relationships from short term dynamics. In this test the maximum Eigen value was used to test the significance of estimates of Eigen values.

The result of the maximum Eigen value test as shown in Table 8 below indicates one cointegrating equation in the model at 5% level of significance as the test rejected the null hypothesis of no cointegrating equation and accepted that of at least one cointegrating equation. We therefore conclude that there was a long run relationship between the variables under investigation.

Table 8: Johansen Cointergration Test

Trend assumption: Linear deterministic trend				
Series: GDP P_HCA S_HCA T_HCA AEEG				
Lags interval (in first differences): 1 to 2				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.720460	53.53356	33.87687	0.0001
At most 1	0.467074	26.43363	27.58434	0.0696
At most 2	0.351889	18.21511	21.13162	0.1220
At most 3	0.162920	7.469119	14.26460	0.4352
At most 4*	0.091123	4.012910	3.841466	0.0451
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Having established that there is a long run equilibrium relationship, we proceed to determine the short run equilibrium between the variables through the vector correction model.

4.5 Vector Error Correction Model (VECM)

We found out that all the data was stationary at level. To determine the model to fit between VECM and VAR, we establish the presence or absence of Cointergration. Since the time series is found to be cointergated as shown by Johansen Cointergration results above, we use the Vector Error Correction Model since it will be able to capture both short run and long run relationship between the variables being examined.

4.5.1 Results for VECM Model

According to Johansen Cointergration results we find that the variables were cointegrated. We can use Vector Error Correction Model to test for both long run and short run relationship between the variables.

The following equations are generated:

D(GDP) = C(1)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(P_HCA(-1)) + C(5)*D(P_HCA(-2)) + C(6)*D(S_HCA(-1)) + C(7)*D(S_HCA(-2)) + C(8)*D(T_HCA(-1)) + C(9)*D(T_HCA(-2)) + C(10)*D(AEEG(-1)) + C(11)*D(AEEG(-2)) + C(12)

D(P_HCA) = C(13)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721) + C(14)*D(GDP(-1)) + C(15)*D(GDP(-2)) + C(16)*D(P_HCA(-1)) + C(17)*D(P_HCA(-2)) + C(18)*D(S_HCA(-1)) + C(19)*D(S_HCA(-2)) + C(20)*D(T_HCA(-1)) + C(21)*D(T_HCA(-2)) + C(22)*D(AEEG(-1)) + C(23)*D(AEEG(-2)) + C(24)

D(S_HCA) = C(25)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721) + C(26)*D(GDP(-1)) + C(27)*D(GDP(-2)) + C(28)*D(P_HCA(-1)) + C(29)*D(P_HCA(-2)) + C(30)*D(S_HCA(-1)) + C(31)*D(S_HCA(-2)) + C(32)*D(T_HCA(-1)) + C(33)*D(T_HCA(-2)) + C(34)*D(AEEG(-1)) + C(35)*D(AEEG(-2)) + C(36)

D(T_HCA) = C(37)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721) + C(38)*D(GDP(-1)) + C(39)*D(GDP(-2)) + C(40)*D(P_HCA(-1)) + C(41)*D(P_HCA(-2)) + C(42)*D(S_HCA(-1)) + C(43)*D(S_HCA(-2)) + C(44)*D(T_HCA(-1)) + C(45)*D(T_HCA(-2)) + C(46)*D(AEEG(-1)) + C(47)*D(AEEG(-2)) + C(48)

D(AEEG) = C(49)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721) + C(50)*D(GDP(-1)) + C(51)*D(GDP(-2)) + C(52)*D(P_HCA(-1)) + C(53)*D(P_HCA(-2)) + C(54)*D(S_HCA(-1)) + C(55)*D(S_HCA(-2)) + C(56)*D(T_HCA(-1)) + C(57)*D(T_HCA(-2)) + C(58)*D(AEEG(-1)) + C(59)*D(AEEG(-2)) + C(60)

The cointegrating equation is thus

GDP(-1) - 0.292892949759*P_HCA(-1) - 0.0646328503433*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(-1) - 0.227608197721

We then proceed to perform a wald test for the short run effect as shown in appendix D. The coefficients are c(4)=c(5)=c(6)=c(7)=c(8)=c(9)=c(10). With a p-value of 0.0026 we reject the null hypothesis that there is no short run causality. We therefore conclude presence of short run causality of human capital accumulation to growth in GDP.

4.6 Post estimation Analysis

In order to evaluate the robustness of the model to determine the effects of human capital accumulation on economic growth in Kenya, we conduct a Post estimation analysis. The analysis includes autocorrelation and stability of variance.

4.6.1 Autocorrelation

The analysis for autocorrelation for the residuals was conducted using the Langrage multiplier test (LM). The results in Table 9 shows that the error term was uncorrelated at lag order 1.

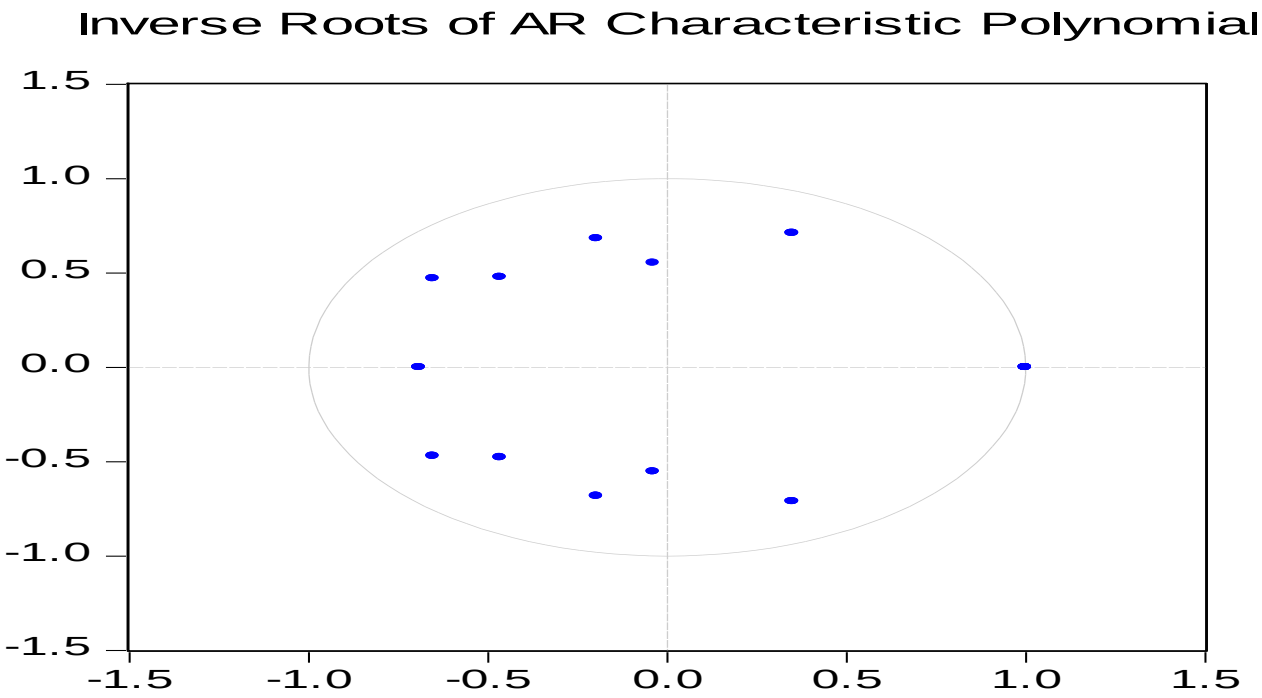
Table 9: Autocorrelation

Lags	LM-Stat	Prob
1	4.751241	0.0167
H_o: No serial correlation at lag order		

4.6.2 Stability of Variance

Polynomial stability condition was satisfied since none of the modulus coefficient was greater than 1 as shown in Figure 5 below.

Figure 5: Stability Condition

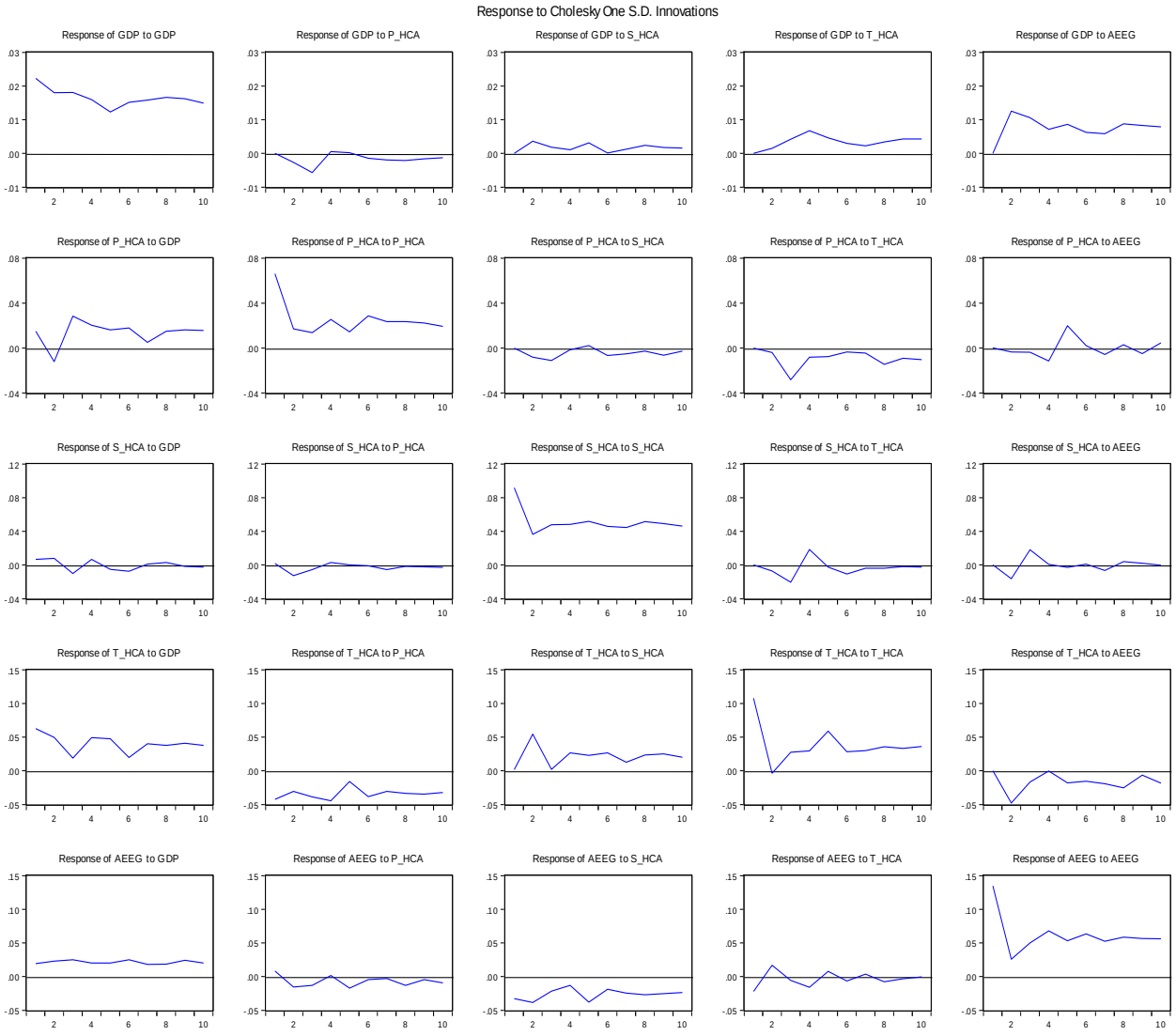


4.7 Impulse Response Analysis

To determine the impulse responses, VECM coefficients result obtained earlier are used as inputs in generation of impulse responses and variance decomposition. The study can determine the effect of one standard deviation shock to changes on current or future values of all endogenous variables in the equation using impulse responses (Gitahi et al, 2014).

Impulse responses of the GDP growth rate for the 45 years as a result of one standard deviation/ shock of each human capital accumulation is presented in Figure 6 below.

Figure 6: Impulse Response Functions



We observe a consistent negative shock response of GDP to primary school human capital accumulation over the first ten years. The other variables don't show negative response to GDP growth rate. We therefore conclude primary growth rate of human capital accumulation affects the economic growth rate in the short run.

4.8 Variance Decomposition

Variance decomposition separates the variation of endogenous variables into the VECM components. The variance decomposition was conducted to determine the proportions of the shocks in GDP growth that were accredited to the growth in primary level human accumulation, secondary level human accumulation, tertiary level human accumulation and Government Expenditure on Education and thus determine the effect on economic growth rate.

Variance decomposition of economic growth rate over the 45-year period is explained in Table 10.

Table 10: Variance Decomposition of economic growth rate

Variance Decomposition of GDP Growth					
Period	GDP	Primary	Secondary	Tertiary	Expenditure
1	100.0000	0.000000	0.000000	0.000000	0.000000
5	73.87723	1.895292	1.299335	4.111875	18.81627
10	75.25161	1.458539	1.072533	3.996690	18.22062
15	75.56331	1.230509	0.999487	4.050275	18.15642
20	75.65707	1.104248	0.958066	4.103329	18.17729
25	75.70487	1.025658	0.933531	4.139251	18.19670
30	75.73795	0.972501	0.916751	4.162669	18.21013
35	75.76304	0.934025	0.904552	4.179119	18.21927
40	75.78248	0.904830	0.895269	4.191455	18.22596
45	75.79784	0.881901	0.887974	4.201124	18.23116

The extract of the results for the 45-year period show that variation in GDP in the first year is due to its own shock. Own shocks reduced significantly to 74% in the fifth year but normalized and remain static at 75% from the sixth to the 45th year.

GDP growth variation due to other variables is zero in the first year signifying that on impact, the variations are solely on own shock. However we observe that of the four human capital accumulation variables, Government Expenditure on Education had the highest impact on the GDP growth rate. This was followed by tertiary capital accumulation.

CHAPTER FIVE
DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter we present the discussion, summary, conclusions and recommendations. Policy implications and recommendations on areas of future research are also discussed.

5.2 Discussions

This study sort to determine the effect of human capital accumulation on economic growth. More specifically, the study sort to determine the effect of Specific Level Primary HCA on economic growth, to establish the effect of Specific Level Secondary HCA on economic growth, to determine the effect of Specific Level Tertiary HCA on economic growth and to establish the effect of Government Expenditure on Education on economic growth.

Secondary data was obtained from Economic Survey of Kenya and Statistical Abstracts both published by the Central Bureau of Statistics. Data on the Specific Level enrollment (primary, Secondary and Tertiary) and Government expenditure on education is obtained from The Economic Survey of Kenya at The Ministry of Finance library.

Descriptive analysis was conducted and observed that the average GDP growth rate for the 45-year period was 5.0% with a minimum rate of -1% and a maximum of 22%. The average growth in enrollment for primary school was 5% with a lowest growth of -3% and the highest growth rate of 51%. The study also shows an average growth for secondary school of 7%. The minimum was -16% and the highest growth was 29%. Enrollment in tertiary institutions had an average growth of 9% with the lowest growth at -29% and the highest growth of 40%. The average growth in government expenditure in education stood at 16% with a minimum of -8% and a maximum of 40%.

We then conducted a regression analysis and looked at the aptness of the model by testing for the classical linear model's assumptions of normality, homoscedasticity and there is no serial correlation among the residuals. Based on the inadequacy of the linear assumptions, we therefore resolved to use time series analysis.

We also conducted diagnostic tests such as stationarity tests, Cointegration tests and error correction mechanism to examine the time series properties of the data. To test for stationarity of the variables in the study, we used the Augmented Dickey Fuller Test (ADF). Results showed that Real GDP growth rate, primary school enrollment growth rate, secondary school enrolment growth rate, tertiary enrolment growth rate and annual education expenditure growth rate were all stationary at levels.

We then tested for long run relationship using the Johansen Cointergration. Maximum Eigen values statistics was used to test the significance of estimates of Eigen values. Prior to this we performed lag selection tests which indicated that we use 2 lags. Johansen Cointergration results showed there was one Cointergration equation between GDP growth rate, primary school enrollment growth rate, secondary school enrolment growth rate, tertiary enrolment growth rate and annual education expenditure growth rate. There was therefore a long run relationship between the variables in the study.

To test for the short run equilibrium, we used the Vector error correction model. Upon generating the appropriate equations and Wald test, Impulse response functions and variance decomposition analysis are used to determine the shocks in the GDP growth rate due to the four variables, primary school enrollment growth rate, secondary school enrolment growth rate, tertiary enrolment growth rate and annual education expenditure growth rate. According to Stock (2001), impulse responses estimate the link between the current and past error term of the

variable under investigation. Impulse responses helps the study trace the effect of one standard deviation shock to changes on current or future values of all endogenous variables in the equation (Gitahi et al, 2014).

The first objective was to determine the effect of Specific Level Primary HCA on economic growth. We performed a regression of GDP growth rate against Specific Level Primary HCA growth rate. From impulse response and variance analysis showed that there was a significant effect of Specific Level Primary HCA on GDP growth rate. This agrees with the findings of Akram, et al. (2008); Petrakis and Stamatakis (2002) and Johnson (2011) who concluded that primary school level certification affects economic growth rate. However, it contrasted with Abbas (2001), who concluded that primary level certification has a negative influence on economic growth while Villa (2005) did not find any significant effect of primary level certification on GDP growth rate.

The second objective was to determine the effect of Specific Level secondary HCA on economic growth. Regression of GDP growth rate against Specific Level secondary HCA growth rate was undertaken and impulse response and variance analysis showed that there was a significant effect of Specific Level secondary HCA on GDP growth rate. This agrees with the findings of Pereira and St. Aubyn (2009) in their evaluation on the growth of economy in Portugal where they concluded that secondary education has a positive influence on GDP. Similar findings were also observed by Shaihani, et al. (2011); Asteriou and Agiomirgianakis (2001); Gyimah, Paddison and Mitiku (2006); Lin (2006) and Lee (2010) that secondary education has a positive and statistically significant influence on economic growth. However, it contrasted with the findings of Adawo (2011), who concluded that, both Secondary and tertiary education dampens growth.

The third objective was to determine the effect of Specific Level tertiary HCA on economic growth. Impulse response and variance decomposition analysis of the component depicted a significant effect of Specific Level tertiary HCA on GDP growth rate. This agrees with the findings of Zhang and Zhuang (2011), in their evaluation of China's economic growth that higher education plays a more important role than primary and secondary. Similar findings were also observed by Papalexandris and Nikandrou (2000); Jorgenson et.al (2003) and Chi (2008) that secondary education has a positive and statistically significant influence on economic growth. However, it contrasted with the findings of Tchalim, T. (2015) who concluded that only primary education has significant impact on growth of the economy, while Mc Mahon, 1998 concluded that tertiary education has a negative effect on growth. The findings also contrasted the findings of Kui (2006); Chaudhary, Iqbal & Gillani, (2009) and Mohsen M, (2013) who concluded that there is unidirectional causality creeping from economic growth to higher education.

The last objective was to establish the effect of Government Expenditure on Education on economic growth. We observe from the Impulse response and variance decomposition analysis that government expenditure on education also has a significant effect on GDP growth rate. This agrees with the findings of Kalio (2000), in his evaluation of effects of different components of government expenditures on GDP growth in Kenya, that government expenditure on education has a positive effect on GDP growth. Similar findings were also affirmed by Oleyami (2012) and Oluwatobi and Ogunrinola (2011) that government expenditure on education has significant effect of Economic growth.

5.3 Conclusion and Recommendation

To determine the effect of human capital accumulation on economic growth, we undertook a time series analysis of the four human capital accumulations on the GDP growth rate.

From the discussion above, we conclude that the four human capital accumulation factors, Specific Level Primary HCA, Specific Level Secondary HCA, Specific Level Tertiary HCA and Government Expenditure on Education all affect economic growth.

From the variance decomposition analysis, of the four human capital accumulation variables, Government Expenditure on Education had the highest impact on the GDP growth rate. This was followed by tertiary human capital accumulation. Primary and secondary human capital accumulation had the least effect.

The government therefore has a pivotal role in investment in the education sector across all levels. The government should therefore continue growing the expenditure of education in all the levels of education as it contributes highly to the level of human capital in the country. It should also improve the quality of education across all the levels.

Investment in the quality of education and growth in expenditure in education results in well skilled labor which results in the level of economic activity and efficiency in the output in the country. Education also opens opportunity for entrepreneurship. It also attracts investment in the country as investors appreciate that the country has skilled labor.

5.4 Limitations of the study

The study, though successfully achieved its objectives experienced several drawbacks which acted as limitations to its successful completion. These include the following;

The data used was secondary in nature which was not purposely collected for the current study and therefore it was not easy to access the data from the planned sources which led to untimely research.

The literature informing the study was limited with little evidence on local perspective. This therefore affected the review of the trends in the variables studied over the years.

The use of secondary data which is prone to personal biasness, such as low response rate or respondent misunderstanding of specific survey questions, limited the study since the data cannot adequately be reliable due to these personal errors and biasness.

5.5 Areas of Future Research

This study relied on secondary data for analysis. We should consider qualitative data that may be provided through questionnaires and thus use primary data. This ensures that we obtain firsthand information from education stakeholders on the effect of human capital accumulation on the economic growth rate.

We also recommend consideration of other measures of human capital accumulation on the economic growth rate. This includes the quality of education, transitions and completion rate as well as impact on the output.

The employment sector being the recipients of this human capital should also be engaged in giving their feedback of the quality of education and the impact on the productivity of employees.

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APPENDICES

APPENDIX A: Annual Growth rate for period 1971-2015

Year	GDP	P_HCA	S_HCA	T_HCA	EE	AEEG
1971	1.22	1.07	1.11	1.03	6.33	1.34
1972	1.17	1.10	1.15	0.95	6.62	1.34
1973	1.06	1.08	1.08	1.22	6.78	1.16
1974	1.04	1.51	1.12	1.04	7.07	1.34
1975	1.01	1.05	1.00	1.02	7.20	1.14
1976	1.02	1.01	1.16	0.89	7.31	1.12
1977	1.09	1.03	1.24	1.12	7.50	1.21
1978	1.07	1.01	1.29	1.14	7.60	1.11
1979	1.08	1.24	1.05	1.14	7.78	1.19
1980	1.06	1.06	1.11	1.10	8.06	1.32
1981	1.04	1.01	0.98	1.09	8.16	1.11
1982	1.02	1.05	1.07	0.71	8.20	1.03
1983	1.01	1.03	1.13	1.37	8.18	0.98
1984	1.02	1.01	1.03	1.17	8.47	1.34
1985	1.04	1.07	0.86	0.95	8.75	1.32
1986	1.07	1.03	1.05	0.98	8.87	1.13
1987	1.06	1.04	1.14	1.09	9.05	1.20
1988	1.06	1.02	1.03	1.27	9.18	1.14
1989	1.05	1.05	1.19	1.13	9.26	1.08
1990	1.04	1.00	0.97	1.29	9.43	1.19
1991	1.01	1.01	0.99	1.04	9.49	1.06
1992	0.99	1.02	1.02	1.01	9.67	1.20
1993	1.00	0.98	0.84	0.98	9.90	1.26
1994	1.03	1.02	1.17	1.00	10.18	1.32
1995	1.04	1.00	1.02	1.09	10.30	1.13
1996	1.04	1.01	1.04	1.00	10.35	1.05
1997	1.00	1.03	1.04	0.99	10.69	1.40
1998	1.03	1.03	1.02	0.88	10.74	1.05
1999	1.02	1.02	1.02	1.32	10.78	1.04
2000	1.01	1.02	1.06	1.14	10.81	1.04
2001	1.04	0.97	1.01	1.13	10.91	1.10
2002	1.01	1.02	1.02	1.19	11.06	1.17
2003	1.03	1.18	1.13	1.04	11.24	1.20
2004	1.05	1.03	1.05	1.22	11.35	1.11
2005	1.06	1.03	1.01	0.99	11.43	1.09
2006	1.06	1.01	1.10	1.22	11.67	1.27
2007	1.07	1.08	1.15	1.08	11.67	0.99
2008	1.00	1.04	1.17	1.08	11.82	1.17
2009	1.03	1.05	1.07	1.09	11.95	1.14
2010	1.08	1.04	1.12	1.13	12.06	1.12
2011	1.06	1.02	1.07	1.08	12.21	1.16
2012	1.05	1.02	1.08	1.23	12.43	1.24
2013	1.06	1.01	1.10	1.40	12.40	0.97
2014	1.05	1.01	1.10	1.14	12.69	1.34
2015	1.06	1.01	1.11	1.11	12.60	0.92

APPENDIX B: Vector Error Correction Estimates

Sample (adjusted): 1974 2015					
Included observations: 42 after adjustments					
Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
GDP(-1)	1.000000				
P_HCA(-1)	-0.292893				
	(0.06256)				
	[-4.68152]				
S_HCA(-1)	-0.064633				
	(0.04694)				
	[-1.37688]				
T_HCA(-1)	-0.200574				
	(0.03512)				
	[-5.71031]				
AEEG(-1)	-0.186457				
	(0.04915)				
	[-3.79377]				
C	-0.227608				
Error Correction:	D(GDP)	D(P_HCA)	D(S_HCA)	D(T_HCA)	D(AEEG)
CointEq1	-0.431770	2.103973	0.404587	3.647960	0.715744
	(0.18809)	(0.57269)	(0.77534)	(1.11081)	(1.19754)
	[-2.29553]	[3.67387]	[0.52182]	[3.28404]	[0.59768]
D(GDP(-1))	0.068449	-2.630288	0.370676	-0.621717	-0.215993
	(0.14007)	(0.42647)	(0.57738)	(0.82720)	(0.89178)
	[0.48869]	[-6.16762]	[0.64199]	[-0.75159]	[-0.24220]
D(GDP(-2))	0.061019	0.110964	-0.313644	-2.078868	-0.095588
	(0.15987)	(0.48676)	(0.65902)	(0.94415)	(1.01787)
	[0.38168]	[0.22796]	[-0.47593]	[-2.20183]	[-0.09391]
D(P_HCA(-1))	-0.160378	-0.147644	-0.124341	0.571042	0.090986
	(0.04404)	(0.13409)	(0.18155)	(0.26010)	(0.28040)
	[-3.64153]	[-1.10105]	[-0.68490]	[2.19551]	[0.32448]
D(P_HCA(-2))	-0.147670	-0.229852	-0.236581	0.386703	-0.052529
	(0.04221)	(0.12852)	(0.17400)	(0.24929)	(0.26875)

	[-3.49838]	[-1.78844]	[-1.35966]	[1.55124]	[-0.19546]
D(S_HCA(-1))	0.044255	0.037429	-0.618983	0.706958	-0.306845
	(0.03945)	(0.12012)	(0.16263)	(0.23300)	(0.25119)
	[1.12173]	[0.31159]	[-3.80609]	[3.03422]	[-1.22158]
D(S_HCA(-2))	0.033954	0.017094	-0.251344	0.169398	-0.357092
	(0.04040)	(0.12302)	(0.16655)	(0.23861)	(0.25724)
	[0.84037]	[0.13895]	[-1.50911]	[0.70993]	[-1.38815]
D(T_HCA(-1))	-0.054074	0.378633	-0.010641	-0.372563	0.340784
	(0.03025)	(0.09211)	(0.12470)	(0.17866)	(0.19261)
	[-1.78747]	[4.11079]	[-0.08533]	[-2.08536]	[1.76934]
D(T_HCA(-2))	-0.029925	0.128208	-0.164195	-0.160646	0.293140
	(0.02507)	(0.07633)	(0.10334)	(0.14805)	(0.15961)
	[-1.19367]	[1.67965]	[-1.58886]	[-1.08506]	[1.83657]
D(AEEG(-1))	0.012818	0.365717	-0.045559	0.325144	-0.675436
	(0.03916)	(0.11923)	(0.16142)	(0.23126)	(0.24931)
	[0.32733]	[3.06743]	[-0.28225]	[1.40598]	[-2.70919]
D(AEEG(-2))	0.033597	0.371134	0.042616	-0.005002	-0.364382
	(0.03150)	(0.09590)	(0.12983)	(0.18600)	(0.20053)
	[1.06671]	[3.87018]	[0.32824]	[-0.02689]	[-1.81712]
C	0.000662	-0.008729	0.000973	-0.006714	-0.014513
	(0.00355)	(0.01082)	(0.01465)	(0.02099)	(0.02263)
	[0.18639]	[-0.80667]	[0.06639]	[-0.31988]	[-0.64138]
R-squared	0.458961	0.748773	0.519272	0.652017	0.513076
Adj. R-squared	0.260580	0.656657	0.343005	0.524423	0.334537
Sum sq. resids	0.014889	0.138026	0.252997	0.519290	0.603543
S.E. equation	0.022278	0.067830	0.091833	0.131566	0.141838
F-statistic	2.313532	8.128554	2.945936	5.110101	2.873752
Log likelihood	107.2453	60.48226	47.75757	32.65681	29.49933
Akaike AIC	-4.535492	-2.308679	-1.702741	-0.983657	-0.833301
Schwarz SC	-4.039015	-1.812202	-1.206264	-0.487180	-0.336824
Mean dependent	-7.14E-05	-0.001667	0.000714	-0.002524	-0.005893
S.D. dependent	0.025908	0.115759	0.113296	0.190780	0.173873
Determinant resid covariance (dof adj.)		3.83E-12			
Determinant resid covariance		7.12E-13			
Log likelihood		289.4154			
Akaike information criterion		-10.68645			
Schwarz criterion		-7.997198			

APPENDIX C: Vector Error Correction Estimates

Dependent Variable: D(GDP)				
Method: Least Squares				
Date: 10/01/17 Time: 09:53				
Sample (adjusted): 1974 2015				
Included observations: 42 after adjustments				
D(GDP) = C(1)*(GDP(-1) - 0.292892949759*P_HCA(-1) - 0.064632850343				
3*S_HCA(-1) - 0.200574174557*T_HCA(-1) - 0.186456576336*AEEG(				
-1) - 0.227608197721) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)				
*D(P_HCA(-1)) + C(5)*D(P_HCA(-2)) + C(6)*D(S_HCA(-1)) + C(7)				
*D(S_HCA(-2)) + C(8)*D(T_HCA(-1)) + C(9)*D(T_HCA(-2)) + C(10)				
*D(AEEG(-1)) + C(11)*D(AEEG(-2)) + C(12)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.431770	0.188092	-2.295525	0.0289
C(2)	0.068449	0.140068	0.488687	0.6286
C(3)	0.061019	0.159872	0.381676	0.7054
C(4)	-0.160378	0.044041	-3.641528	0.0010
C(5)	-0.147670	0.042211	-3.498379	0.0015
C(6)	0.044255	0.039453	1.121734	0.2709
C(7)	0.033954	0.040404	0.840374	0.4073
C(8)	-0.054074	0.030252	-1.787469	0.0840
C(9)	-0.029925	0.025070	-1.193671	0.2420
C(10)	0.012818	0.039158	0.327325	0.7457
C(11)	0.033597	0.031496	1.066715	0.2946
C(12)	0.000662	0.003554	0.186394	0.8534
R-squared	0.458961	Mean dependent var		-7.14E-05
Adjusted R-squared	0.260580	S.D. dependent var		0.025908
S.E. of regression	0.022278	Akaike info criterion		-4.535492
Sum squared resid	0.014889	Schwarz criterion		-4.039015
Log likelihood	107.2453	Hannan-Quinn criter.		-4.353514
F-statistic	2.313532	Durbin-Watson stat		2.035043
Prob(F-statistic)	0.033746			

APPENDIX D: Wald Test

Wald Test:				
Equation: Untitled				
Test Statistic	Value	df	Probability	
F-statistic	2.957966	(8, 30)	0.0145	
Chi-square	23.66373	8	0.0026	
Null Hypothesis: C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=C				
(11)=0				
Null Hypothesis Summary:				
Normalized Restriction (= 0)		Value	Std. Err.	
C(4)		-0.160378	0.044041	
C(5)		-0.147670	0.042211	
C(6)		0.044255	0.039453	
C(7)		0.033954	0.040404	
C(8)		-0.054074	0.030252	
C(9)		-0.029925	0.025070	
C(10)		0.012818	0.039158	
C(11)		0.033597	0.031496	
Restrictions are linear in coefficients.				

APPENDIX E: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	4.751241	Prob. F(2,28)		0.0167
Obs*R-squared	10.64207	Prob. Chi-Square(2)		0.0049
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 10/01/17 Time: 11:12				
Sample: 1974 2015				
Included observations: 42				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.079686	0.180342	-0.441862	0.6620
C(2)	-0.147398	0.167665	-0.879120	0.3868
C(3)	0.363177	0.193378	1.878063	0.0708
C(4)	-0.002705	0.040330	-0.067070	0.9470
C(5)	-0.009348	0.040228	-0.232372	0.8179
C(6)	-0.018430	0.035912	-0.513194	0.6118
C(7)	0.001450	0.038510	0.037656	0.9702
C(8)	-0.013534	0.033547	-0.403435	0.6897
C(9)	0.011811	0.024900	0.474327	0.6389
C(10)	-0.003709	0.036918	-0.100471	0.9207
C(11)	0.015725	0.028651	0.548833	0.5875
C(12)	0.001123	0.003200	0.350948	0.7283
RESID(-1)	0.167019	0.277573	0.601712	0.5522
RESID(-2)	-0.773111	0.251549	-3.073404	0.0047
R-squared	0.253383	Mean dependent var		-2.18E-17
Adjusted R-squared	-0.093261	S.D. dependent var		0.019056
S.E. of regression	0.019925	Akaike info criterion		-4.732457
Sum squared resid	0.011116	Schwarz criterion		-4.153233
Log likelihood	113.3816	Hannan-Quinn criter.		-4.520148
F-statistic	0.730960	Durbin-Watson stat		1.973128
Prob(F-statistic)	0.719127			

APPENDIX F: Impulse Response Analysis

Response of GDP:					
Period	GDP	P_HCA	S_HCA	T_HCA	AEEG
1	0.022278	0.000000	0.000000	0.000000	0.000000
2	0.018005	-0.002719	0.003610	0.001469	0.012564
3	0.018083	-0.005669	0.001821	0.004177	0.010589
4	0.015935	0.000525	0.001114	0.006742	0.007165
5	0.012298	0.000159	0.003118	0.004622	0.008610
6	0.015146	-0.001450	9.46E-05	0.002955	0.006230
7	0.015770	-0.001932	0.001245	0.002211	0.005812
8	0.016647	-0.002083	0.002360	0.003385	0.008767
9	0.016217	-0.001600	0.001729	0.004291	0.008320
10	0.014948	-0.001264	0.001549	0.004301	0.007903
11	0.015117	-0.001114	0.001629	0.003763	0.007392
12	0.015413	-0.001437	0.001432	0.003446	0.007080
13	0.015732	-0.001731	0.001648	0.003284	0.007661
14	0.015885	-0.001580	0.001672	0.003760	0.007779
15	0.015555	-0.001488	0.001702	0.003894	0.007817
16	0.015423	-0.001373	0.001624	0.003792	0.007701
17	0.015429	-0.001430	0.001553	0.003690	0.007454
18	0.015561	-0.001510	0.001617	0.003576	0.007574
19	0.015644	-0.001523	0.001636	0.003647	0.007637
20	0.015598	-0.001522	0.001636	0.003724	0.007688
21	0.015550	-0.001460	0.001641	0.003738	0.007682
22	0.015511	-0.001457	0.001613	0.003725	0.007605
23	0.015533	-0.001481	0.001614	0.003667	0.007608
24	0.015570	-0.001490	0.001620	0.003671	0.007613
25	0.015574	-0.001501	0.001628	0.003690	0.007641
26	0.015566	-0.001484	0.001630	0.003703	0.007653
27	0.015546	-0.001478	0.001623	0.003709	0.007632
28	0.015545	-0.001479	0.001622	0.003693	0.007628
29	0.015554	-0.001482	0.001621	0.003688	0.007622
30	0.015559	-0.001489	0.001623	0.003689	0.007630
31	0.015562	-0.001486	0.001626	0.003694	0.007637
32	0.015556	-0.001484	0.001624	0.003699	0.007634
33	0.015553	-0.001483	0.001624	0.003696	0.007633
34	0.015554	-0.001482	0.001623	0.003694	0.007629
35	0.015556	-0.001485	0.001623	0.003692	0.007630
36	0.015558	-0.001485	0.001624	0.003693	0.007632
37	0.015556	-0.001485	0.001624	0.003695	0.007632
38	0.015555	-0.001484	0.001624	0.003695	0.007633
39	0.015555	-0.001483	0.001624	0.003694	0.007631
40	0.015555	-0.001484	0.001624	0.003694	0.007631
41	0.015556	-0.001484	0.001624	0.003693	0.007631
42	0.015556	-0.001484	0.001624	0.003694	0.007632
43	0.015556	-0.001484	0.001624	0.003694	0.007632
44	0.015556	-0.001484	0.001624	0.003694	0.007632
45	0.015555	-0.001484	0.001624	0.003694	0.007631

APPENDIX G: Variance Decomposition Analysis

Variance Decomposition of GDP:						
Period	S.E.	GDP	P_HCA	S_HCA	T_HCA	AEEG
1	0.022278	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.031637	81.97352	0.738698	1.301708	0.215564	15.77051
3	0.038639	76.86069	2.647895	1.094877	1.313429	18.08311
4	0.042955	75.94999	2.157369	0.953117	3.525848	17.41368
5	0.045844	73.87723	1.895292	1.299335	4.111875	18.81627
6	0.048793	74.85347	1.761443	1.147401	3.996673	18.24101
7	0.051705	75.96218	1.708176	1.079773	3.741985	17.50788
8	0.055215	75.69998	1.640132	1.129504	3.657063	17.87332
9	0.058351	75.50523	1.543751	1.099171	3.815316	18.03654
10	0.060937	75.25161	1.458539	1.072533	3.996690	18.22062
11	0.063360	75.29772	1.380034	1.058142	4.049577	18.21453
12	0.065713	75.50382	1.330795	1.031234	4.039706	18.09444
13	0.068124	75.58707	1.302804	1.018052	3.991149	18.10092
14	0.070521	75.61080	1.265984	1.006220	4.008726	18.10827
15	0.072777	75.56331	1.230509	0.999487	4.050275	18.15642
16	0.074917	75.54596	1.194777	0.990190	4.078413	18.19066
17	0.076969	75.58957	1.166417	0.978820	4.093678	18.17151
18	0.079003	75.62755	1.143674	0.970979	4.090559	18.16724
19	0.081011	75.65351	1.123001	0.964194	4.092887	18.16641
20	0.082970	75.65707	1.104248	0.958066	4.103329	18.17729
21	0.084874	75.65702	1.084860	0.952938	4.115218	18.18996
22	0.086722	75.66683	1.067356	0.947343	4.126213	18.19226
23	0.088533	75.68099	1.052125	0.942235	4.130662	18.19399
24	0.090315	75.69612	1.038218	0.937581	4.134470	18.19361
25	0.092067	75.70487	1.025658	0.933531	4.139251	18.19670
26	0.093785	75.71018	1.013453	0.929852	4.144808	18.20170
27	0.095468	75.71616	1.001999	0.926244	4.150917	18.20468
28	0.097121	75.72307	0.991393	0.922878	4.155441	18.20721
29	0.098747	75.73114	0.981547	0.919694	4.159202	18.20842
30	0.100348	75.73795	0.972501	0.916751	4.162669	18.21013
31	0.101925	75.74346	0.963897	0.914047	4.166176	18.21242
32	0.103477	75.74838	0.955756	0.911477	4.169926	18.21446
33	0.105005	75.75313	0.948073	0.909049	4.173287	18.21646
34	0.106512	75.75822	0.940821	0.906733	4.176344	18.21789
35	0.107997	75.76304	0.934025	0.904552	4.179119	18.21927
36	0.109463	75.76744	0.927579	0.902502	4.181747	18.22073
37	0.110909	75.77146	0.921459	0.900556	4.184377	18.22215
38	0.112337	75.77520	0.915636	0.898711	4.186875	18.22357
39	0.113747	75.77891	0.910091	0.896949	4.189244	18.22481
40	0.115139	75.78248	0.904830	0.895269	4.191455	18.22596
41	0.116515	75.78589	0.899816	0.893673	4.193539	18.22708
42	0.117874	75.78911	0.895033	0.892150	4.195558	18.22815
43	0.119219	75.79213	0.890461	0.890697	4.197493	18.22922
44	0.120548	75.79504	0.886085	0.889306	4.199353	18.23021
45	0.121863	75.79784	0.881901	0.887974	4.201124	18.23116