A CAUSAL ANALYSIS OF THE RELATIONSHIP AMONG EXPORTS, HUMAN DEVELOPMENT AND ECONOMIC GROWTH IN KENYA: MULTIVARIATE TIME SERIES APPROACH

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REG NO. X50/75983/2014

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RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF ECONOMICS, UNIVERSITY OF NAIROBI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF ARTS IN ECONOMICS

NOVEMBER 2016

DECLARATION

I, Daniel Ndunda Mbithi, hereby declare that this research project is my original work except where acknowledged and has never been submitted for any other degree award in any other university/institution before.

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Sign: …… Date: ……

This research paper has been submitted for examination with my approval as University supervisor

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DEDICATION

I dedicate this research paper to my dear mother, Rose Mbula and my grandfather, Joshua Ndunda Mbithi for their moral, spiritual and financial supporting for my education achievements this far. I pray that the Almighty God will reward your abundantly for your patience and the encouragement you extended to me.

ACKNOWLEDGEMENT

I thank the Almighty God for granting me the opportunity to pursue my Masters of Arts in Economics program and for seeing me through this research paper. I extend my heartfelt appreciation to the School of Economics, University of Nairobi for providing me with adequate economic tools which have contributed to the successful culmination of my masters' studies.

I like to express my sincere and utmost gratitude to my supervisor, Dr. Elizabeth Owiti for providing guidance, criticism and direction throughout this research paper. I will forever be indebted to her for her invaluable time and commitment in making the completion of this research paper a reality. I would like also to pass my sincere appreciation to Dr. Owen Nyang'oro for his immense assistance. I enjoyed every invaluable discussion with him about each concept investigated within the dissertation. Without your support, I would not have achieved my anticipated goals.

I am also so grateful to the University of Nairobi for the award of the scholarship to pursue Masters of Arts in Economics. Without the scholarship, this could not have been possible.

My special thanks goes to my dear mother, Rose Mbula, my sister Agnes Kanini and my brother, Moses Mbithi for their amazing support throughout my studies. Lastly, I thank all my classmates for their assistance during our coursework and comments through my dissertation process

God bless you all.

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ABSTRACT

This study examined the causality relationship among the human development, exports of goods and services and economic growth. The study, among others, analyzed the validity of export-led growth hypothesis and human capital endogenous growth hypothesis. Employing VECM and block exogeneity Wald test over 1980-2015 period, human development granger caused economic growth and economic growth granger caused exports at 5% and 10% significance level. There was unidirectional causality effects from human development to economic growth. However, exports granger caused economic growth at 5% and economic growth granger cause exports at only 10% significance level. Hence, there was support of bi-directional causality between exports and economic growth only at 10% significance level.

LIST OF ABBREVIATIONS

ARDL: Autoregressive Distributive lags

ASEAN: Association of Southeast Asian Nations

BLUE: Best Linear Unbiased Estimator

COMESA: Common Market for Eastern and Southern Africa

EAC: East African Community

ECM: Error Correction Model

EPS: Export Promotion Strategy

GDP: Gross Domestic Product

HDI: Human Development Index

IHDI: Inequality-adjusted Human Development Index

IMF: International Monetary Fund

Johansen ML: Johansen Maximum Likelihood

KNBS: Kenya National Bureau of Statistics

ROK: Republic of Kenya

TYDL: Todo Yamamoto Dolado and Lutkepohl

UNDP: United Nations Development Programme

VAR: Vector Autoregressive

VECM: Vector Error Correction Model

CHAPTER ONE-INTRODUCTION

1.1 BACKGROUND

Worldwide, both developed and developing economies are concerned with the advancement of their economic development. These concerns have necessitated each economy to work around the clock to develop different economic strategies and policies geared towards sustained high level growth rates of their output. Economic development encompasses both the quantitative and qualitative change of an existing economy. Economic growth as a subset of economic development plays an important role as part of the initial stage of economic development as it involves an increase in the productive potential of an economy. This is measured by increase in the country's real output over a specified period of time. According to Fatas and Mihov (2005), economic growth is a complex phenomenon that is influenced by many factors. For instance, growth can be influenced by physical and human capital, energy, government expenditure, trade openness, financial development, political stability, foreign direct investments (Ahmed et al., 2004). Over the years, various theories[1] , not limited to the above factors, have tried to explain how these factors stimulate economic growth and development. This study narrows down to the role of human development and exports (is an important component of trade) on the economic growth of an economy.

Trade activities opens the economy of a country. No economy in the world is self-sufficient and can operate successfully in an autocracy environment. According to Alexiadis and Tsagdis (2006), with trade in operation, countries have comparative advantage to specialize in production of some commodities for export purposes while at the same time import products which are comparatively disadvantageous to them. International trade contributes to transfer of superior technologies from other countries, competition which leads to economies of scale, increasing productivity and creation of employment opportunities (Helpman and Krugman, 1990). A country is able to appreciate new technologies if the country as adequate human capital in place. Utilization of such technologies depends on the level and quality of human capital development the country has and how best they can put them in production activities. "Human capital

[1] Classical theorists (such as Adam Smith, David Ricardo, Francois Quesnay, Thomas Malthus) and Neoclassical theorist (Robert Solow, William Jevons etc)

development denotes both the processes of widening people's choices and levels of their achieved wellbeing" (UNDP, 1990) and literally encompass embodied knowledge and skills.

International trade enhances growth of incomes and foreign exchange which aids the country in acquisition of imported manufactured and capital goods and technologies which contributes towards economic development of a country (Levin and Raut, 1997). Higher level of human capital can contributes towards production of exports which are able meet international competition and also increases overall efficiency in production and use of resources (Yanikkaya and Butkiewicz, 2008).

1.1.1 Exports Policies and Performance in Kenya

Since independence, trade policies in Kenya have evolved through various orientations (Krugman, 1988). Before 1980s, Kenya was under import substitution strategy which was highly protective (Wanjala and Kiringai, 2007). In 1980s, structural adjustments policies were introduced which involved liberalization of market structures, promotion of non-traditional exports and reform of international trade regulations (Biwott et al., 2013). The liberalization policies (Wagacha, 2000) contributed to easy shift of the Kenyan economy from import substitution strategy to Export Promotion Strategy which was first contained in the National Development Plan of 1970-1978 and 1979-1983. Over the years, several programmes[2] have been adopted to facilitate successful implementation of Export Promotion Strategy (EPS). The EPS is also envisaged in chapter six of the Kenya's Poverty Reduction Strategy Paper (ROK, 2011) as a strategy towards being industrialized and Vision 2030 under economic pillar.

To ensure trade openness, Kenya has embraced worthy partnerships other world economies. She is a member of five trading blocks[3] and three preferential trading agreement [4](ROK, 2015). EAC and COMESA are the main markets for Kenya's exports highlighting the importance of regional economic trading blocs. This owes to close proximity, preferential treatment, restructuring

2 These programmes are Green Channel, export promotion council, Manafucturing under Bond (1988), Export Processing Zones (1990), Export Promotion Programmes Office

[3] These includes; East African Community (EAC), Inter-governmental Authority on Development(IGAD), Common Market for Eastern and Southern Africa (COMESA), Tripartite Agreement between COMESA, EAC and Southern African Development Community (SADC) and Indian Ocean Rim-Association of Regional Cooperation (IOR-ARC)

[4] Economic Partnership Agreements (EPAs) of the European Union (EU), USA's African Growth Opportunity Act (AGOA) of States and WTO's Generalized System of Preferences (GSP)

activities and a relatively well developed manufacturing industry in Kenya compared to neighboring countries.

Table 1 shows Kenya exports majorly classified in four destinations across the world. From 2004 to 2014, statistics shows that Kenya exported more of its commodities around Africa compared to Europe, Asia and America.

Table 1: Kenyan Exports by destination as from 2004 to 2014

Year	Africa (Kshs. Millions)	Europe (Kshs. Millions)	Asia (Kshs. Millions)	America (Kshs. Millions)
2004	101,853	60,933	33,038	6,066
2005	120,790	66,451	38,692	13,259
2006	108,306	71,415	37,915	21,487
2007	124,010	76,846	46,224	20,520
2008	116,995	94,685	57,241	22,055
2009	162,609	100,975	59,236	18,961
2010	188,914	109,422	81,600	24,380
2011	247,600	136,246	95,613	27,491
2012	250,589	125,195	105,460	28,740
2013	231,474	123,299	107,558	33,765
2014	241,363	138,965	100,018	45,664

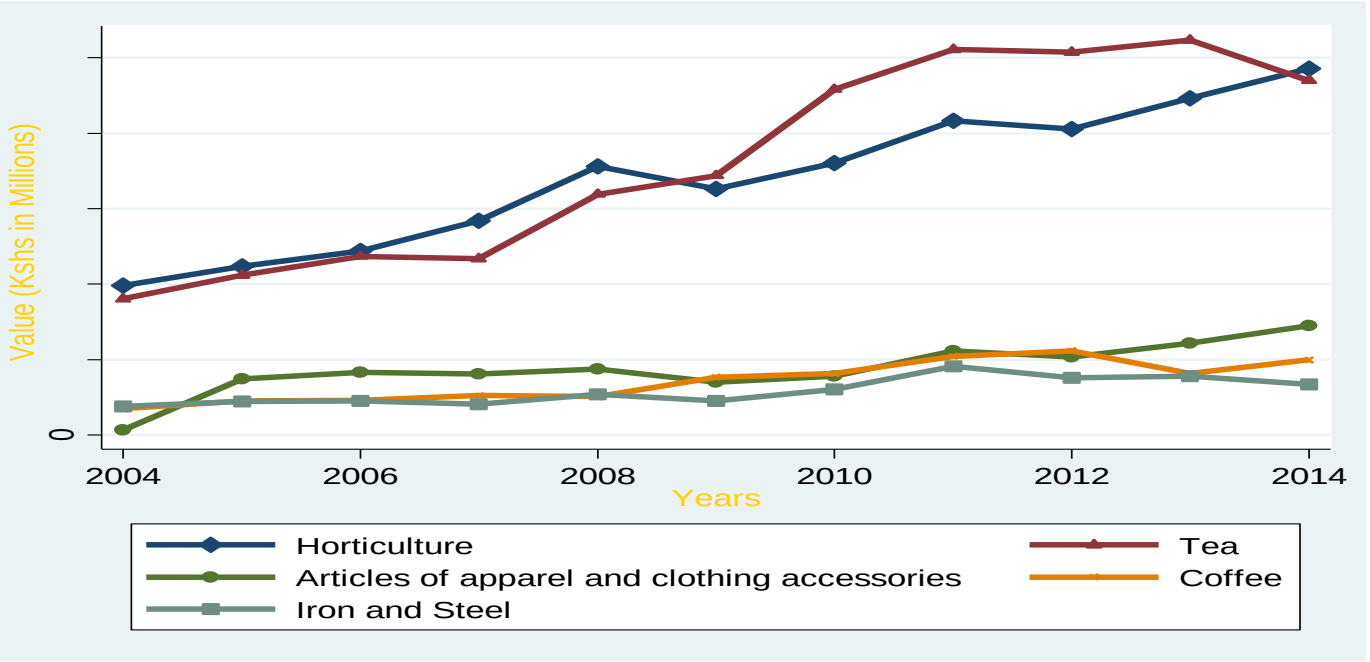
Source: Author's computations from Kenya facts and figures (KNBS, 2006 to 2015 issues)

From table 1, Exports of goods and services to Africa is made up of exports to COMESA, EAC and other African countries. Exports to Europe is an aggregation of exports to European Union and other European countries. The export totals to America consists of exports to USA, Canada and other American countries (KNBS, 2006 to 2015 issues).

In regards to trade openness, the composition of Kenya's export is merely led by agricultural products whose price fluctuations and production factors vary in contrast to manufactured exports. Primary exports dominate the export sector i.e. at 60% while manufacturing exports are at 35%. Nevertheless, there has been a significant improvement of manufactured exports which has grown from below 30% in 1995 to 36% in 2012 (ROK, 2015). Service exports have also improved and even accounted for 44% of total exports in 2012.

Figure 1 shows the first five performing exports commodities in Kenya which are mainly primary agricultural products. This shows dominance of the agricultural commodities in the total value of the export commodities from the country. Until late 1980s, coffee was the leading commodity export with the two notable performances in 1977[5] and 1986. This was generally due to favorable price shocks in the global markets. Over the last twenty-five years, Tea exports and the steadily increasing horticultural exports have taken the lead as the two principal commodity exports.

Figure 1: Exports Trend for the first five Performing Commodities in Kenya



Source: Author's computations from Kenya facts and figures (KNBS, 2006 to 2015 issues)

1.1.2 Performance of Kenyan Economy

Since independence, economic growth in Kenya has been affected negatively by occurrence of several internal and external shocks (Collier and Gunning, 1989). After independence up to 1970s, economic growth rate averaged 6.6% though this performance was negatively affected by Oil crisis in 1973 and 1979 and bad policies implemented especially in the management of coffee boom of 1976 which led to deterioration of growth rate to 3.2% early 1980s (Mwega and Ndung'u, 2004) .According to Mwega and Ndung'u (2004), the deterioration of the growth rate

5The year Kenya experienced a "coffee boom" due to severe frost in Brazil, one of the leading coffee production in the world which led to increased international prices for coffee

concurrently affected capital formation and balance of payments in the country. In mid to late 1980s, economic growth recovered and improved tremendously and this could be attributed partly to decrease in oil prices, mini coffee boom in 1986 and good weather experienced over the period (Collier and Gunning, 1989). The economy performed poorly in 1990s following oil increased due to the Gulf War in 1991/1992, ethnic clashes experienced in 1992, 1997 elections and bad weather following El Nino rains in 1997 (Collier and Gunning, 1989).

In 2003, the government launched Economic Recovery Strategy (ERS) for Wealth and Employment which contributed to economic growth rate of 5.9% and 7.1% between 2005 and 2007 (ROK, 2003). Following post-election violence in 2007/2008, spillovers effects from international financial crisis and high international commodity prices, this growth rate was adversely affected reducing to 1.7% in 2008 (ROK, 2011). In order to boost the economic growth out of recession, the government of Kenya initiated Economic Stimulus Program (ESP) (ROK 2009). The EPS major aim was to expand economic opportunities in rural areas for employment creation, to boost country's economic recovery, invest in long term solutions to challenges of food security, improve infrastructure and quality of health and education, establish and increase access to ICT capacity centers. (ROK 2009). In addition to the implementation of several government policies to stimulate growth and implementation of second Medium-Term Plan under Vision 2030, the annual growth rate increased recording a high of 5.9% in the first quarter of 2016 (ROK 2013).

1.1.3 Human Development in Kenya

By definition human development involves expansion of people's choices such that they are able to access knowledge and get better education, have long, better and healthy life and have ability to access resources which facilitates their decent level of living. These three components of human development have been well envisaged in the seventeen goals adopted by Kenya under sustainable development goals (SDGs) (Ministry of Finance, 2015).

"Human development denotes both the processes of widening people's choice and level of their achieved well-being" (UNDP, 1990). Human development index (HDI) is a measure of human development (UNDP, 1990). HDI is a geometric mean of normalized indexes (health index, education index and income index) which represents long and healthy living, access to knowledge and a decent standard of living (UNDP, 2008). However, HDI does not recognize the inequalities with the dimensions of life expectancy index, education index and health index. The

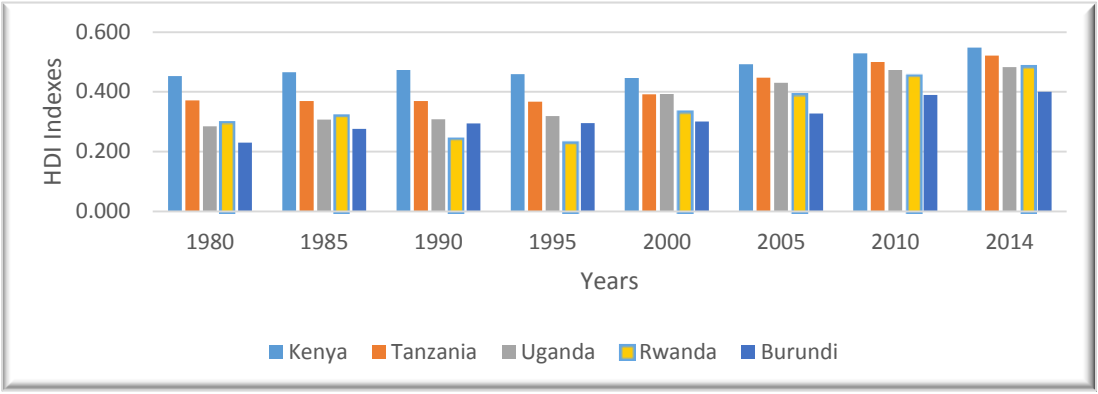
index ignores completely the genuine distribution of each outcome across the population in a country (UNDP, 2008).

Due to its inadequacies, UNDP (2014) introduced Inequality-adjusted Human Development Index (IHDI) in 2010 which is an improved index for measuring human development. The IHDI involves combination of country's average achievements in health, education and income with how those achievements are distributed among country's population by "discounting" each dimension's average value according to its level of inequality. The index captures both inequality within dimensions in the three variable using Atkinson measure of inequality (UNDP, 2014). Thus, the IHDI is distribution-sensitive average level of human development. HDI and IHDI are assumed to be equal in an economy where the distribution of resources and their outcome are perfectly done among the population. However this paper will utilize HDI data due to limited data for IHDI.

Though Kenya has achieved a lot in education and health sectors and is ranked on top of all other Eastern and Central African countries in terms of HDI, it remains in a low human development category (UNDP, 2014). As per region, Sub-Saharan Africa remains in a low human development category compared to other region like East Asia and the Pacific which are in high human development category.

Figure 2 shows the HDI trend for the East African Community (EAC) for comparison purposes with Kenya. Kenyan's HDI has been growing above other countries in EAC recording a high of 0.548 in 2014 compared to Burundi with the lowest HDI (0. 400) same year. Singapore and Hong Kong belongs to ASEAN and had an HDI of 0.912 and 0.910 respectively in 2014. Kenya is ranked in low human development category while most countries in ASEAN are ranked in either very high or high human development category. Between 1980 and 2014, the average annual increment in HDI has remained at 0.21% and this growth needs to be further improved in coming years by ensuring formulation and implementation of policies geared towards improving health sector, education sector and standard of living in order to cope with requirements of latest technologies and healthy workers in production.

Figure 2: HDI Trend for East Africa Community (1980-2014)



Source: Author's computations (UNDP, 2014)

1.2 PROBLEM STATEMENT

In order to achieve long term development blueprint towards transforming Kenya into a newly industrialized, middle income country by 2030, under economic and social pillars of Kenya Vision 2030, the government has deliberately put some efforts towards trade and human capital development (ROK, 2007). The allocation of resources to improve these sectors is of great importance to the economy. For this reason, the study sought to establish the causality outcomes of human capital development and exports on economic growth.

Despite many efforts made by the government of Kenya and her affiliates, the export promotional policies undertaken have not yielded much to the growth of exports (Biwott et al. 2013). This confirmations that there is a wide scope for research in reference to the adoptions and implementations of outward oriented policies and its implication in Kenyan economy. To obtain more reliable results on the performance of exports sector on economic growth of Kenya, this study aims at introducing an endogenous human capital development as a third variable in a multivariate framework.

Empirical studies on the export-economic growth nexus and human capital-growth nexus have been conducted along a number of divergent approaches. Longstanding studies are largely based on the correlation (Jung and Marshall, 1985) and bivariate causality tests (Granger, 1969). However, most recent studies have embraced more recent multivariate techniques such as Autoregressive Distributed Lag and Granger causality based on error correction models and co-integration methodology (Dritsaki, 2013; Muhoro and Otieno, 2014). However, in spite of the

many studies on the above nexuses, contradictory empirical results have been realized leading to different and conflict conclusions on the growth hypothesis. For instance, Fosu (1990) and Axfentious and Serletis (2000) generally supported the export led hypothesis while others (Jung and Marshal, 1985; Ahmad et al., 2004) failed to find sufficient empirical evidence favoring export led hypothesis. Hence, the motivating factor to introduce human capital as a third variable is the mixed and contracting results from several empirical studies which have been conducted with reference to the export-led hypothesis. Consolidated human capital and export may play a significant part in the economic growth of a country. Romer (1986) and Lucas (1988) argues that the stock of human capital plays an important role not only as an input in production but also as a factor responsible for higher growth in open economies. Presence of open economy curbs the problem of diminishing return to scale in human capital which might be experienced in an autarky economy hence this paper seeks to reconcile these previous empirical findings for export led hypothesis and human based endogenous growth hypothesis (Lucas, 1988).

Notwithstanding the fact that there exist large amount of studies addressing the nexus between exports and economic growth, there is a dearth of studies exploring the linkage among exports, human development and economic growth in a combined approach in the Kenya perspective (Vinok and Kaushik, 2007; Moboloji, 2010). To our knowledge, only a few of these studies addressed the export-human capital-growth relationship problem (Gould and Ruffin, 1995; Chuang, 2000; Narayan and Smyth, 2004; Ahmad et al., 2004). Among the limited studies addressing this problem, only few of them includes Kenya in the analysis using a cross country panel analysis (Levin and Raut, 1997; Afxentious and Serletis, 2000). In contrast with the present literature, the study fills this gap by using the most recent econometric techniques and 1980-2015 dataset to tackle the export-human development-growth nexus in a multivariate model in the Kenyan context. This study therefore seeks to answer the following question: Is there any causality relationship between exports, human development and economic growth? And if yes, what kind and direction of the causality?

1.3 OBJECTIVES OF THE STUDY

The general objective of this study is to establish the impact of exports and human development on economic growth in Kenya. The specific objectives of the study are:

i. To determine the relationship between exports, human development and economic growth in Kenya,

ii. To determine the validity of export-led growth hypothesis, growth led export hypothesis and human capital- based endogenous growth theory,
iii. To examine the stability of parameter estimates over the study period,

1.4 SIGNIFICANCE OF THE STUDY

Owing to several policies (Wagacha, 2000) changes and implementation that have taken place in Kenyan economy since 1970s, the study seeks to provide the dynamic analysis on the causal relationship between exports, human development and economic growth.

The study aims to cover the periods immediately after import substitution strategy: structural adjustments which brought about liberalization era and the period after 1990s to date which is characterized by export promotion strategies. The study findings therefore is useful in the Kenyan Economy in several ways. First, the study is useful as a guide to the government on the appropriate policy initiatives, implementations and implications on the resource allocation to human development (education and health sector) and trade (exports) especially in accomplishing Vision 2030 goals. Their prioritization on which sector (human development and trade) to invest more resources will be guided on the empirical causality outcomes of the study.

Secondly, the study finding provides better insight on the link among human development, exports and economic growth among scholars and academicians. The study also forms a basis for future studies and further scrutiny by researchers who might be interest on the same subject.

1.5 SCOPE OF THE STUDY

The study employed data for GDP annual percentage growth, Exports annual percentage growth and HDI which proxies' human development in Kenya. The study used HDI instead of the improved IHDI due to lack of adequate data covering the period under study. The study covers the period over 1980-2015. HDI for the study period is constructed using UNDP methodology developed in 1999/2000.

1.6 ORGANIZATION OF THE STUDY

The rest of the paper is organized into other three chapters. Subsequent to the introduction chapter is chapter two which covers the theoretical and empirical literature review. Chapter three describes the methodology and theoretical framework. Chapter four gives the research analysis and results and chapter five provides the summary of the study, conclusions and policy recommendations in addition to any further possible area of research.

CHAPTER TWO -LITERATURE REVIEW

2.1 THEORETICAL LITERATURE

2.1.1 The Theory of Comparative Advantage

Openness to international markets provides an important platform within which rapid productivity in an economy and enhancement of international competitiveness could be realized (Kowalski, 2011).The theory of Mercantilism advocates for reduction in taxes, low wages and interest rates of a country as a way of export promotion and making the exports competitive in the international trade. This argument was later criticized by classical economists in 17th century. Adam smith supported favorable free trade in his theory of absolute advantage. He brought out the importance of international trade as a "vent-for-surplus" gain. A country produces more of the commodities or services that it has absolute advantage compared to their opponents using the same capacity of resources. Ricardo's theory of comparative advantage asserts that countries in a free trade gains from each other due their differences in factor endowment or technological progress. That is, if one state has an absolute advantage over the other state in one line of production and the other state has absolute advantage of the first state in other line of production, both the states could accrue more benefits by trading.

Heckscher-Ohlin-Samuelson's (H-O-S) factor abundance theory encompasses Heckscher-Ohlin theorem, factor-price equalization, Stopler-Samuelson theorem and Rybczynski theorem. The H-O-S theory extends Ricardo's theory by suggesting that countries produce and export commodities that use their abundant and cheap resource and imports those commodities that utilizes their relatively scarce and expensive factors (Helpman, 1981). The theory states that an increase in the abundance factor in a country results to a rise in production of goods that utilizes that factor intensively and a decrease in production of goods that do not. H-O-S builds on the Ricardo's comparative advantage trade theory by extending the theory in terms of explaining what determines the comparative advantage. The theory of comparative advantage generally argues that relative difference in productivity between countries enables them to engage into international trade hence realizing trade gains. The H-O-S model uses the concept of the comparative advantage built on factor endowments as a basis for openness. Under international trade, the model assumes equalization of factor prices in the countries and increases in the returns on the abundant factor of production in each country. The H-O-S model was extend by Kowalski and Bottini (2011) and modelled into two-good dynamic model in which the human

capital accumulation was integrated. The model divided human capital accumulation into skilled and unskilled factors of production. Human capital (taken as the abundant factor of production) fits better in the role of the abundant factor in a Heckscher-Ohlin model in U.S (Branson and Junz, 1971). Kowalski (2011) argues that the comparative advantage of a country cannot be enhance through accumulation of physical and human capital and financial factors distinctly but through the combinations of several factors resulting to increased productivity which contributes on economic growth.

2.1.2 The Export-Led Growth model

Theoretically, the export-led growth model postulates that expansion of exports spurs economic growth. This theoretical assertion on the outward oriented policies under export led growth hypothesis emerged among neo-classical economists following the success of the free market and outward oriented policies of the East Asian Tigers (World Bank, 1993). Roberts (2007) modelled circular and cumulative causation between exports growth, output growth, international competitiveness and productivity growth by extending export-led growth model develop by Dixon and Thirlwall in 1975. His model emphasized on the vicious circle of increase in return on the aforementioned factors.

Figure 3: The Basic export-led growth model

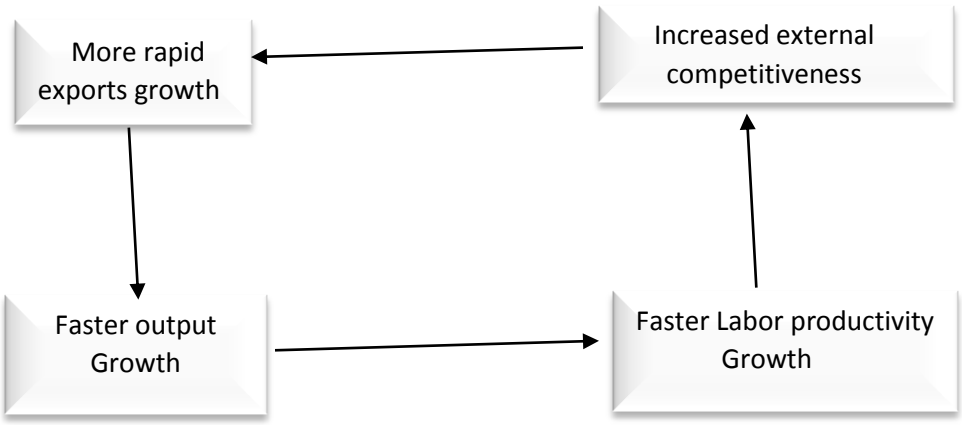


Figure 3 shows the interactive relationship between the factors in an export-led growth model as developed by Robert (2007). Increased export growth results to faster output growth through Keynesian multiplier effects and increased utilization rates stimulus to investment. Faster output growth in the economy through increased returns to scale, induced technological innovation and Research and development translates to faster labor productivity growth. Faster labor productivity promotes external competitiveness based on markup pricing over unit labor costs,

taking nominal wage increases as given. In turn, increased external competitiveness promotes export growth through export demand function with a high relative price elasticity. These increasing returns to the factors forms the so called the vicious circle of export led growth model.

2.1.3 Solow's Exogenous Growth model

The model is a neoclassical growth model which was developed by Robert Solow in 1956 to determine the long run economic growth (Solow, 1956). In the model, labor productivity was treated as an exogenous factor which depended on the workforce and physical capital. Physical capital was characterized with diminishing returns to scale. Technological progress was conceived as a force outside the model and exogenously determined long run economic growth in the model. Solow (1956) argued that growth of capital contributed to the growth of GDP while unexplained residual termed as total factor productivity was used to measure the long run economic growth. The Solow model augmented with human capital can be written as:-

$$\mathbf{Yt = (A_t L_t)^{1-\alpha-\beta} (K_t)^{\alpha} (H_t)^{\beta}}$$

Where Y is GDP, AL is effective labor, K is physical capital, H is human capital, α, β and $\mathbf{1-\alpha-\beta}$ measure the elasticity of the output to the respective inputs. The model assumes that $\alpha+\beta < 1$ such that it exhibits constant returns to scale but diminishing returns to reproducible factors. Based on features of the Solow exogenous growth model, Bernanke and Gurkaynak (2001) concluded that endogenous growth model can explain long run economic growth in a better way.

2.1.4 Romer-Lucas inspired Endogenous Growth model

The model was pioneered by Romer (1986) and Lucas (1988). The model internalizes technology and human capital and these factors are characterized with increasing returns which drive the economy. Romer (1986), Lucas (1988), Rebelo (1991) and Barro (1991) in their individual works emphasized the effects of human capital accumulation on economic growth. In the model, human capital is treated as a factor of production which determines the long run economic growth. In their work, human capital accumulation variable was an endogenous rather than exogenous as in the case of exogenous growth model. Lucas (1988) explain how the type of human capital accumulation is based on the type of goods produce in the country which further depended on the comparative advantage of a country. He argued that in the absence of international trade, human capital accumulation based on learning by doing could have a diminishing return to scale hence exhibit importance of trade on human development. Romer

(1990), Grossman and Helpman (1991a), Lichtenberg et al. (1998) also showed how human endogenous growth theory explains how economic growth may a result of an economic factor such as innovation and technological improvements and spillovers. Open economies provides a room for innovation which could consequently lead to technological improvement, diffusion of international knowledge spillovers, access to international inputs, diffusion of soft and hard technologies such as marketing, management and production experts.

2.2 EMPIRICAL LITERATURE

The empirical studies involves application of modern techniques of co-integration and error correction model in determining causality and direction of causality between variables[6] (Johansen and Juselius, 1990). The previous methodologies used included simple correlation coefficient, neoclassical growth accounting techniques of production function analysis and Granger or Sims causality[7] (Granger, 1969; Sims, 1972). Due to inability of the correlation approach and production regression model to verify or refute the causal relationship of the two variable and other shortcomings[8], most of the researchers have utilized new time series techniques (Toda and Yamamoto, 1995; Dolado and Lutkepohl, 1996). These techniques are able to test the nature and direction of the causality of the variables under investigation using either a bivariate or a multivariate framework (Johansen and Juselius, 1990).

2.2.1 Human Development and Economic Growth

Empirical studies investigating the causality linkage between human capital and economic growth gained popularity in the late 1980's after the emergence of new growth theories pioneered by proponents of human capital endogenous hypothesis (Romer, 1986; Lucas, 1988; Rebelo 1991). Different proxies for human capital have been utilized in the empirical test analysis of the human capital and economic growth (Romer, 1986; Lucas, 1988; Barro, 1991; Mankiw et al., 1992)

[6]Some of these new time series techniques are unit roots and co-integration analysis, Toda-Yamamoto Augmented Granger Causality, multivariate Granger causality based on VECM or VAR Bounds Testing Approach to Co-integration (ARDL approach). Some of the studies which applies some of these approaches are discussed under the empirical literature section

7 See examples of the empirical studies using those different methodologies in subsequent section of empirical literature

8 The main shortcomings are related to the reversal of causation, simultaneity and Spuriousness of the empirical results

Middendorf (2006) investigated human capital and economic growth nexus in OECD countries. The paper employed the panel data estimation framework, using fixed effects model and instrumental variable estimation. The study found that an increase in average school years raised the economic growth rate by 0.9% though Islam (1998) found that average school years had negative effects on growth rate.

Vinok and Kaushik (2007) investigated the effects human capital on economic growth for 18 developing countries, with Kenya and Uganda been only Africa countries in the analysis. They applied a multivariate regression in determining the relationship between the factors for the period between 1982 and 2001. The regression data found a statistically significant and positive coefficient for human capital. The study found out that a 1% increase in literacy increased growth by 1.2-4.7% in most of the countries.

Moboloji, (2010) conducted a study to determine the importance of banking development, human capital and economic growth in Sub-Saharan Africa. The study employed a panel data methodology by utilization of fixed effect techniques, random effects techniques and maximum likelihood estimation techniques. The paper further carried out some sensitivity analyses. The study found that human capital was statistically significant at 1% significant level and showed that 1% increase in human accumulation could result to 2% increase in output per worker. There was a strong existence of complementarity between human capital and financial development and the two variables had a progressive effect on the economic growth.

Cadil et al. (2014) studied the Human capital endowment's effects on the economic growth and unemployment in the European region. Using robust regression techniques for the period between 2007 and 2010, they found negative effects of human capital endowment on the economic growth and lack of any association between human capital and the rate of unemployment. The negative effects were attributed to over education effects, structural unemployment and over educated population which could not march the requirements of the European region market.

Benerjee and Roy (2014) applied an improved growth accounting model and ARDL based cointergration techniques in determining the impact of human capital technological progress and trade on the India economic growth for 1950-2010 period. The study results found that human

capital positively causes economic growth and technological spillovers from international trade played an important role in the long run growth.

Pelinescu (2015) used a panel methodology to explore the impact of human capital on economic growth using the annual data for 2000-2012 period. In the study, number of employees with secondary education and number of patents were used to proxy human capital. The empirical results showed a significant and positive relationship between GDP per capita and the human capital for the entire period. However, the study revealed a negative relationship between human capital and GDP per capital for 2008 and 2009 owing to the financial crisis that affected the European Union member states.

2.2.2 Export and Economic Growth

Michaely (1977) conducted a study to determine the impact of exports of goods on the economic growth. The study utilized majorly Spearman Rank Coefficient to determine any relationship and it covered the period between 1950 and 1973. The empirical results showed that there was existence of a significant positive relationship between economic growth and export. The study primarily relied on the presence of high correlation between variables to conclude existence of export-led growth strategy. In their paper, Jung and Marshall (1985) only established support for export-led hypothesis in four countries (Indonesia, Costa Rica, Egypt and Ecuador) and growth-led hypothesis in three countries (Kenya, Thailand and Iran). The study encompassed 37 countries. Ahmed and Kwam (1991) employed ECM and co-integration methodology for 47 African countries and found no evidence for the support of export-led hypothesis. However upon apportioning them into two sub-samples, there was a meagre support for growth-led proposition for 1981-1987 period.

Afxentious and Serletis (2000) conducted a research on the causality between output growth, imports growth and exports growth for a sample of fifty countries covering fifty countries over the world using a continuous data from 1970 to 1993. At 5% significant level, the results from all countries including the Asian tigers did not support the export led hypothesis. However causality was found in two oil exporting countries (Indonesia and Oman) at 10% level of significance. Among the countries included in the study were 15 Sub-Saharan Countries.

In a study in Costa Rica, Smith (2001) found evidence for both short and long run relationship between exports and economic growth hence supporting the export led growth hypothesis. The study cover the period between 1950 and 1997. In Pakistan, Ahmad et al. (2004) found support for export-led hypothesis using TYDL[9] Granger causality. The empirical results established evidence of unidirectional causality from exports growth to output growth. From the study findings, the foreign direct investment proved to be another crucial macroeconomic factor of export promotion policies that cannot be overlooked. However, in Greece, Dritsaki (2013) found that exports and debt servicing influenced the growth of national output in the short run but failed to support export led hypothesis in the long.

Muhoro and Otieno (2014) investigated the export led growth hypothesis in Kenya using annual time series techniques of Autoregressive Districted Lag and two-stage least square which factors in the problem of endogeneity between the variables. Using a seven-variable Vector Auto Regression (VAR) model, the empirical results confirmed causality running from exports to economic growth hence reinforced export-led hypothesis in Kenya for the period between 1976 and 2011. This results contradicted Ngumi et al. (2013) results which depicted insignificant influence of manufactured exports on economic growth over 1970-2007 period.

Some studies have explored more on export led growth hypothesis in a trivariate analysis by incorporating a third variable. Amoateng and Adu (1996) incorporated external debts in the analysis of export-led growth strategy in African countries and found a bidirectional causality among the variables. Ahmed et al. (2000) examined south and East Asian countries and their empirical results showed no feedback among exports, external debts and economic growth. While utilizing a trivariate framework, Levin and Raut (1997) carried study on the role of exports and human capital on economic growth. The study results showed that human capital and export significantly influence the GDP growth. The sample was made up of 30 semi-industrialized developing countries over the period 1965-1984. The results done by Chuang (2000) using Granger Causality test under ECM and co-integration supported both the export-led

[9] This approach was developed by Toda and Yamamoto in 1995 and Dolado and Lutkepohl in 1996. The model has been found superior to ordinary Granger-causality tests since it is possible to test Granger's concept of causality on an augmented VAR levels even if analyzed series are integrated or co-integrated of an arbitrary order. It avoids the potential bias associated with unit roots and co-integration tests since it can be applied regardless of the nature of the order of integration.

growth hypothesis and human capital based endogenous growth theory for the 1952-1995 period in Taiwan.

2.3 LITERATURE REVIEW

There is a large literature which examines the export- growth relationship in a bivariate model. Notwithstanding such, results from the vast empirical studies on the export and growth variables for either a country specific or cross-country studies (Ahmed et al., 2004) have produced different conclusions of which some are contradicting. The deficiency of a reliable causal pattern may be accredited to misspecification of the causal framework utilized in these past studies due to omission of a third important economic variable. Trying to mitigate these controversies, many other studies have been conducted that included other relevant macroeconomic variables (financial development, foreign direct investment, trade openness, external debts, human capital, energy consumption, imports, expenditure on Research and development) in a multivariate framework analysis and tried to exert their pressure on export-led-growth and human capital endogenous hypothesis (Ahmed et al., 2004; Chuang, 2000;) .

However, some of these variables have been found to be significant in some of the studies while at the same time insignificant in other empirical studies carried out (Levite and Renelt, 1992; Sala-i-Martin et al., 2004). For this reason, such anomalies may be addressed by focusing on the importance of some specific variables such as exports, human capital and economic growth. From most of the empirical studies which includes a third variable in examination of export led growth verse growth led export and human capital endogenous hypotheses, it can be argued that some of these macroeconomic variables can be significant in explaining the hypotheses and omitting them from analysis may either conceal or exaggerate the effects of exports and economic growth. Kenya has been included in some of studies which used cross country panel analysis (see Afxentious and Serletis, 2000; Levin and Raut, 1997).

In these studies, assumption is made that the countries grouped in the analysis have similar social economic and political settings and features. However the grouped study assumption raises some questions considering that different countries have diverse social-economic and political systems. For this reason, it can be argued that the country specific study is appropriate on account of the special traits in each country. It is also fundamental to realize that under cross-country analysis, an assumption of parametric invariance across countries is made and this renders it difficult to draw policy implication for a specific country.

This paper will utilized a trivariate structure in examination of export-economic growth nexus by incorporating human development. The study therefore undertakes to investigate the association between export, human capital and economic growth by employing cointergration and augmented granger causality analysis in Kenya.

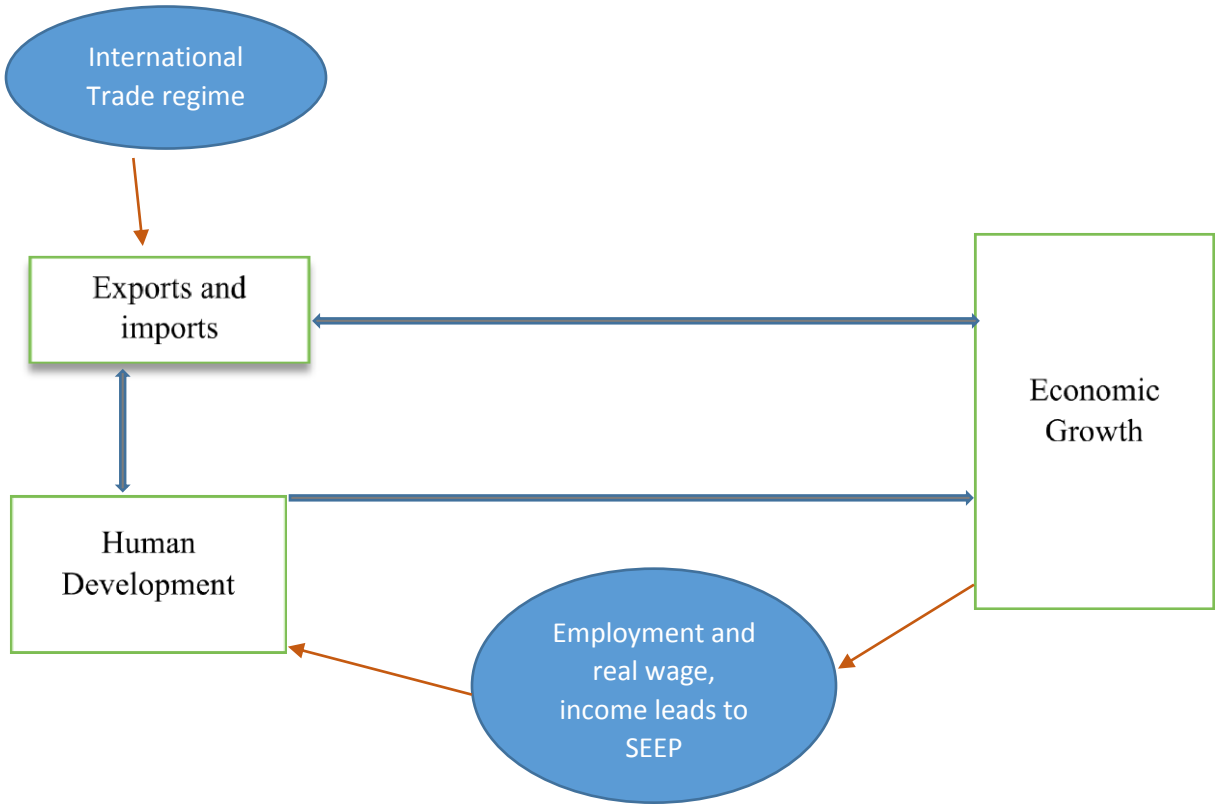
CHAPTER THREE- METHODOLOGY

This chapter discusses the conceptual model, the various estimation method utilized and the nature and the source of data utilized by the study.

3.1 CONCEPTUAL FRAMEWORK

The conceptual framework for examining the causality relationship between exports, human development and economic growth is based on human development report linking trade and human capital and their impacts to economic growth (UNDP, 2006). The conceptual framework is diagrammatically shown in figure 4 below.

Figure 4: The conceptual Framework for export, human development and Growth



Source: UNDP (2006)

Where SEEP means Sustainability, Empowerment, Equity and Productivity and are known as the four pillars of human development

From figure 4, trade represented by export and imports have the capacity to influence the rate of economic growth which concurrently improves the employment rate of factors of production. Skilled human capital are able to adopt more quickly to the sophisticated technology and rapid

production changes required for competitiveness on international markets. Human development through domestic policy framework influences export flows hence feedback effects between them. These effects work through higher income, higher technical competence and skills. Human development can also have a direct influence on the rate of economic growth and trade (UNDP, 2008).

3.2 ECONOMETRIC METHODOLOGY

Various econometric methodologies including correlation, Ordinary Least Squares, Engel-granger for cointergration, ARDL, TYDL, Johansen Maximum likelihood (ML) for cointergration and ECM have been employed in causality analysis in the past empirical studies (Michaely, 1977; Ahmad et al., 2004; Benerjee and Roy, 2014). However, the latter econometric methodology, that is Johansen-ML and ECM have various advantages over the other methodologies in that it affords more accurate estimates of the variables of the cointergration model and does not suffer the problem of normalization. Hence this paper employed the Johansen cointergration and error correction model to determine long run and short run causal relationship between the variables. This is done in three stages. First, variables are tested for stationary. If the variables are established to be non-stationary, co-integration follows to establish the long run equilibrium. Vector error correction (VEC) or Vector Autoregressive model (VAR) (based on the rank of the π matrix) is then applied to establish the nature and the direction of causality between the variables. VAR model is the reduced form of VEC model without error corrections patterns.

3.2.1 Stationary test

The time series properties of the variables are examined by unit roots test. The aim of this test is to establish the stationarity condition for the study variables in order to avoid spurious regression and to eliminate erroneous inference. A stationary series has no unit root hence is said to be integrated of order zero, which is usually denoted by $X_t \sim I(0)$ and such series do not require any differencing while non-stationary series has unit roots and thus we say it is integrated of order *d*, denoted by $X_t \sim I(d)$ and the series is differenced *d* times to make the series stationary (Gujarati, 2004). The paper applies Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1981) and Phillip and Perron (PP) test (Phillip and Perron, 1988) for stationarity test. PP test is included in the study because it has superior testing power compared to ADF test. The Zivot and Andrews (1992) test is preferred for confirmation of the results because it tends to be more robust to serial

correlation and autoregressive heteroscedasticity of the error term and it takes care of structural breaks in the data.

3.2.2 Determination of Lag length

To ensure suitable specification of the model, optimal lag length is determine prior to testing of the co-integration amid the variables. Some of the information criteria that have been recognized by the literature when the vector autoregressive model is subject to restrictions of co-integration includes Akaike Information Criteria (AIC), Hannan-Quinn Information Criteria (HQIC), Schwarz Bayesian Criteria (SBC) and Final Prediction Criteria (FPC) (Gujarati, 2004). Most of the past studies use AIC and SC and are utilized also in this paper. The formulas for AIC and SC is specified as follows AIC (n) = logσ^2 + 2n/N and SC (n) = Inσ^2 + n log (N)/N respectively.

3.2.3 Co-integration Test

The procedure for co-integration involves determination of the existence of long run equilibrium relationship but it does not explain the direction of the causality of the variables. If the variables are not co-integrated, then long run equilibrium relationship does not exist hence only short run relationship can be carried out in such a case (Asterious and Hall, 2007). In bivariate framework, two series can only be co-integrated if they are integrated of the same order, say order *d.* Engel and Granger (1987) considered two series, X_t and Y_t both with order of integration *d* and showed that a linear combination of both series was generally *I (d).*However, if the linear combination of *I (d)* series is stationary, the series are said to be co-integrated, that is, if $X_t \sim I(d)$ and $Y_t \sim I(d)$ and $Z_t = Y_t - \beta X_t$ is $I(0,)$ then X_t and Y_t are said to be co-integrated.

Given a vector AR (p) of *I* (1) X's: $X_t = \phi_1 X_{t-1} + \ldots + \phi_p X_{t-p} + \varepsilon_t$, then the generalization of Johansen's error correction representation is given as follows:

$$\Delta \boldsymbol{X_t} = \propto + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p-1}} \acute{\Gamma}\mathbf{i}\, \Delta\, \mathbf{X(t-i)} + \prod \boldsymbol{X_{t-p}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(2)}$$

Where

X_t is a vector of p variables in the model, $\acute{\Gamma}_i = -I + \phi_1 + \ldots\ldots + \phi_{i;}$ i = 1, …, p-1 {a square (p x p) matrix}, Π ($\Pi = \alpha\beta'$ where α and β are p x r matrices of rank r) is the number of independent co-integrating vectors, ΠX_{t-p} is the error correction term (long run relationship) and $\Delta X_t = X_t - X_{t-1}$

The two tests (Maximum Eigen Value and trace tests)[10] that estimates the number of co-integrating vectors in Johansen's cointergration procedure will be employed in this study (Johansen, 1988).

3.2.4 Granger Causality

Given, two variables X and Y, variable Y is said to Granger cause variable X if we are more likely to predict X with exactness using the entire information on Y and X than if only past information on X had been employed. If X_t Granger cause Y_t and Y_t Granger cause X_t then $Z'_t = (X'_t, Y'_t)$ is a feedback system. In theoretical literature, most of the macroeconomic variables are not stationary at their level and become stationary at their first difference, that is, they are integrated of order 1 (Gujarati, 2004).Causality tests are valid if and only if the variables under consideration are co-integrated. Simple Granger causality approach (Granger, 1969 and Sims, 1972) and Error Correction Model approach are used in determination of causality between variable. The rank of Π matrix in the error correction representation determines the model to be used in causality analysis. If Π matrix =0 then there is no cointergration implying non-existence of long run relationship. In this case VAR model is estimated. If Π has a full rank (Π matrix = p), then the vector process is stationary and the equation in X_t is modelled in levels- *I* (0). If Π matrix = r, where 0 < r > p then VEC model is estimated. In this study, an assumption is made that Π matrix = r hence VEC model is adopted.

3.2.5 Model Specification

Human capital theory based on Romer (1990) is utilized in this study. The theory states that economic growth is influenced by not only physical capital and labor but also by human capital. The theory has been utilized by various empirical studies among them (Chuang, 2000; Mobolaji, 2010 and Din, 2013). Mankiw et al (1992) (MRW) model extended the Solow model by augmenting it with human capital such that the production function is given as

$$\boldsymbol{Y_t = A_t K_t^{\beta 1} h_t^{\beta 2}} \qquad 0< \beta_1 >1 \text{ and } \; 0< \beta_2 > 1 \qquad \textbf{(1)}$$

Where Y_t, A_t, K_t, and h_t are gross domestic product, Total Factor Productivity (TFP), capital stock and human capital respectively.

[10] The formulas for the two tests are shown as $LR_{max}(m) = -(T-p)\log(1-\delta_{m+1})$ and $LR_{tr}(m) = -(T-p)\sum_{i=m+1}^{k} In(1-\delta_i)$ respectively (see Johansen 1988)

Human capital from the equation 1 represents only the education sector which is commonly measured by literacy rate or net school enrolment. Therefore, equation 1 is extend by replacing human capital (**h)** with human development (**H**) variable which incorporates not only the education sector but also the health sector and standards of living.

$$\boldsymbol{Y_t = A_t K_t^{\beta 1} H_t^{\beta 2}} \qquad 0< \beta_1 >1 \text{ and } \quad 0< \beta_2 > 1 \qquad \textbf{(2)}$$

According to Levin and Raut (1997) TFP is endogenously determined by volume of exports (X), the share of imports in GDP (M/Y) and the residue productivity factor ($\mathbf{C_t}$). The function captures some of the effects of export-oriented policies on TFP and is expressed as follows:

$$\boldsymbol{A_t = C_t \left[1 - \left(\frac{M}{Y}\right)_t\right]^{\beta 3} X_t^{\beta 4}} \qquad \textbf{(3)}$$

X from the equation shows the superiority of the export sector, (M/Y) shows the effect of externalities or alleviation of import capacity constraint and $\mathbf{C_t}$ shows the exogenous influences.

We substitute equation (3) into equation (2) to obtain equation (4) expressed as

$$\boldsymbol{Y_t = C_t \left[1 - \left(\frac{M}{Y}\right)_t\right]^{\beta 3} X_t^{\beta 4} K_t^{\beta 1} H_t^{\beta 2}} \qquad \textbf{(4)}$$

By taking the natural logarithm of equation (4), and assuming the approximation that

$\log(1 + w) \cong w$ and $In\, C_t = \boldsymbol{\beta_0}$ is the constant parameter we obtain the long run co-integrating equation

$$\boldsymbol{In\, Y_t = \beta_0 + \beta_1 InK_t + \beta_2 InH_t + \beta_3 In\left(\frac{M}{Y}\right)_t + \beta_4 InX_t + \mu_t} \qquad \textbf{(5)}$$

μ_t is the stochastic error term with mean zero and a constant variance

The short-run dynamic parameters are obtained by estimating an error correction models associated with long run estimates. Hence the granger causality test incorporating VEC is specified as

$$\boldsymbol{\Delta In\, Y_t =}$$

$$\boldsymbol{\alpha_0 + \sum_{i=1}^{N} \alpha_{1i} \Delta InY_{t-i} + \sum_{i=1}^{N} \alpha_{2i} \Delta InK_{t-i} + \sum_{i=1}^{N} \alpha_{3i} \Delta InH_{t-i} + \sum_{i=1}^{N} \alpha_{4i} \Delta In\left(\frac{M}{Y}\right)_{t-i} +}$$

$$\boldsymbol{\sum_{i=1}^{N} \alpha_{5i} \Delta InX_{t-i} + \partial_1 ECM_{t-1} + \varepsilon_{1t}} \qquad \textbf{(6)}$$

$$\Delta In\, X_t =$$

$$\rho_0 + \sum_{i=1}^{N} \rho_{1i} \Delta InX_{t-i} + \sum_{i=1}^{N} \rho_{2i} \Delta InK_{t-i} + \sum_{i=1}^{N} \rho_{3i} \Delta InY_{t-i} + \sum_{i=1}^{N} \rho_{4i} \Delta In \left(\frac{M}{Y}\right)_{t-i} +$$

$$\sum_{i=1}^{N} \rho_{5i} \Delta InH_{t-i} + \partial_2 ECM_{t-1} + \varepsilon_{2t} \qquad (7)$$

$$\Delta In\, H_t =$$

$$\gamma_0 + \sum_{i=1}^{N} \gamma_{1i} \Delta InH_{t-i} + \sum_{i=1}^{N} \gamma_{2i} \Delta InK_{t-i} + \sum_{i=1}^{N} \gamma_{3i} \Delta InY_{t-i} + \sum_{i=1}^{N} \gamma_{4i} \Delta In \left(\frac{M}{Y}\right)_{t-i} +$$

$$\sum_{i=1}^{N} \gamma_{5i} \Delta InX_{t-i} + \partial_3 ECM_{t-1} + \varepsilon_{3t} \qquad (8)$$

Where $\alpha_{ji,}\, \rho_{ji}, \gamma_{ji} (j = 1 \ldots\ldots 5)$ are the short run dynamics coefficients of the models' convergence to equilibrium and ∂_1 is the speed of adjustments to a long run equilibrium

From (6) four outcomes are of interest for short run causality based on the economic theory. First, X and H Granger cause Y if null hypothesis is rejected. Secondly, Y and H Granger cause X if null hypothesis is rejected. Thirdly Y and X Granger cause H if null hypothesis is rejected. Fourth outcome, a feedback system holds if the first, second and third outcomes hold simultaneously (Granger, 1969). For the long run causality, the significance of the coefficients for the error corrections term are test.

3.3 DATA TYPE AND SOURCES

The study utilizes annual time series secondary data for Kenya for the period 1980 to 2015. The data for GDP, HDI (proxy for human development), fixed capital formation and exports will be extracted from World Development Indicators from World Bank and Economic surveys and statistical abstracts which are published by Kenya National Bureau of Statistics (KNBS). Table 2 shows variables definition, measurement and expected signs

Table 2: Definitions, measurements and expected signs for the variables

Variables	Definitions and Measurements	Expected Sign
In Y_t	Represents the logarithm of Gross Domestic Product in Kenya (GDP). GDP is the worth of goods and service which the country produces.	$\beta_0 > 0$
In K_t	Represents the logarithm of physical capital. It is proxied by the fixed capital formation obtained from World Development Indicators	$\beta_1 > 0$
In H_t	Represents the logarithm of human development in the country. It is proxied by human development index obtained from author's computations using UNDP formulas. HDI is a composite of life expectancy index, education index, and GNI index. The data will be obtained from World Development Indicators	$\beta_2 > 0$
In X_t	Represents the logarithm of volumes of exports of goods and services. Exports value is the worth of exported goods and services by Kenya	$\beta_3 > 0$
In M_t	Represents the logarithm of volumes of imports of goods and services. Imports value is the worth of imported goods and services in Kenya	$B_4 < 0$

CHAPTER FOUR-ANALYSIS, RESULTS AND DISCUSSIONS

This chapter embarks on the empirical approaches used to quantify the links between human development, exports, physical capital, imports and economic growth in order to understand the underlying forces in the Kenyan economy. To evaluate the relations, several equation estimation techniques are utilized. As earlier started in the previous chapters of the paper, the study seeks to establish the role of human development and exports on the economic growth in Kenya.

4.1 DESCRIPTION OF DATA

Before performing any empirical econometric analysis, it is important to institute the elementary characteristics of the time series data covering the study by carrying out a descriptive analysis of data. In the study, two types of descriptive analysis were carried out namely: descriptive statistics of data and correlation matrix for the period between 1980 and 2014.

4.1.1 Descriptive statistics of Data

Before analyzing in details the empirical tests of the time series data, it is crucial to run the data descriptive statistics to understand the normality and a symmetric distribution of *In* GDP (Gross Domestic Product), *In* K (Fixed capital formation), *In* H (Human Development), *In* X (Exports of goods and services) and *In* (M/Y).

Table 3: Descriptive Statistics Results

	***In* Y**	***In* X**	***In* K**	***In* (M/Y)**	***In* H**
Mean	23.9750	22.3235	21.6940	22.3573	-0.7350
Medium	23.9440	22.3315	21.4236	22.4265	-0.7604
Std Deviation	0.3599	0.4379	0.8146	0.7551	0.0659
Minimum	23.4050	21.6444	20.6971	21.1705	-0.8074
Maximum	24.6783	22.9770	23.3677	23.5898	-0.5656
Skewness	0.2448	-0.1081	0.7930	0.1430	1.1495
Kurtosis	2.1616	1.8054	2.2743	1.7888	3.0457
Jarque-Bera	1.4139	2.2106	4.5631	2.3234	7.9308
Probability	0.49315	0.33111	0.10213	0.31296	0.01896
Sum	863.1012	803.6471	780.9852	804.8632	-26.4383
Sum Sq. Dev.	4.53301	6.71063	23.2273	19.9549	0.15193
Observation	36	36	36	36	36

The normality and distribution was done by running different measures of central tendency and measures of variability. Jarque-Bera test uses the mean based coefficients of skewness and kurtosis to establish the normality state of the variables. Kurtosis coefficient measures the peakedness of the dispersal for the time series data and ranges between -3 and +3 when the data series is normally distributed. For the skewness, it measures the degree of asymmetry in the data and data series is said to be normally distributed if skewness coefficients falls with -2 and +2 range.

From the Table 3 above, the mean and medium coefficients of the variables are almost identical hence predicting that the variable are normally distributed. The maximum and minimum estimates of the study variables depicts very little variations, inferring stability of the time series data over the period of study. Jarque-bera test for normality indications that the *In* GDP, *In* K, *In* H, *In* X and *In* (M/Y) are normality distributed given that skewness estimates are almost zero and the kurtosis estimates are less than +3. Skewness estimates for *In* GDP, *In* K, *In* H, and *In* (M/Y) were positive implying that their distributions are skewed to the right and while the skewness estimate (-0.1081) for *In* X is negative implying that exports distribution is negatively skewed hence its distribution has a longer left tail compared to the right tail.

4.1.2 Correlation Matrix Results

The correlation test are used to merely explore the static association between variables in regression and its values ranges between -1 and +1. The values of correlation implies the level of multicollinearity between variables. High values of correlation estimates shows that the variables are highly correlated.

Table 4: Correlation Matrix Results

	***In* Y**	***In* K**	***In* H**	***In* X**	***In* M**
***In* Y**	1.00000	0.9254	0.87180	0.97150	0.57570
***In* K**	0.92540	1.00000	0.30360	0.56420	0.41300
***In* H**	0.87180	0.30360	1.00000	0.40160	0.34550
***In* X**	0.97150	0.56420	0.40160	1.00000	0.65310
***In* M**	0.57570	0.41300	0.34550	0.65310	1.00000

The correlation matrix in table above depicts the existence of positive correlation between the variables in the study thus in line with the economic theory. There is a highly positive correlation between *In* Y, *In* K, *In* X strongly suggesting the presence of multicollinearity between the regressors in the model. Presence of multicollinearity affects the reliability of the model estimates since it increase the variance and standard error of the estimates. However, according to Gujarati (2004) multicollinearity does not infer the model is misspecified since the best linear unbiased estimator (BLUE) properties of regression remains unaffected and standard errors retain their validity.

4.2 UNIT ROOT TEST

As it is discussed from chapter three, it is important to establish the integration properties for all-time series data used in the study prior to estimation. From economic theory, it is always assumed that most of macroeconomic variables in time series exhibits a stochastic time frame hence presence of unit roots. It is always necessary to check for stationarity properties of the data in order to avoid problems of spurious regression which may influence the policy implications that could be inferred from modelling hypothesis (Engel and Granger, 1987).

Table 5.1: Unit root tests results at levels

Variables	Test	Lag	Restriction	t-stat	5% critical values	Inference
***In* Y**	ADF	2	Const., LT	-0.859	-3.568	Non stationary
	PP	2	Const., LT	-0.719	-3.56	Non stationary
	Z & A	2	Const., LT	-2.938	-4.800	Non stationary
***In* X**	ADF	4	Const., LT	-3.098	-3.576	Non stationary
	PP	4	Const., LT	-2.674	-3.560	Non stationary
	Z & A	4	Const., LT	-3.744	-4.800	Non stationary
***In* K**	ADF	1	Const., LT	-1.907	-3.564	Non stationary
	PP	1	Const., LT	-0.982	-2.972	Non stationary
	Z & A	1	Const., LT	-3.536	-4.800	Non stationary
***In* (M/Y)**	ADF	2	Const., LT	-3.417	-4.564	Non Stationary
	PP	2	Const., LT	-2.183	-3.560	Non Stationary
	Z & A	2	Const., LT	-3.897	-4.800	Non Stationary
***In* H**	ADF	2	Const., LT	0.219	-3.568	Non stationary
	PP	2	Const., LT	1.444	-2.972	Non stationary
	Z & A	2	Const., LT	-1.851	-4.800	Non stationary

* Const-Constant, LT-Linear Trend

* The optimal lag lengths of the three unit tests were determined by SIC, AIC and HQIC

* ADF-Augmented Dickey Fuller, PP-Phillip and Perron and Z & A- Zivot and Andrews test

In order to estimate the order of integration for each of the variables that enters the multivariate model, the ADF and PP test for unit root were conducted. Zivot and Andrews' unit test was also conducted to prove the results of the above tests since it considers structural breaks in time series. The stationarity test were conducted solely to establish whether the variables used were dependent of time. The test were carried at 5% significance level.

Table 5.1 above shows the results for all variables in the study. All unit tests conducted failed to reject the null hypothesis for *In* Y, *In* X, *In* K and *In* H implying existence of unit roots at their levels. In carrying out the tests, if the calculated test statistics value is greater than the critical value (in our case at 5% critical value), then the null hypothesis is rejected, henceforth absence of unit root in the variables. From Table I4 in the appendix, the restrictions of the variables are determined by graphing each variable over time.

In order to determine the order of integration of the variables, the series were differenced and tested for the unit root as before. Table 5.2 shows the results of the variables after differencing the variables. The ADF, PP and Z&A tests reject the null hypothesis of unit root after differencing hence the variables had no unit root showing that *In* Y, *In* K, *In* X, *In* H and *In* M/Y are integrated of order one, *I*(1). This findings implies that there may be one or more cointergration vectors between the variables hence cointergration test was carried out.

Table 5.2: Unit root test results at first difference

Variables	Test	Lag	Restriction	t-stat	5% critical values	Inference
***In* Y**	ADF	1	Const., LT	-3.276	-2.978	*I(1)*
	PP	1	Const., LT	-3.374	-2.975	*I(1)*
	Z & A	1	Const., LT	-4.764	-4.800	*I(1)*
***In* X**	ADF	3	Constant	-2.714	-2.623	*I(1)*
	PP	3	Constant	-5.794	-2.975	*I(1)*
	Z & A	3	Constant	-5.872	-4.800	*I(1)*
***In* K**	ADF	2	Constant	-4.408	-2.975	*I(1)*
	PP	2	Constant	-4.517	-3.564	*I(1)*
	Z & A	2	Constant	-4.964	-4.8	*I(1)*
***In* (M/Y)**	ADF	1	Const., LT	-4.417	-3.564	*I(1)*
	PP	1	Const., LT	-5.183	-3.560	*I(1)*
	Z & A	1	Const., LT	-5.897	-4.800	*I(1)*
***In* H**	ADF	1	Constant	-4.406	-2.978	*I(1)*
	PP	1	Constant	-8.101	-2.975	*I(1)*
	Z & A	1	Constant	-11.025	-4.800	*I(1)*

4.3 COINTEGRATION AND ERROR CORRECTION MODEL PROCESSES

This section covers the cointergration, stability of the vector error correction model, and vector error correction model and the interpretations of the results for the analysis.

4.3.1 Lag Length Determination

It is important to determine the selection of the unrestricted vector autoregressive (p) process before carrying out the cointergration and VECM of the study. The optimal lag length included in the cointergration and VECM was determined using several criteria as stated earlier in chapter three of the study.

Table 6 shows the results of the optimal number of lag length using different criterions. From the results below, LR, FPE, AIC, HQIC and SBIC show different and conflicting optimal lag length for pre-estimation of VEC model. When the sample size is small (less than 100), AIC and FPE are recommended for the determination of optimal lag since both have superiority over other criteria (Enders 2010). However, in this study, AIC results shows an optimal lag length of four while FPE shows an optimal lag length of one hence conflicting results. In this case, HQIC is used to solve such conflicts (Liew, 2004) hence FPE optimal lag length of one was chosen which corresponds to HQIC optimal length.

Table 6: Optimal Lag Length Results

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	129.65				2.8e-10	-7.7906	-7.7147	-7.5616
1	290.391	321.48	25	0.0000	6.0e-14*	-16.275	-15.819*	-14.901*
2	311.373	41.964	25	0.0180	8.80e-14	-16.023	-15.188	-13.504
3	340.453	58.158	25	0.0000	9.60e-14	-16.278	-15.064	-12.614
4	375.584	70.263*	25	0.0000	1.10e-13	-16.912*	-15.317	-12.102

* Indicates lag order selected by the criterion
LR: Sequential modified LR test statistics (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
HQIC: Hannan -Quinn information criterion
SBIC: Schwarz Bayesian Information criterion

4.3.2 Cointergration Estimation

The study utilized the Johansen Maximum Likelihood (ML) Procedure for testing presence of cointergration in a multivariate framework. Assumption was made on existence of at least one cointergration vector. The study utilized Johansen ML over Engle-Granger two stage methodology because restrictions can be applied to cointergration vectors, which is not possible with Engle-Granger two stage approach. When Johansen ML is applied in VEC, there is less need for determining whether the explanatory variables are endogenous or exogenous.

As discussed in chapter three, the Johansen ML produces two statistics which are maximal eigenvalue of stochastic matrix and trace statistics of the stochastic matrix which were used to determine the number of cointergration vectors. After establishing the results on the Johansen ML, the long run coefficients were then determined together with the resultants error correction model. Table 7 shows the results after application of Johansen ML approach to test for cointergration utilizing VAR at an order of 1. Both, Maximal eigenvalues and trace statistics are presented in the table. From the table, because the max statistics and trace statistics values at r=0 of 33.48393 and 76.79409 exceeds their critical values of 31.87687 and 69.81889 respectively, the null hypothesis of no cointergration equation was rejected. However at r<=1, the null hypothesis was not rejected. Hence the results shows that there is existence of at most one cointergration relationship. This further shows that the variables in the model converges to the long run equilibrium.

Table 7: Cointegration Test Results for Trace an and Max eigenvalue Statistics

Sample (adjusted): 1982 2015
Included observations: 34 after adjustments
Trend assumption: Linear deterministic trend
Series: INY INX INM INK INH
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	05 Critical Value	Prob.**
None *	0.603864	76.79409	69.81889	0.0125
At most 1	0.486865	45.31016	47.85613	0.0851
At most 2	0.376593	22.62482	29.79707	0.2650
At most 3	0.166405	6.557909	15.49471	0.6295
At most 4	0.010813	0.369645	3.841466	0.5432

Trace 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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None*	0.603864	33.48393	31.87687	0.0440
At most 1	0.486865	22.68534	27.58434	0.1873
At most 2	0.376593	16.06691	21.13162	0.2210
At most 3	0.166405	6.188265	14.26460	0.5892
At most 4	0.010813	0.369645	3.841466	0.5432

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

The cointergration tests results in the table confirms that the variables are co-integrated. The cointergration equation of the variables are represented in table 8.

Table 8: 1st Cointegrating equation

1 Cointegrating Equation(s): Log likelihood 305.2734

Normalized cointegrating coefficients (standard error in parentheses)

INY	INX	IN(M/Y)	INK	INH	C
1.000000	0.217371	-0.405308	-0.188514	0.147453	-15.80060
	(0.10394)	(0.07391)	(0.07646)	(0.56209)	

Adjustment coefficients (standard error in parentheses)

D(INY)	-0.025401
	(0.01914)
D(INX)	0.041111
	(0.07600)
D(INM/Y)	0.250833
	(0.09894)
D(INK)	0.183296
	(0.13931)
D(INH)	-0.034536
	(0.01860)

Table 8 above shows the co-integration equation results. The standard error associated to estimation of each variable are small except for In H which has a quite high standard error of 0.56209. Small standards error implies that there is low uncertainty associated with estimation of the coefficients of *In* X, *In* (M/Y) and *In* K. Except for *In* K, all other variables have the expected sign.

4.3.3 Short Run Results/Error Correction Model

The residuals from the cointergration equations are used to generate an error correction term, that is lagged residuals, which is then inserted in the short run model as showed in Table A2. The lagged residuals acts as linkage between short run and long run relationships. From Table A2, ECT1, ECT2 and ECT3 represents the lagged residuals when *In* Y, *In* H and *In* X are dependent variables in estimation.

The coefficients of the ECT have expected negative signs and are statistically significant. The coefficients of lagged residuals reveals the speed of adjustment of the model to equilibrium. -0.4642 error correction term of economic growth implies that 46.42% of the prevailing long run disequilibrium will be adjusted per year when economic growth increases above its long run relationship with other variables. -0.6330 and -0.3023 error correction term of human development and export implies that the speed of adjustment towards equilibrium is at the rate of 63.3% and 30.23% towards long run equilibrium of human development and exports respectively.

Table A2 also shows that the R-squared, which measures the goodness of fit, of the short run models is 55.862% for Y, 52.9611% for H and 41.2668% for X. For instance, R^2 for Y shows that 55.862% of the total variations in economic growth are explained by the independent variables in the model.

When *In* Y is the dependent variable, the test statistics shows that exports and human development are statistically significant in explaining the variations in gross domestic product in the short run. A 1% increase in X (exports) results to 0.11918% increase in Y (economic growth) and a 1% increase in H (human development) results to 0.24098% increase in Y (economic growth). Imports per GDP share is not statistically significant in explaining the change in GDP though this variable exhibits the expected (negative) sign.

When *In* H is the dependent variable, the results in Table A2, Appendix shows that the coefficients of Y (0.427065) and X (0.041408) are statistically significant in explaining variations in H. This implies that a 1% increase in economic growth results to 0.427065% increase in human development and a 1% increase in exports results to 0.041408% increase in human development. K (fixed capital formation is not statistically significant in explaining variations in human development.

When In X is the dependent variable, the results in Table A2, Appendix shows that Y is statistically significant in explaining changes in exports in the short run. 1.39294 coefficient of Y implies that a 1% increase in economic growth results to 1.39294% increase in exports. Although imports per GDP share are statistically significant, the coefficient of M/Y has an unexpected positive sign. Human Development (H) is not statistically significant in explaining the variations in exports of goods and services (X).

4.4 DIAGNOSTIC TEST

To check the validity of the regression results, the study carried out Cholesky of covariance (Lutkeptol) normality test, Autocorrelation LM test and white heteroscedasticity (no cross term) tests on the error correction residuals. The results of the tests are contained in Table A3, Appendix I. The null hypothesis of no serial correction between the residuals at lag 1, 2 and 3 for Autocorrelation LM test was not reject given that the probability values of the test are greater than 10% significance level. White heteroscedasticity test results showed that the residuals were homoscedastic, hence heteroscedasticity was not a major problem. The probability test values for the Cholesky of covariance normality test showed that the null hypothesis of the test (that the residuals are multivariate normal) could not be rejected except for the component 3 which revealed rejection of the null hypothesis implying that the residuals of the component 3 is not normally distributed.

4.4 GRANGER CAUSALITY

The granger causality was carried out to establish the validity of the export-led hypothesis and human development endogenous growth hypothesis. Granger Causality/Block Exogeneity Wald test was conducted for the variables in the study and the results are presented in Table A4, Appendix. The test inspects whether the null hypothesis of no causality between the dependent and independent variable is significant against an alternative hypothesis of existence of causality

relationship between the variables. Therefore rejection of null hypothesis implies presences of causality.

From Table A4, given that the p-value of 4.48% is smaller than 5% significance level, then the null hypothesis that INH1 does not Granger catuse INY1 is rejected. The null hypothesis of INY1 does not Granger cause INH1 is also rejected. This implies that there is existence of bidirectional causality effect running from human development to economic growth and from economic growth to human development in the short run. In the case of export and economic growth, the p-value of 8.26% shows that exports of goods and services in Kenya have causal influence on the economic growth at only 10% significance level. The null hypothesis that INY1 does not Granger cause INX is reject at both 5% and 10% significance level hence economic growth has a cause impact on exports. Therefore there is a bi-directional causal effect between export and economic growth at 10% significance level.

4.5 STABILITY TEST

The test is carried out by estimating cumulative sum test and cumulative sum of square test. Cumulative sum (CUSUM) test is used to measure whether the coefficients of the regression are changing systematically whereas cumulative sum (CUSUM) of square test measures whether the coefficients of the regression changes suddenly (Hansen, 1992). The Figure A2, Appendix shows that the blue lines for both CUSUM test and CUSUM of square are within the red line hence we fail to reject the null hypothesis of stability of parameters. This implies that all the variables in the model estimated are stable except for the period between 1994 and 1996 where the results shows a sudden change of coefficients of the regression.

CHAPTER FIVE-CONCLUSION AND RECOMMENDATION

This chapter provides the summary of the present study and the policy recommendation based on the study findings inferred from chapter four. The chapter covers the summary of the study in sub-section 5.1, policy recommendation in 5.2, limitation of the study and areas for further study in sub-section 5.3.

5.1 SUMMARY AND CONCLUSION

The role of human development and exports of goods and services on the economic growth cannot be overemphasized based on the theory. Built on the past empirical studies, while some studies approved this assertion, others have disapproved it. The studies have resulted to mixed results hence contradicting conclusions. It is against this background that the study sought to investigate the causal effects of human development and exports on the economic growth in Kenya over the period of 1980 to 2015. The study covers the period commencing with the introduction of liberalization policy which ushered in export promotion policy in 1980s and the introduction of the first conventional measurement for human development variable by UNDP in 1990.

The study sought to analysis the causality nexus between human development, exports of goods and services and the economic growth in Kenya. This area of study has not been examined thoroughly in Kenya hence dictating the interest to carry this particular study using time series data for a very long period coupled with advance multivariate time series techniques. The previous empirical studies carried around the same area differ adversely in terms of the econometric methodologies applied and the results thereafter. Some of the previous studies utilized only correlation to draw their conclusion (Jung and Marshall, 1985) while more recent empirical studies have acknowledged use of TYDL Granger causality techniques and Autoregressive Districted Lag and two-stage least square, Muhoro and Otieno (2014). Different choice of proxies for the variables contributes to varying and conflicting empirical results. For instance, human capital variable can be proxied by several factors such as school enrolment, literacy rate, expenditure on education, innovations, expenditure on research and development among others (Romer,1986; Rebelo, 1991; Gross and Helpman, 1991a).

Due to the above facts on the choice of econometric methodology and proxies for various variables to be utilized, the current study considered the use of cointergration and error correction model. To achieve the objective of the study, preliminary investigation of the time series data were conducted via use of unit root test and all variables were found to be non-stationary in their level and stationary in their first differences. Zivot and Andrew (1992) test for unit root was utilized to confirm the results for ADF and PP test for unit root because it takes care of structural breaks. The study then proceeded to test for cointergration relationship between the variables using Johansen ML techniques. According to Gujarati (2003), Johansen ML has advantages over the Engel-Granger two-stage cointergration techniques in that it affords more accurate estimates of the variables of the cointergration relationship and does not suffer the problem of normalization.

Using the Johansen-ML techniques, the study found existence of one cointergration vector hence confirming presences of long run relationship between the variables under the study. Since the variables were non-stationary at their level and were co-integrated, the study employed the vector error correction model in order to establish the short run relationship of the variables. The results for lagged residuals are presented in Table A2, Appendix. The error correction terms of 0.46421 for *In* Y, 0.633033 for *In* H and 0.302259 for *In* X were found to be statistically significant and having the expected negative sign. The results found existence of short run relationship between human development and economic growth implying that human development contributes positively towards the economic growth in Kenya. The results therefore confirmed the validity of human development endogenous growth hypothesis in Kenya. However, the results found that economic growth on the other side does not contribute towards human development.

The exports were statistically significant and had a positive relation with economic growth. This results shows that export contributes positively towards economic growth. Economic growth on the other side was also statistically significant and had a positive relation with exports implying that economic growth contributes positively to growth of exports of goods and services in Kenya. The results confirmed that export-led growth hypothesis is supported hence Kenya had to curve a niche in the international trade.

Finally, the study sought to establish the causality effects of the variables by running the granger causality test/block Exogeneity Wald tests. From table A4 in the appendix, results confirmed the presences of causality effects running from human development to economic growth hence unidirectional causality effects. This implies that human development has causality influence on the economic growth confirming human capital endogenous growth hypothesis in Kenya. The findings also established a feedback system between exports and economic growth. This means that according to the empirical results of the study results that exports of goods and services have causality effects on the economic growth and also that the growth of the economy influences the growth of exports hence bi-directional causality effects. This findings supports Muhoro and Otieno (2014) whose empirical findings supported export-led growth hypothesis in Kenya.

5.2 POLICY IMPLICATION AND RECOMMENDATION

The empirical findings of the nexus between human development, exports and economic growth have important policy implications for the economic growth and development strategies in Kenya. The policy recommendations centered from our study findings is that human development and exports are not only theoretically growth-driven variables but also empirically tested growth driven variables over the period between 1980 and 2015 in Kenya. There is need of all rounded development and funding of the components of the human development variables. Such components includes provision of proper and quality education which marches with industry and world innovations. At the same time proper implementations of health policies is required in addition to much funding health sector. In order to be able to appreciate the international spillovers and innovation especially in the production of competitive exports in the international market, integration of modern farming techniques and investment in research and development need to be esteemed coupled with policies geared towards establishment of more ICT centers in the country.

With the empirical establishment of validity of export-led growth hypothesis in Kenya, the government should also give great attention to the full implementation of the already established export promotion policies. The government should also create a more conducive policy environment in order to enhance a competitive manufacturing export performance sector within the country. More resources should also be directed to specific policies which are geared towards manufacturing of exports, exports diversification through value-addition of primary exports. In addition to these, the policymakers need to relax bureaucracy and requirements for establishment

of more exports processing zones (EPZs) besides offering full support to the existing EPZs. Finally, with the appropriate superstructure of specialized and informed institutions, there will be opportunities for exporters to get necessary advice on market outlets, product quality, standards, and packaging among other information. These, coupled with other economic policies would substantially accelerate the economic growth in the country.

5.3 LIMITATIONS AND AREAS FOR FURTHER STUDY

The study succeeded in addressing the underlined research objectives. Nevertheless, there are some precincts within the study which needs to be pointed out. Firstly, HDI (used as the proxy for human development) was established calculated in 1990. Hence due to the unavailability of HDI for 1980 to 1989, the missing data for the period was extrapolated. Secondly, Inequality-Adjusted HDI (IHDI) which is a new improved proxy for human development was introduced in 2010 and due to inadequate data for the study, HDI was utilized instead. Lastly, this study was limited by the period covered by time series data hence did not include the period when the country was under Import-Substitution Strategy for comparison purposes with the preceding strategies.

This study bases its empirical investigation wholly in Kenya. More research on the topic can be done focusing on the EAC. Also further studies can be done in future by utilizing data from new improved IHDI and modern econometric techniques like Autoregressive Distributed lag techniques for cointergration and granger causality.

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APPENDIX

Table A1: OLS Estimates

Dependent Variable: INY
Method: Least Squares
Date: 11/12/16 Time: 21:41
Sample: 1980 2015
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INX	0.443463	0.078223	S5.669245	0.0000
INH	0.589881	0.456263	2.292852	0.0056
INK	0.105949	0.060375	1.754847	0.0892
INM	0.065899	0.067175	0.981004	0.4342
C	10.73681	1.532127	7.007778	0.0000

R-squared	0.981409	Mean dependent var	23.97503
Adjusted R-squared	0.979011	S.D. dependent var	0.359881
S.E. of regression	0.052139	Akaike info criterion	-2.941573
Sum squared resid	0.084272	Schwarz criterion	-2.721640
Log likelihood	57.94832	Durbin-Watson stat	0.503285
F-statistic	409.1256		
Prob(F-statistic)	0.000000		

Dependent Variable: INH
Method: Least Squares
Date: 11/12/16 Time: 21:47
Sample: 1980 2015
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INY	0.086729	0.067084	1.292852	0.2056
INX	0.026588	0.042539	0.625028	0.5365
INK	0.097349	0.016837	5.782007	0.0000
INM	-0.081034	0.021731	-3.728981	0.0008
C	-3.707458	0.669695	-5.536042	0.0000

R-squared	0.918447	Mean dependent var	-0.734397
Adjusted R-squared	0.907924	S.D. dependent var	0.065885
S.E. of regression	0.019992	Akaike info criterion	-4.858705
Sum squared resid	0.012390	Schwarz criterion	-4.638772
Log likelihood	92.45669	Durbin-Watson stat	1.512123
F-statistic	87.28049		
Prob(F-statistic)	0.000000		

Dependent Variable: INX
Method: Least Squares
Date: 11/12/16 Time: 21:51
Sample: 1980 2015
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.

INY	1.147852	0.202470	5.669245	0.0000
INH	0.468073	0.748883	0.625028	0.5365
INK	-0.280683	0.088492	-3.171844	0.0034
INM	0.275445	0.097955	2.811967	0.0085
C	-4.921591	3.862644	-1.274151	0.2121

R-squared	0.967495	Mean dependent var	22.32353
Adjusted R-squared	0.963301	S.D. dependent var	0.437872
S.E. of regression	0.083883	Akaike info criterion	-1.990540
Sum squared resid	0.218127	Schwarz criterion	-1.770607
Log likelihood	40.82972	Durbin-Watson stat	0.645854
F-statistic	230.6764		
Prob(F-statistic)	0.000000		

Table A2: Error Correction Model/short run results

Dependent Variable: DINY
Method: Least Squares
Date: 11/13/16 Time: 20:31
Sample: 1980 2015
Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINX	0.11918	0.044776	3.661745	0.0113
DINH	0.24098	0.013904	2.450639	0.0201
DINK	0.09096	0.021662	4.200000	0.0000
DINM	-0.02606	0.029392	-0.893544	0.3824
C	0.02483	0.003549	7.007778	0.0000
ECT1	-0.46421	0.067628	-2.957254	0.0302

R-squared	0.558623	Mean dependent var	5.01295
Adjusted R-squared	0.482501	S.D. dependent var	0.03371
S.E. of regression	0.052139	Akaike info criterion	-3.642503
Sum squared resid	0.084272	Schwarz criterion	-3.321649
Log likelihood	97.28701	Durbin-Watson stat	1.552084
F-statistic	7.34175		
Prob(F-statistic)	0.00010		

Dependent Variable: DINH
Method: Least Squares
Date: 11/13/16 Time: 20:47
Sample: 1980 2015
Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINY	0.427065	0.160861	2.651098	0.0136
DINX	0.041408	0.043373	-1.952841	0.0345
DINK	-0.004979	0.026485	-0.191859	0.8523
DINM	0.014881	0.028034	4.853505	0.0004
C	-0.008079	.0054247	-1.479276	0.0147
ECT2	-0.633033	0.149811	-4.23286	0.0000

R-squared	0.529611	Mean dependent var	-0.091392
Adjusted R-squared	0.448532	S.D. dependent var	0.003775
S.E. of regression	0.007048	Akaike info criterion	-4.941706
Sum squared resid	0.015591	Schwarz criterion	-4.778712
Log likelihood	135.33541	Durbin-Watson stat	2.197806
F-statistic	6.530656		
Prob(F-statistic)	0.000400		

Dependent Variable: DINX
Method: Least Squares
Date: 11/13/16 Time: 20:58
Sample: 1980 2015
Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DINY	1.392937	0.6419457	2.175268	0.0380
DINH	-0.457954	0.5720850	-0.807073	0.4307
DINK	-0.248155	0.0931179	-0.660915	0.5122
DINM	0.308969	0.1005061	3.071698	0.0050
C	-0.009220	0.0219778	-4.421179	0.0011
ECT3	-0.302259	0.1474042	-2.056919	0.0493

R-squared	0.412668	Mean dependent var	22.32353
Adjusted R-squared	0.311405	S.D. dependent var	0.437872
S.E. of regression	0.109546	Akaike info criterion	-2.148157
Sum squared resid	0.061460	Schwarz criterion	-2.273614
Log likelihood	78.17028	Durbin-Watson stat	1.443893
F-statistic	4.07081		
Prob(F-statistic)	0.00640		

Table A3: ECM Diagnostic Tests

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 10/19/16 Time: 08:44
Sample: 1980 2015
Included observations: 33

Lags	LM-Stat	Prob
1	23.04351	0.5750
2	18.61222	0.8153
3	35.76253	0.0753

Probs from chi-square with 25 df.

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 10/19/16 Time: 09:35
Sample: 1980 2015
Included observations: 33

Joint test:

Chi-sq	df	Prob.

351.0507	330	0.5037

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 10/19/16 Time: 09:42
Sample: 1980 2015
Included observations: 33

Component	Jarque-Bera	Df	Prob.
1	0.487735	2	0.7836
2	0.978549	2	0.6131
3	38.30378	2	0.0000
4	1.140441	2	0.5654
5	0.540456	2	0.7632
Joint	41.45096	10	0.0000

Table A4: Granger Causality/Block Exogeneity Wald Tests

Granger Causality/Block Exogeneity Wald Tests
Date: 10/22/16 Time: 14:55
Sample: 1980 2015
Included observations: 33

Dependent variable: D(INY)

Excluded	Chi-sq	df	Prob.
D(INK)	0.859387	2	0.6507
D(INH)	5.471671	2	0.0448
D(INX)	6.193034	2	0.0826
D(INM)	3.420346	2	0.1808
All	12.11860	8	0.1460

Dependent variable: D(INH)

Excluded	Chi-sq	df	Prob.
D(INY)	0.155133	2	0.0263
D(INK)	4.381615	2	0.9254
D(INX)	3.035445	2	0.2192
D(INM)	0.810807	2	0.6667
All	8.606056	8	0.5797

Dependent variable: D(INX)

Excluded	Chi-sq	df	Prob.
D(INY)	5.702812	2	0.0268
D(INK)	0.978460	2	0.6131
D(INH)	0.934355	2	0.6268
D(INM)	3.769525	2	0.0658

All	4.907157	8	0.6654

Figure A1: Graphical Representations of the Variables

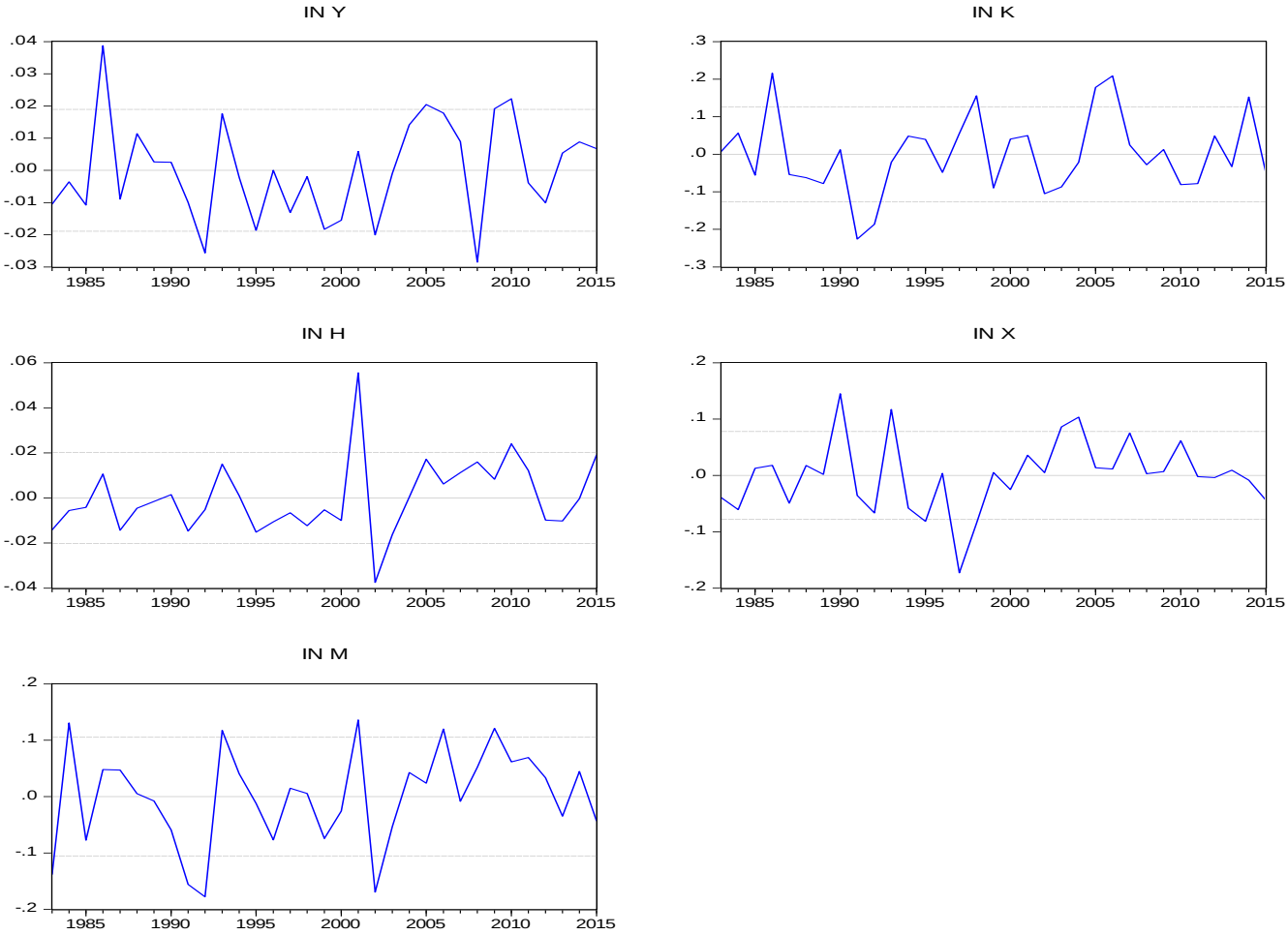

Figure A2: CUSUM test and CUSUM of squares test