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Determinants of Sustainable Development in Kenya

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Abstract
This study investigated the determinants of sustainable development in Kenya using annual data for Kenya for the period of 1991 to 2014. Adjusted net savings rate (ANSR) was used as a proxy sustainable development. The study used the autoregressive distributed lag model (ARDL) for the analysis and the bounds test for cointegration to test whether a long run relationship exists between the study variables - household consumption per capita, unemployment rate, resource productivity, energy efficiency, real gross domestic product per capita and terms of trade. The main result from the study was that a long run relationship exists between the variables. Secondly, the estimated coefficients of household consumption per capita negatively impacts sustainable development in the long run while unemployment rate and energy efficiency both negatively influence sustainable development in the short run. Resource productivity, real gross domestic product per capita and terms of trade are insignificant in determining sustainable development. The results suggest that developing the economy while stimulating savings and promoting a contractionary fiscal policy on public deficits will promote sustainable development.
Keywords: sustainable development, adjustable net savings rate, ARDL

1. Introduction

There is a global paradigm shift to sustainable development as a solution to various problems facing regions and countries. These problems vary from country to country and region to region but they all have a common theme – development with access to limited resources for an improved livelihood. The concept of sustainability was formally pronounced in 1987 following a report dubbed "Our common future" written by the World Commission on Environment and Development, also referred to as the Brundtland Commission, where they defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). However, this concept was presented more than 25 years ago and is still yet to be captured by most countries in their development plans.

1.1. Development background of Kenya

KANU's Manifesto can be defined as the first development plan for the country with its main objective being "to achieve the fastest economic independence for Kenya" "to attain the fastest rate of economic growth and to secure a just distribution of the national income both between different areas of the country and between individuals" (KANU Manifesto, 1963). The manifesto also aimed to decrease the tax burden for the low income population with significance given to development in the rural areas by improving infrastructure. In 1983, the DRFD was endorsed as a means to increase economic growth by stimulating rural development at the household level. Unfortunately, the DRFD's success was minimal as the government was not held accountable and policies were not able to be influenced positively. In 1994, the Social Dimensions Development programme was used as a means of providing a fall back for the poor following the implementation of the SAPs in the 1980s. However, this also had minimal effect and further led to a population increase facing poverty. In 1999, the National Poverty Eradication Plan (NPEP) was put in place to sustain economic growth while increasing the capacities of the poor. It was implemented as a 15-year plan with short term strategies dubbed as PRSPs for meeting the long-term vision. It was launched in 2001 and was based on the first United Nations' Millennium Development Goal (MDG) of halving global poverty by 2015. PRSP multiple objectives guided the country towards the goal of reducing poverty and increasing economic growth in the country. By the year 2000, Kenya's GDP growth rate was between 0 to 0.2% and approximately 60% of Kenyans were living below the poverty line (Waiyaki, 2005).

After the general elections in 2002, the new NARC Government's main objective was reviving the economy. This objective produced a new strategy and policies that discarded the PRSP and NPEP and adopted the ERS development plan (Government of Kenya, 2003). The ERS was launched in 2003 and emphasized economic growth and creation of wealth and employment as means of eradicating poverty and achieving food security. The strategy recognized agriculture as the leading productive sector for economic recovery and thus, agricultural institutions were revived with investments made in agricultural research. Some key policy actions for the economic recovery of the Kenyan were based on four pillars; macro-economic stability, robust institutional governance; rehabilitation and expansion of physical infrastructure and investment in human capital

for the poor. This led to an establishment of an investment programme that gave the much-needed clarity on government funding for various projects and funding requirements from external sources such as donors. The ERS expired in the financial year 2007/08 and was superseded by a new development strategy dubbed "Vision 2030". Vision 2030 was the new long-term development blueprint for the country with the main objective being to create a globally competitive and prosperous nation with a high quality of life by 2030 (Government of Kenya, 2007). This implied transforming Kenya to a newly industrializing, middle-income country that endeavoured to provide a high quality of life to all its citizens by 2030 in a clean and secure environment. This new strategy is to be implemented through 5-year medium term plans (MTP). We are currently in the 2nd batch of the MTP's spanning the year 2013 to 2017. Thus, the PRSP, EMCA, ERS, Vision 2030 and the New Constitution 2010 have laid the foundation for a framework for sustainable development in Kenya.

1.1.1. Development challenges facing Kenya

Kenya faces various development challenges such as poverty, inequality and unemployment. One demographic challenge for Kenya is its population growth. The country averages a population growth of 2.3 percent and is projected to increase to 66.3 million by 2030. A report by USAID (2009) showed a close link between poverty and population growth citing that with Kenya's current trend, national development may not be realised since a country's population dictates the amount of resources available for services per capita. More so, more people implies more pressure on the environment with demands for food, clean water, land and energy resources. Moreover, the country is vulnerable to climate change and environmental degradation from a decrease in annual precipitation and extreme weather patterns. Despite having negligible pollution from emissions, land degradation still features highly in Kenya due to overgrazed land, deforestation and intensive use of biomass energy. The economy is still overwhelmed with widespread poverty despite having improved other social indicators such as infant mortality and literacy levels. Kenya's social context is still facing various challenges such as decreasing the instances of maternal mortality, population living below income poverty line at 45.9 percent of the population and income inequality that stands with a Gini coefficient of 47.7 (UNDP, 2015). High unemployment rates still feature widely in Kenya where 80 percent of unemployed people are between the ages of 15 and 34 of which 35 percent are of people at 20 years (UNDP, 2013). The country's expansionary economic policies implemented through significant public investments and incentivised private, both domestic and foreign, industrial investment have seen an accumulation of debt that is poorly repaid at 1.1 percent of GNI. Kenya also has a chronic balance of payments issue following decrease in its export prices and an increase in both price and quantity of imports. This has put a strain on its annual growth per capita placing it at 2.6 percent in 2014 (World Bank 2014).

1.2. Understanding Sustainable Development

Sustainable development is generally guided by three dimensions; environmental, economic and social dimensions. Each of these dimensions has its own system – economic system, environmental system and social system. It is highly unlikely to analyse all three systems at once, it needs a dissection of each system on its own as the IISD (1999) stated that "… sustainable development is possible only if component systems as well as the total system are viable. Despite the uncertainty of the direction of sustainable development, it is necessary to identify the essential component systems and to define indicators that can provide essential and reliable information about the viability of each and of the total system". There is also a need to look into the interaction of the three classifications and the extent to which each classification's boundaries are respected. Daly (1990) proposed a framework for sustainability as a triangular set up of three E's – environment, equity and economy where the bottom of the triangle is represented by the environment as the 'ultimate means' that features natural resources as a prerequisite for a decent livelihood with the economy on the next rung which serves as a mode to achieve a decent livelihood and the top of the triangle represented by equity as the 'ultimate end' featuring wellbeing. This study will use the IISD (1999) understanding of sustainable development.

Various indicators of sustainable development are compiled against the three categories – social, environment and economy, either from their impact or interaction. Very many indicators of sustainable development have come up over the years from the failure of the use of GDP and income as the key indicators for economic progress. Two recently developed indicators that have been used are the Human Development Index (HDI) developed by the UNDP in 1990 and the Index of Sustainable Economic Welfare (ISEW) developed by Daly & Cobb (1989). HDI is measured on a scale of 0 to 1, with 1 signifying high human development, which is aggregated under three indicators – longevity, knowledge and use of resources for a decent life. For longevity, life expectancy at birth data is used, while for knowledge, adult literacy and mean years of schooling data is used, and for use of resources, GDP per person after adjusting for purchasing power data is used. While this composite of indicators may not directly reveal income inequalities but, for example, having high index on longevity implies a broad access to health and adequate access to food, sanitation and water. Despite the use of HDI in many countries and the availability of most of the data, the HDI does not account for environmental degradation. However, ISEW is a more comprehensive indicator since it accounts for

environmental degradation. ISEW has only been used for the United States of America and is calculated by adjusting the index for consumption with inequality distribution and factoring in various environmental measures such as non-renewable resource depletion, farmland loss due to urbanisation, wetlands loss and the cost of air and water pollution. Despite the ISEW comprehensiveness, the data and information it needs is only available in few countries who have comprehensive data on environment data.

Sustainable development in Kenya, as measured using HDI developed by UNDP has been steadily increasing while ANSR has been fluctuating over time. This is shown below in figure 1.

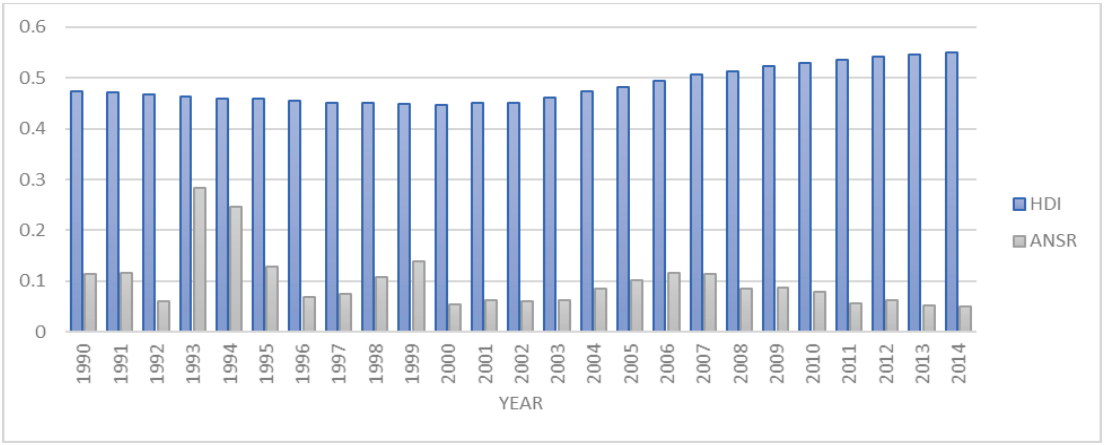

Figure 1. Sustainable development measured by Human Development Index (HDI) and ANSR

Figure 1 shows a fluctuating trend before year 2007 in ANSR and a drop then a steady increase in HDI. However, HDI seems to have slowed down after 2007, the same for ANSR. The steady state of HDI can be attributed to the favourable performance of the factor of education and gross domestic product and gross national income under both indicators.

1.3. Statement of the Problem

AfDB's strategic paper on Kenya stated that despite Kenya not being classified as a fragile state, it shows fragile characteristics such as "high level of poverty and regional disparities as well as high youth unemployment, which, if not effectively addressed, might pose threats to the country's overall stability" (AfDB, 2014 pg. 10). Kenya's fragility can be attributed to its unsuccessful implementation of development plans, specifically poverty reduction strategies, as cited by Nyamboga *et al*. (2014) who characterized these failures to "weak mapping and coordination of the lead institutions, duplication of efforts, inadequate coverage by region and even gender, competition among and between players, and lack of clear policy direction". Mngoda & Misati (2012) also stated that Kenya's targets and ambitions as outlined in Vision 2030 are unrealistic and may not be easily achieved considering stifled human development through neglected health sector in terms of quality and access of healthcare services as seen in the minimal changes to child mortality rates and maternal health and in the education sector, specifically, high cost of training, inequality in access to education and minimal relevance of education training. Discourse suggests a separate parallel paper and/or report to Vision 2030 that highlights the progress Kenya has made towards sustainable development (United Nations, 2012 pg. 41).

Drawing from the background of the study, Kenya can be seen to lag behind in its achievement of sustainable development. More so, past studies have seen Kenya time and time again failing in delivery of its promise of equitable wealth and improvement of livelihoods (Nyamboga *et al.,* 2014; Mngoda & Misati, 2012). Development plans have come and gone and Vision 2030 is at its MTP2, but there's still a delinked perspective of what Kenya wants to achieve and what is actually happening in reality - economic growth witnessed in reports is not distributed evenly over the population. This causes social unrest in the population from the lack of socioeconomic opportunities that may improve their livelihoods. Environmental degradation features highly especially in urban areas where pollution and conversion of agricultural land and forest areas for human settlements putting a strain on ecology.

There is a little existing literature that empirically determines sustainable development using variables under the three dimensions collectively. However, to the best of my knowledge, this study is the first to empirically determine and assess determinants of sustainable development in Kenya. This study aims at bridging the gap brought up by lack of inclusive investigation on determinants of sustainable development in Kenya. There is need to determine these predictors so as to propose development policies that feature sustainability in the long run. The key contribution of this study is in enhancing the understanding of sustainability from an empirical perspective by determining and assessing variables that can be used to model a sustainable

development framework and in providing guidance to policymakers and development organizations in this developing field.

1.4. Objectives of the study

The main objective of this study is to identify and investigate the determinants for sustainable development in Kenya.

The specific objectives of this study include:

1. To investigate economic, environmental and social determinants of sustainable development in Kenya.
2. To assess to what extent household consumption per capita, unemployment rate, resource productivity, energy efficiency, terms of trade and real GDP per capita can be used to determine sustainable development in Kenya.
3. to observe the direction and magnitude of sustainable development in relation to variations in household consumption per capita, unemployment rate, resource productivity, energy efficiency, terms of trade and real GDP per capita.

1.5. Research Questions

The study seeks to answer the following primary question: *"What social, environmental and economic variables can be used to determine sustainable development?"*

The following secondary questions are posed to answer the primary question above:

1. What variables can be used to determine sustainable development in Kenya?
2. To what extent the identified variables will affect sustainable development in Kenya?
3. What actions can be recommended to hasten achievement of sustainability in Kenya?

1.6. Significance and Scope of Study

Assessing and determining significant predictors of sustainable development in Kenya will aid in informing policymakers on effective policies, given these predictors, which can be implemented to pursue a development pathway that is both progressive and sustainable. Economic, social and environmental pressures need to constantly be reviewed against sustainability for the country to enjoy prosperity that is distributed equally in a preserved environment. The need to mainstream the agenda of sustainable development has never been more important as it is today, especially so for Kenya against its development plan, Vision 2030. Hence, this begs for accurate identification of determinants of sustainable development empirically evaluated to produce valid and reliable findings that will inform policies and institutions.

This research is confined to Kenya and the period ranging 1991 to 2014 evaluating the annual data on social, environmental, economic and sustainable development variables.

1.7. Limitations of Study

There is no appropriate measure of sustainability as it is a concept and a theory for development. Hence, it is measured by the factors it is made up of from social, environmental and economic dimensions. Various indices can be used to proxy sustainability, however, these indices have various measurements and estimation techniques which are estimated from data collected from surveys which are few in number.

This paper is organized as follows; Section 2 reviews the literature, both theoretical and empirical and Section 3 prescribes the methods and procedures while giving definitions of the indices used in the study, Section 4 examines and provides the results of the determinants of sustainable development in Kenya and Section 5 concludes the paper.

2. Review of Related Literature

2.1. Theoretical Literature

Despite the term sustainable development receiving much audience, theories on it have not received the same zeal. Sustainable development is not a uniform concept but rather an idea that guides the context to which development is implemented given the different social context a region and/or country has.

2.1.1. Theories of Development

2.1.1.1. Marshall Theory

Marshall's fundamental principle was of economic progress where he states that "the production of wealth is but a means to the sustenance of man; to the satisfaction of his wants; and to the development of his activities, physical, mental and moral" (Marshall, 1961). Marshall emphasized on the importance of pursuing policies that improve the quality of life and in investigating the economic system with its relation to political, social, institutional and cultural contests. Marshall also stated that present generation have a responsibility for society's progress by taking care of future generations. Emphasis was also placed in having a knowledge driven economy with investment in human capital and protection of the environment by having an optimal allocation of scarce

resources (Marshall, 1919) as significant steps to progress. Marshal also stated the damaging consequences of a growing population and the pressure it places on natural resources. Thus, Marshall envisaged progress as a marriage of improving the quality of life and protecting the environment with an increase in material wealth.

2.1.1.2. Harrod-Damar Model

This model attempts to utilise development economics to explain economic growth in terms of level of saving and capital productivity. The theory in its simplistic interpretation is that if a country has a high level of savings then it has enough funds for firms to borrow and invest. Investment then leads to an increase in capital stock hence economic growth spurs via an increase in production of goods and services. The converse also applies. Capital productivity is then measured from the investment productivity that has taken place. This implies, if capital productivity increases via decrease in capital output ratio then an economy is growing since the economy is experiencing higher outputs from fewer inputs (Sato, 1946). Simply put, rate of growth (g) = Savings (s)/Capital Output ratio (c)

Hence, if developing countries need to grow then they need to stimulate domestic savings and support technological advancements to reduce the capital output ratio. However, this model has been highly criticised since developing countries suffer from droughts and diseases hence domestic savings cannot be stimulated enough considering the many immediate needs. The model is also oversimplified and ignored some important factors such as labour productivity and corruption. The model is also based on an assumption that wages are fixed which is not the case seeing as they keep changing and are sticky.

2.1.1.3. New Growth Theory

This theory attempts to explain the poor performance of underdeveloped countries who have implemented policies prescribed from the neoclassical theory. New growth theorists such as Romer (1986), Lucas (1988) and Aghion & Howitt (1992) postulated that technological change leads to the production of knowledge. Thus, this theory emphasised that development results from increasing returns to the use of knowledge rather than labour and capital. Knowledge, being a different economic good, has the potential for unlimited growth. Knowledge can be reused as zero cost and investments in knowledge creation can lead to sustained growth. Intervention via policy was then claimed to be significant to influence growth in the long term. Thus, new growth models promoted the role of government and public policies in complementing investments in human capital formation and reinforcement of foreign private investments in knowledge-intensive industries (Meier 2000).

The literature on development, specifically its theories, highlight economic development as a multidimensional process that involves interactions among different goals of development, whether it is economic growth, quality of life, it would require systematically designed policies and strategies. Development issues are complex and multifaceted thus the design of economic development policies will need consideration the social, cultural, political systems and institutions as well as their changing interaction over time in a country. The concept of development as an upward climb to "success", is inadequate for the 21st Century considering the various dimensions that planning needs to take into account. This has led to the acceptance of the concept of sustainable development. The concept is alluring – protection of the environment, social justice for all and economic progress. But, what does sustainable development really mean?

2.1.2. Theory of Sustainable Development

Sustainable development definition is synonymous with The Brundtland Commission where is was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). From this definition, development is not only seen as its former definition that was linked to economic growth implying that countries with high economic growth translated from having high GDP as the only path to development but as development that meets the "needs of". This definition brings in the question of exhaustible resources and begets the question, if exhaustible resources are to be preserved, then how can they be exploited today? (Markandya *et al.*, 2002). However, sustainability doesn't mean that resources may not be exploited, it just means that current generations need to be prudent in their rates of use so as not to exhaust the resources for future generations.

Theoretical interpretations of sustainable development focused on environmental and economic dimensions omitting the social dimension such as Pearce & Warford (1993) who suggested sustainable development to be viewed from an economic perspective as "the development where no generation n in the future would be worse of than the present generation". Munasinghe (1993, 2000) viewed sustainable development from a broader perspective taking into account environmental, social and economic dimensions and a World Bank (2001) development report that placed emphasis on quality of growth by taking into account poverty alleviation over time. Each dimension of sustainable development – environmental, social and economic, has a mix of disciplines and the methods that link these three dimensions are considered important.

2.1.2.1. Economic Sustainability

This aspect looks at consumption and the contribution that natural resource makes into production. This is achieved by maximising the welfare of all generations which can be termed as "…non-declining utility of a representative member of society for millennia into the future" (Pezzey, 1992). Solow (1986) proposes keeping

total capital stock constant and measuring utility with consumption (Hartwick, 1977), this is known as the Solow-Hartwick sustainability model. Hartwick's rule of sustainability noted that if the objective is to ultimately gain the highest constant per capita consumption, then investments into man-made capital should equal the rents received from depletion of natural capital. This model was critiqued in its assumption that consumption is the only input of the utility function excluding the stock of renewable resources and that natural and man-made capital may be substituted which may not be true when looking are other ecosystem properties such as air (Perman *et al.,* 2003). An indicator borne out of the Solow-Hartwick sustainability model is the Genuine Savings (GS) indicator that indicates if a country is on a sustainable development pathway whereby if the GS is positive then the country is sustainable (Pearce & Atkinson, 1993). However, GS doesn't take into account the impact trade can have on sustainability (Martinez-Alier, 1995) and the study does not indicate the method that depreciation rate of natural capital should be estimated (Cabeza-Gutes, 1996). Bojo *et al.* (1992) recommended that "economic development in a specified area (region, nation, the globe) is sustainable if the total stock of resources - human capital, physical reproducible capita, environmental resources, and exhaustible resources - does not decrease over time".

2.1.2.1.1. Real GDP per capita

Harrod–Domar model implied that growth depends on the quantity of labour and capital. Thus, more investment leads to capital accumulation which in turn generates economic growth. This model implies that economic growth significantly depends on policies to increase investment which increases savings and proposed the use of investment more efficiently through technological advances.

2.1.2.1.2. Terms of Trade

Terms of trade usually affects the distribution of income between countries hence an important variable in defining economic policy in countries. An increase in terms of trade implies that a certain amount of exports will exchange for a large amount of imports. Income from terms of trade does not directly imply that a country's welfare has increased but can inform on welfare changes. This is because that if export prices increase while keeping import prices and quantities constant, then a country is better off in terms of welfare since at this given import volume, the country has exchanged less exports thus the country's real national income is larger. Thus, one can use terms of trade variable as a measure of how much a country has gained from trade.

2.1.2.2. Environment Sustainability

This aspect has been viewed often as a strong sustainability model where natural capital is maintained at a certain level while keeping the safe minimum standards (SMS) rule postulated by Ciriacy-Wantrup (1952), Bishop (1978). SMS ensures that natural capital levels are only breached when the opportunity cost of not utilising the resources is quite high. However, there is no definition in how opportunity cost is determined and exploited resources that are significant for the development of an economy are not considered. An alternative theorem proposed for this non-declining natural capital is operational principles (OPs) by Daly (1990). Daly categorized these OPs under (1) management of resources where exploitation of resources should not exceed the regeneration rate, (2) both natural capital and man-made capital to be maintained at optimal levels – level that gives the maximum yield per time period for natural resources where man-made capital and natural capital are complements of each other, (3) investment of part of the receipts from non-renewable resources into renewable substitute resource at a rate that when the non-renewable resource is extinguished then the renewable resource will replace the non-renewable one, and (4) focus should be placed on technology that is not resource intensive. A critic on Daly's OPs includes the assumption that man-made capital and natural capital are complements of each other and the replacement of the non-renewable resource with a renewable one. This aspect is derived from the acknowledgement that the environment is an important input in economic production and consumption that cannot be substituted due to the uniqueness of some elements of the environment and the irreversibility of some environmental processes.

2.1.2.2.1. Resource Productivity

Malenbaum (1978) theory – intensity-of-use hypothesis, states that resource demand is driven by demand for final goods thus income is a significant factor in resource consumption. Malenbaum hypothesised non-uniform income elasticities over time and across countries due to the difference in the nature of composition of final demand that is also associated with different stages of economic development. Thus, a country in its nascent stage of economic development would feature more resource intensive activities growing its resource use at a near similar rate to that of economic growth. However, resource use declines over time for developed countries due to the inaccurate measurement of resource use – due to translocation of production to other countries leading to environmental stress and overexploitation of renewable resources. Thus, this indicator can not only show the stage of economic development a country is at but can also inform the optimal use of resources.

2.1.2.2.2. Energy Efficiency

Gilingham *et al.* (2009) stated that market failures and environmental externalities, inefficient energy pricing, lack of information and principal-agent issues have influenced low levels of investment in energy efficiency while Allcott & Greenstone (2012) proposed that behavioural biases in consumer decisions due to their

heterogenic nature explain for the slow uptake in energy efficient investments. Thus, both firms and consumers would prefer to withhold investment in energy efficient investments until the externalities associated with it are solved. This indicator is worthwhile to gauge the level at which a country's diffusion of energy efficiency stands.

2.1.2.3. Social Sustainability

Social sustainability is viewed as the interaction of economic actors and how they are organized to spur economic development given the various endowments of human , natural and physical capital (World Bank, 2006). This link, dubbed social capital, places emphasis on the association of people and the norms and impact that productivity has on overall well-being of people. It covers labour and human rights as well as governance of institutions. Social sustainability views that social resources should have equitable access for inter-generations, dubbed inter-generational equity, and this equal access should also feature within generations, dubbed intra-generational equity. Widok (2009) notes that social sustainability is always tied to an ethical aspect since social factor are partially based on an ethical value with ethics being a difficult concept to quantify. Social justice features highly under the aspect of social sustainability where Koning (2001) cited "a society that is just, equal, without social exclusion and with a decent quality of life, or livelihood, for all". Hence, since sustainability implies a future focus then it follows that social sustainability calls for a just society both in the present and future. McKenzie (2004) however suggests a range of approaches but not a singular definition where social sustainability is "a life-enhancing condition within communities, and a process within communities that can achieve that condition" with the condition being equity in access to significant services, equity between generations, positive system of cultural relations, and consistent participation in the electoral process by citizens. WACOSS (2002) suggests an array of principles that can be used to guide the assessment of social sustainability, they are equity, diversity, interconnectedness, quality of life and democracy and governance. Hence, from these principles, social sustainability can be assessed.

2.1.2.3.1. Household Consumption per capita

Modigliani and Brumberg (1955) life-cycle hypothesis and Friedman (1957) permanent income hypothesis states that most households, who are risk-averse, prefer a smooth to a variable consumption flow. Thus, households would choose their consumption based on a constant fraction of their permanent income and not current income due to the volatility nature of current income and its reliability in giving an idea of the living standards of households. Households can achieve a smooth consumption flow depending on the resources they have and can move over time and over various states. These tools include savings, credit, government transfers and insurance. However, not all households have the ability to smoothen consumption flow which leads to consumption inequality. Consumption inequality arises due to significant changes in permanent income which leads to income inequality. However, consumption inequality may increase at a smaller amount than income inequality due to the ability of households to partially cushion themselves from income shock using the tools mentioned above even when income is volatile. Thus, the trend in household consumption per capita can give us a general idea on income inequality.

2.1.2.3.2. Natural unemployment rate

The labour market medium-run equilibrium is composed of compatibility of wage claims by workers in the bargaining and real wages that firms are willing to pay, given their labour costs and the degree of imperfections in the product market. Thus, the equilibrium unemployment rate, natural rate of unemployment, determines the labour market medium-run equilibrium. Layard *et al.* (1991) shows that having standard assumptions the equilibrium unemployment rate is determined by supply side variables, for example labour market institutions and degree of competition in the product market, but will not be affected by changes in aggregate demand that is driven by consumption patterns. Bande & Karanassou (2010) proposed that productivity that essentially builds capital stock does not affect equilibrium unemployment rate. Thus, an inverse relationship exists between investment, thus savings, and unemployment rate.

In summary, theoretical literature in sustainable development is still evolving with various dimensions such as governance being added to its definition. Becker *et al.* (1999) suggests an "analytical framework for considering environmental sustainability that focuses on economic processes, social processes, patterns and factors, and decision-making processes and institutional arrangements". Sustainable development is a normative theory that aims for justice and economic goals under social and ecological constraints. Sustainable development requires constant monitoring to ensure that a country is progressing towards a sustainability goal. The role of sustainable development indicators was emphasized at a United Nations Conference on Environment and Development (UNCED) in 1992 that called for countries to "develop and identify indicators of sustainable development in order to improve the information basis for decision-making at all levels" (UNCED, 1992, Agenda 21, Chapter 40).

2.2. Conceptual framework of the study

The conceptual framework for this study has been developed to show the relationship between the selected variables. Figure 2.1 shows the conceptual framework with the dependent variable as adjustable net savings rate

as a measure of sustainable development and independent variables as household consumption per capita, old-age dependency ratio, resource productivity, energy efficiency, terms of trade and real GDP per capita growth.

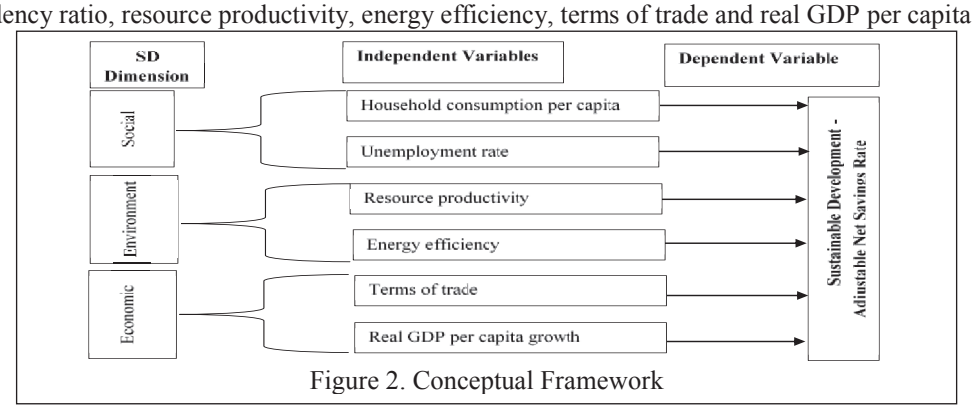

Figure 2. Conceptual Framework

2.3. Empirical Literature

Mokhtar & Deng (2015) carried out a political, economic, social, technological (PEST) analysis to analyse the key forces that influence sustainable development in Taiwan. Mokhtar & Deng analysed 11 reports published by the National Council of Sustainable Development between 2003 and 2013 and found that 9, 8, 10 and 5 key forces in the political, economic, social and technological environment respectively influence sustainable development. They further recommended that involvement by key stakeholder groups from central government, local governments, private sectors, non-governmental organizations and civil society is critical to achieve sustainable development in Taiwan. The downside of this literature is the use of the PEST analysis on reports already published rather than data collected as it will give a skewed view of the forces of sustainable development. More so, not all countries have publications related to sustainable development that can be reviewed.

Pardi, Salleh & Nawi (2015) carried out an econometric analysis of determinants of sustainable development in Malaysia by using Adjusted Net Saving (ANS) rate as a proxy for sustainable development. Pardi *et al.* used ANS rate, adjusted for GDP and net national saving, as they assumed that it is a true measure of the rate of saving of a country. They assessed several variables; inflation rate, financial development, per capita income and minerals exports share using a vector error correction model (VECM). From their study, they found that in the short run, one-year lagged values of all the variables except minerals export share have a substantial effect on sustainable development and in the long run, all variables including minerals export share have a substantial effect on sustainable development. The study calls for firm macroeconomic policy to aid sustainable development progress and reveals a way that sustainable development can be empirically determined. The disadvantage of this study is the exclusion of variables that could depict a better picture on the short run and long run indicators of sustainable development such as real GDP per capita, shocks to the economy from trade and poverty variables.

Bakritas, Baykar & Cetin (2014) investigated the relationship between carbon dioxide emissions and economic growth under the theory of the Environmental Kuznets Curve (EKC) for 34 OECD and 5 BRICS countries using dynamic panel data analysis. Bakritas *et al.* found that 36% of the countries investigated were consistent with the EKC hypothesis. They recommended the consideration of environmental impacts on income increases given the context of maximising economic growth in countries. The main limitation of this study was in the use of economic growth variables as opposed to economic development variables that would have given a better picture of development in the 34 OECD and 5 BRICS countries.

Phimphanthavong (2014) carried out a study that sought to obtain determinants of sustainable development in Laos by employing a regression analysis on various variables such as GDP, poverty reduction, income inequality, air pollution and deforestation to obtain a sustainable development degree, a ratio of sustainable development to GDP. Phimphanthavong concluded that sustainable development is a combination of economic growth, social development and environmental protection and further stated that progress is achieved once economic growth is distributed to all citizens via poverty reduction strategies that aim to minimize inequality in the society and at the same time maintaining a suitable condition for the environment and protection of natural resources. This empirical literature is a good contribution to determinants of sustainable development through the capture of social and environmental costs to economic growth. However, Phimphanthavong view is from a domestic point of view given that he did not account for external shocks that Laos may face from trade and by the use of GDP as opposed to real GDP per capita which is a better depiction of economic growth.

Boos & Müller-Holm (2013) carried out a cross-country analysis to determine the relationship between genuine savings (GS) and resource curse. Boos & Müller-Holm used analogous regressions to Sachs & Warner's work (1995/1997) to carry out the analysis. This investigation was premised on past studies that showed there is

a negative relation between GS and resource curse. They found that the factors that lead to the resource curse are exogenous of GS and slow down economic growth since the resource curse influences capital stock. Boos & Müller-Holm further concluded that a shrinking GS is a sign of erosion of sustainable development stock hence can serve as an economic warning for a country. However, Boos & Müller-Holm failed to consider that GS fails to include education and health expenditure as a part of social development that is an essential factor of sustainable development.

Tchouassi (2012) analysed the relationship between gender equality and sustainable development across 11 countries in Central Africa in 2010 by use of cross-sectional analysis and found a positive correlation between gender equality and sustainable development. Tchouassi study showed that when multidimensional poverty index increases, environmental problems reduce highlighting the positive role of gender equality in sustainable development. The weakness in this study is from the use of indices as opposed to raw data to analyse the relationship as the indices are pre-calculated which can skew data results. More so, indices are limited to certain years hence one cannot extract time series data to evaluate them.

Carbonnier, Wagner & Briggs (2011) assessed the impact of resource-dependence, particularly oil and gas, and governance on sustainable development of 96 developing countries using dynamic panel data analysis. Carbonnier *et al.* employed ANS per capita as a variable of weak sustainability that would examine if there was a nexus between resource dependence and sustainable development. The study resulted in a negative relationship between resource dependence and ANS per capita and a positive relationship between ANS per capita and effective legislation and established institutions. The study was however limited to only the impact of resource dependency and governance rather than the impact of various social, environmental and economic variables to sustainable development.

The literature suggests that for sustainable development to be embedded in a country policies and strategies, then it needs to be understood from a theoretical and empirical approach. It is not enough to know what sustainable development is but measuring it and benchmarking the country against it is. This paper contributes to literature by identifying, measuring and determining the key determinants of sustainable development in Kenya which in turn will inform development plans and policies needed for a pathway to sustainable development

3. Research Methodology

3.1. Research Design

This study is based on a quantitative research design which is defined by Bryman & Bell (2005) as that "entailing the collection of numerical data and exhibiting the view of relationship between theory and research as deductive, a predilection for natural science approach, and as having an objectivist conception of social reality". Quantitative research is usually a formal, objective, systematic process for obtaining quantifiable information about a topic. It is presented in numerical form and analysed by use of econometric and/or statistics. It is also used to describe and to test relationships and to investigate the cause-and-effect of relationships. The study combined various theoretical expectations and empirical interpretations that aided in assessing and evaluating variable(s) that can influence sustainable development.

3.2. Target Population

The population study consists of annual data of adjusted net savings rate, social, environmental and economic for the years ranging 1991 to 2014 for Kenya in the form of time series econometric data.

3.3. Data Collection

Data is obtained from secondary sources from World Bank open data https://data.worldbank.org/country/kenya?view=chart . The variables investigated are listed under section 3.3.1.

3.3.1. Definition of variables

The variables used as determinants in this model are determined based on the existing literature on the topic, availability of data, economic theory and whether they fit well in the model in statistical terms. A concise description of the variables is provided for the model.

HC is household consumption per capita and is used as a measure of reduced poverty.

UER is unemployment rate that is used as a measure of labour as a factor of productivity.

RP is Resource Productivity measured by the percentage of natural resource rents to GDP used as a measure of resource richness.

EE is Energy Efficiency is measured by the degree of self-sufficiency (a measure for the ratio between primary energy production and consumption of oil, natural gas, coal, renewables and waste).

RGDP is real GDP growth per capita that is used as a measure of economic growth.

TOT is terms of trade growth that is used as a measure of trade.

To quantify sustainable development, Adjusted Net Savings Rate (ANSR) is used. ANSR is found by dividing adjusted net savings (ANS) with GNI. ANSR is used in this study because it depicts the true economic

sustainability of a country. If Kenya's net saving is positive, economic theory suggests that wellbeing is increasing since "positive savings allow wealth to grow over time thus ensuring that future generations enjoy at least as many opportunities as current generations" (World Bank, 2012). This implies that buy increasing savings, a country's wealth increases thus enabling the country to plan for both current and future generations. More so, ANSR is used in this study as a proxy for sustainable development since it is policy sensitive; meaning that if the Kenyan government decides to spend more on health or implement a policy to reduce public sector expenditure, this will be highlighted in ANSR. Small amounts or negative amounts of ANSR may not be visible in the short run, but in the long run, these changes can be seen through a decrease in wealth and general well-being of a country thus the use of time series data. ANS is found by equation 1 below:

ANS = Net National Savings + Education Expenditure – Energy & Mineral Depletion - Net Forest Depletion - Carbon Dioxide Emissions Damage (*1*)

where Net National Savings is found by deducting Consumption of Fixed Capital from Gross National Saving.

3.4. Data Source and Analysis

The data will be analysed by use of EViews software. Data outputs will include graphs, tables and figures.

3.4.1 Empirical model

To investigate the determinants of sustainable development, the study uses empirical literature from Pardi, Salleh & Nawi (2015), Phimphanthavong (2014), Boos & Müller-Holm (2011), and Carbonnier, Wagner & Briggs (2011) to specify the economic model below. Sustainable development (SD) is influenced by the following variables specified in the economic model under equation (2):

SD = F (HC, OADR, RP, EE, TOT, RGDP) *(2)*

3.4.2. Econometric Modelling

This study uses the bounds testing approach for cointegration analysis that is based on the Autoregressive Distributed Lag framework popularized by Pesaran & Shin (1995, 1999) and Pesaran, *et al.* (1996). The ARDL approach is suitable for this study since some variables are likely to be stationary while others may have unit roots. ARDL approach to cointegration (Peresan *et al.,* 2001) involves estimating the conditional error correction (EC) form of the ARDL model for sustainable development and its determinants:

$$\Delta LN(ANSR)_t = a_0 + \sum_{i=1}^{n} c_{1i}\Delta LN(ANSR)_{t-i} + \sum_{i=1}^{n} a_{1i}\Delta LN(HC)_{t-i} + \sum_{i=1}^{n} a_{2i}\Delta LN(UER)_{t-i} + \sum_{i=1}^{n} a_{3i}\Delta LN(RP)_{t-i} + \sum_{i=1}^{n} a_{4i}\Delta LN(EE)_{t-i} + \sum_{i=1}^{n} a_{5i}\Delta LN(RGDP)_{t-i} + \sum_{i=1}^{n} a_{6i}\Delta LN(TOT)_{t-i} + B_1LN(ANSR)_{t-1} + B_2LN(HC)_{t-1} + B_3LN(UER)_{t-1} + B_4LN(RP)_{t-1} + B_5LN(EE)_{t-1} + B_6LN(RGDP)_{t-1} + B_7LN(TOT)_t + E_t \quad (3)$$

where LN(ANSR), LN(HC), LN(UER), LN(RP), LN(EE), LN(RGDP), LN(TOT) are adjustable net savings rate, household consumption per capita, unemployment rate, resource productivity, energy efficiency, real GDP per capita and terms of trade in natural logarithm, respectively, Δ is the difference operator, and n is the optimal lag length.

The ARDL equation is estimated using ordinary least squares method and zero coefficient restrictions are imposed on the lagged level variables to derive the F-test statistic. The F test is used to test the existence of a long-run relationship and indicates which variable should be normalized. The null hypothesis, H_0: $B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = B_7 = 0$, of no long run relationship among the variables in equation (3) is tested against the alternative hypothesis, H_1: $B_1 \neq B_2 \neq B_3 \neq B_4 \neq B_5 \neq B_6 \neq B_7 \neq 0$, of the presence of long run relationship among the variables. The F-test has a non-standard distribution that relies on the variables included in the model to be *I(0)* or *I(1)*; the number of regressors, and if the model contains an intercept and/or a trend. Since the small sample size in this study, 24 observations, is relatively low, the critical values used are as reported by Narayan (2004) which based on small sample size between 30 and 80. The test involves asymptotic critical value bounds which depends on whether the variables are *I(0)* or *I(1)* or a mixture of both. Two sets of critical values are generated with one set being referred to as the *I(1)* series - upper bound critical values and the other for the *I(0)* series – lower bound critical values. If the computed F-statistic is greater than the upper bound critical value, the null hypothesis of no cointegration can be rejected and one can conclude that the variables are cointegrated. If the F-statistic is below the lower bound critical values, the null hypothesis of no cointegration cannot be rejected and if it falls between the lower and upper critical values, the test yields an inconclusive result.

Once cointegration is established, the long-run estimates are derived by estimating equation (4). The order of the lags in the ARDL model are selected by either the Akaike Information criterion (AIC) or the Schwarz Bayesian criterion (SBC), before the selected model is estimated by ordinary least squares. For annual data, Pesaran & Shin (1999) recommended choosing a maximum of 2 lags. From this, the lag length that minimizes SBC is selected.

$$LN(ANSR)_t = a_0 + \sum_{i=1}^{n} c_{1i}LN(ANSR)_{t-i} + \sum_{i=1}^{n} a_{1i}LN(HC)_{t-i} + \sum_{i=1}^{n} a_{2i}LN(UER)_{t-i} + \sum_{i=1}^{n} a_{3i}LN(RP)_{t-i} + \sum_{i=1}^{n} a_{4i}LN(EE)_{t-i} + \sum_{i=1}^{n} a_{5i}LN(RGDP)_{t-i} + \sum_{i=1}^{n} a_{6i}LN(TOT)_{t-i} + \lambda_t \quad (4)$$

Thus, an ARDL specification of the short run dynamics can be derived using an error correction model (ECM) of

the form:

$$\Delta ANSR_t = a_0 + \sum_{i=1}^{n} c_{1i} LN(ANSR)_{t-i} + \sum_{i=1}^{n} a_{1i} LN(HC)_{t-i} + \sum_{i=1}^{n} a_{2i} LN(UER)_{t-i} + \sum_{i=1}^{n} a_{3i} LN(RP)_{t-i} + \sum_{i=1}^{n} a_{4i} LN(EE)_{t-i} + \sum_{i=1}^{n} a_{5i} LN(RGDP)_{t-i} + \sum_{i=1}^{n} a_{6i} LN(TOT)_{t-i} + \delta ECM_{t-1} + \nu_t \quad (5)$$

where ECM_{t-1} is the error correction term defined as

$$ECM_t = LN(ANSR)_t - a_0 - \sum_{i=1}^{n} c_{1i} LN(ANSR)_{t-i} - \sum_{i=1}^{n} a_{1i} LN(HC)_{t-i} - \sum_{i=1}^{n} a_{2i} LN(UER)_{t-i} - \sum_{i=1}^{n} a_{3i} LN(RP)_{t-i} - \sum_{i=1}^{n} a_{4i} LN(EE)_{t-i} - \sum_{i=1}^{n} a_{5i} LN(RGDP)_{t-i} - \sum_{i=1}^{n} a_{6i} LN(TOT)_{t-i} \quad (6)$$

and all the coefficients are the short-run dynamics of the model's convergence to equilibrium δ is the speed of adjustment.

To ascertain the goodness of fit of the ARDL model, diagnostic and stability tests are conducted. The diagnostic test examines the serial correlation, functional form, normality, and heteroscedasticity associated with the model. The structural stability test is conducted by employing the cumulative sum of squares of recursive residuals (CUSUMSQ). If CUSUMSQ statistic stays within 5% significance level then the coefficient estimates are said to be stable (Bahmani-Oskooee & Barry, 2000).

4. Results and Discussions

4.1. Data and Analysis

With the purpose of observing the determinants of sustainable development in Kenya, the econometric model (section 3.4.2) is subjected to a multiple regression analysis. The set of time series data for Kenya between the years 1975 and 2014 is used in this paper. In order to study the regression models, OLS technique is applied to estimate. Further, this study also employs the Johansen cointegration test to observe the long-run relationship between the variables as well as the ECM to show the adjustment of variable when it moves apart from its long run equilibrium.

4.2. Descriptive statistics

Descriptive statistics describe the position of the variables which statistics contain the following items such as mean, standard deviation, skewness, and kurtosis values. The descriptive statistics of the variables are shown in table 4.1.

Table 4.1: Descriptive statistics of variables (24 observations)

Variable	Mean	Std. Dev.	Skew.	Kurtosis	Jarque-Bera	Prob.
LNANSR	0.0922	0.0501	1.9820	6.4971	27.9437	0.0000^
LNHC	0.0720	0.1393	-0.2272	4.2642	1.8048	0.4056
LNUER	0.1006	0.0102	-0.3504	2.5475	0.6958	0.7062
LNRP	0.0416	0.0120	0.9237	2.8150	3.4470	0.1784
LNEE	0.6061	0.0081	0.4267	3.1259	0.7440	0.6894
LNRGDP	0.0337	0.1080	1.2978	5.3774	12.3893	0.0020^
LNTOT	-0.0357	0.0198	-0.4792	2.5592	1.1130	0.5732

Note: ^ denotes a normal distribution.

The correlation matrix (table 4.2) shows the correlation coefficient (Pearson's r) for each of the independent variable with every other variable including the dependent variable, ANSR. The correlation matrix highlights the respective independent variable's contribution after allowing for the contributions of other independent variables. Thus, if a variable is highly correlated with another it will have no additional contribution to make over and above the contribution of the other. In this particular data set, none of the independent variables are closely correlated. Hence, we can reliably estimate the effects of the independent variables.

Table 4.2: Correlation matrix of variables

	LNANSR	LNHC	LNUER	LNRP	LNEE	LNRGDP	LNTOT
LNANSR	1.0000						
LNHC	-0.2529	1.0000					
LNUER	-0.2878	0.1338	1.0000				
LNRP	0.5916	0.0563	-0.3244	1.0000			
LNEE	0.2801	0.1358	-0.3932	0.5011	1.0000		
LNRGDP	0.3522	-0.7515	-0.1916	0.2725	-0.1684	1.0000	
LNTOT	-0.4113	0.1489	0.4563	-0.7298	-0.4645	-0.4881	1.0000

4.3. ARDL Model

4.3.1. Result of stationarity

The test for stationarity to detect unit root problem used the ADF test at first difference. This was done to

confirm that there are no unit roots in first difference concluding that all variables are not order *I(2)*. This will ensure that we are able to carry out an ARDL model. The results are shown on Table 4.3. confirm that at all significance levels, we can reject the null hypothesis of existence of unit root since the p-value is 0 for all series.

Table 4.3: Unit root test at first difference results

Null Hypothesis: There exists unit root	Statistic	p-value
ADF - Fisher Chi-square	155.864	0.0000
Individual Tests at first difference		p-value
D(LNANSR)		0.0000
D(LNHC)		0.0000
D(LNUER)		0.0000
D(LNRP)		0.0000
D(LNEE)		0.0001
D(LNRGDP)		0.0000
D(LNTOT)		0.0000

Source: Author's composition

4.3.2. Result of lag length selection

A lag order on the basis of the Schwarz information criteria (SC) because the computation of F-statistics for cointegration is very sensitive to lag length. The lag length that minimizes SC is 1 as seen in Table 4.4.

Table 4.4. VAR Lag Order Selection Criteria

Endogenous variables: D(LNANSR)		
Exogenous variables: C D(LNHC) D(LNUER) D(LNRP) D(LNEE) D(LNRGDP) D(LNTOT) LNANSR(-1) LNHC(-1) LNUER(-1) LNRP(-1) LNEE(-1) LNRGDP(-1) LNTOT(-1)		
Lag	Log Likelihood	Schwarz information criterion
0	64.4889	-4.1121
1	67.3254	-4.2373*
2	67.4559	-4.1047

(*) Indicates lag order selected by criteria; (^) sequential modified LR test statistic (each test at 5% level)

4.3.3. Results of conditional ECM

The ARDL equation (3) using the lag length selected of 1 is estimated using ordinary least squares method and no coefficient restrictions are imposed on the lagged level variables to derive the F-test statistic using a conditional ECM as described by Pesaran *et al.* (2001), also known as an unrestricted ECM. The equation output is:

$$\Delta LNANSR_t = 0.2842 + 0.5681\Delta LNANSR_{t-1} + 0.0302\Delta LNHC_{t-1} - 1.9849\Delta LNUER_{t-1} + 2.5426\Delta LNRP_{t-1} - 2.5350\Delta LNEE_{t-1} - 0.1253\Delta LNRGDP_{t-1} + 1.3785\Delta LNTOT_{t-1} - 1.4725LNANSR_{t-1} + 0.0686LNHC_{t-1} + 1.4493LNUER_{t-1} - 0.5647LNRP_{t-1} - 0.6375LNEE_{t-1} + 0.1506LNRGDP_{t-1} - 3.1179LNTOT_{t-1} \quad (7)$$

Table 4.5. Conditional ECM Output

Dependent Variable: D(LNANSR)				
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNANSR(-1))	0.5681	0.4036	1.4075	0.2021
D(LNHC(-1))	0.0302	0.0950	0.3174	0.7602
D(LNUER(-1))	-1.9849	1.7211	-1.1533	0.2866
D(LNRP(-1))	2.5426	2.3908	1.0635	0.3229
D(LNEE(-1))	-2.5350	2.2578	-1.1228	0.2986
D(LNRGDP(-1))	-0.1253	0.2238	-0.5599	0.5930
D(LNTOT(-1))	1.3785	0.9483	1.4537	0.1894
LNANSR(-1)	-1.4725	0.3835	-3.8394	0.0064 *
LNHC(-1)	0.0686	0.2838	0.2418	0.8158
LNUER(-1)	1.4493	1.0689	1.3559	0.2172
LNRP(-1)	-0.5647	1.5395	-0.3668	0.7246
LNEE(-1)	-0.6375	2.1448	-0.2972	0.7749
LNRGDP(-1)	0.1506	0.4262	0.3535	0.7341
LNTOT(-1)	-3.1179	1.0459	-2.9812	0.0205*
C	0.2842	1.2640	0.2248	0.8285
R^2	0.9092	F Staistic (p-value)		5.0092 (0.0197)
Adjusted R^2	0.7277	Durbin-Watson stat		1.5740

(*) indicates a statistically significant variable

The Breusch-Godfrey Serial Correlation LM test is then used to test if the errors of this model are serially independent. Table 4.6 shows that the errors of the model are not serially correlated.

Table 4.6. Breusch-Godfrey Serial Correlation LM test

H_0: No serial correlation		Remarks
F statistic (p-value)	1.8262 (0.2539)	Cannot reject null hypothesis hence serial correlation does not exist

The ARCH test is also used to test if the errors of this model are homoscedastic. Table 4.7 shows that the errors of the model are homoscedastic.

Table 4.7. ARCH test

H_0: No heteroscedasticity		Remarks
F statistic (p-value)	0.2776 (0.7609)	Cannot reject null hypothesis hence heteroscedasticity does not exist

4.3.4. Results of VAR stability

Since the model is autoregressive, we need to check that the model is dynamically stable. To check for this, a VAR model is estimated with one lag and its inverse root is checked to be within the circle. Figure 3 shows the inverse root is inside the unit circle.

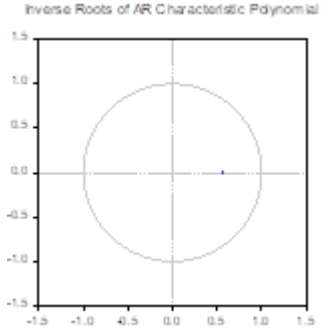

Figure 3. AR Roots Graph

Also, the fit of the unrestricted ECM using equation 7 from the actual, fitted and residuals graph 4 confirms stability of the model.

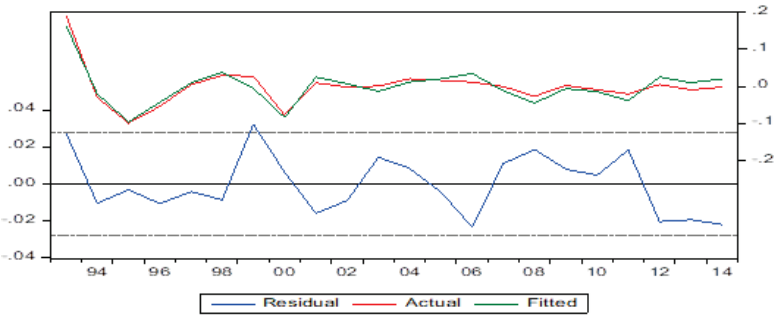

Figure 4. Actual/Fitted/Residuals Graph

Unscrambling figure 5, shows the fit of the model in terms of explaining the level of ANSR itself, rather than ΔANSR is good. Thus, the model is dynamically stable.

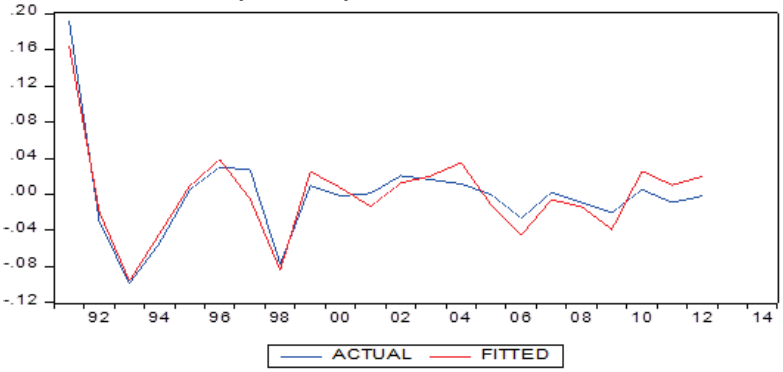

Figure 5. ANSR – Actual and Implied Fit from Conditional ECM Graph

4.3.5. Results of long run relationship test

Having a lag of order one and ensuring the conditional ECM has no serial correlation nor heteroscedastic properties as emphasised by Pesaran *et al.*(2001), a long run cointegration equation can be modelled. In addition,

the function includes two appropriate dummy variables to account for the 1992 general elections, the first multi-party elections since independence (DUM2) and post-election violence from the 2007 general elections (DUM3).

LNANSR = -0.2643LNANSR(-1) + 0.0213LNHC - 0.1860LNHC(-1) - 2.5944LNUER + 3.6694LNUER(-1) + 2.7460LNRP - 2.4185LNEE + 1.8861LNEE(-1) + 0.1118LNRGDP + 0.2886LNTOT - 1.3857LNTOT(-1) - 0.1473DUM2 + 0.1195DUM3 + 0.1885 (8)

The empirical results are shown in table 4.8 show that the model does not suffer from serial correlation nor heteroscedasticity. This shows that the relationship between variables is confirmed.

Table 4.8. Autoregressive Distributed Lag Estimates

Dependent Variable: LNANSR				
Method: ARDL Model selection criteria: Schwarz criterion (SIC) Fixed regressors: DUM2, DUM3, C Selected model: ARDL (1,1,1,0,1,0,1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNANSR(-1)	- 0.2643	0.3329	- 0.7940	0.4476
LNHC	0.0213	0.0994	0.2141	0.8352
LNUER	- 0.1860	0.0735	- 2.5301	0.0322
LNUER (-1)	- 2.5944	1.3045	- 1.9888	0.0779
LNRP	3.6694	0.9907	3.7038	0.0049
LNEE	2.7460	1.2498	2.1972	0.0556
LNRGDP	- 2.4185	1.7696	- 1.3667	0.2049
LNTOT	1.8861	1.1497	1.6405	0.1353
LNTOT(-1)	0.1118	0.1367	0.8176	0.4347
DUM2	- 0.2643	0.3329	- 0.7940	0.4476
DUM3	0.0213	0.0994	0.2141	0.8352
C	- 0.1860	0.0735	- 2.5301	0.0322
R^2	0.9208	F-statistic (p-value)	8.0434(0.0019)	
Adjusted R^2	0.8063	Durbin-Watson stat	2.3869	
Test Statistic	*Test*	*Statistic*	*Result*	*Remarks*
Serial Correlation	Breusch-Godfrey Serial Correlation LM Test	F statistic (p-value)	1.2168(0.3520)	No serial correlation
Heteroscedasticity	ARCH Test	F statistic (p-value)	0.6193(0-.4405)	No heteroscedasticity

More so, the model is tested for its stability using the CUSUMSQ test as shown on figure 6 CUSUMSQ statistic stays within 5% significance level thus confirming the stability of the coefficient estimates.

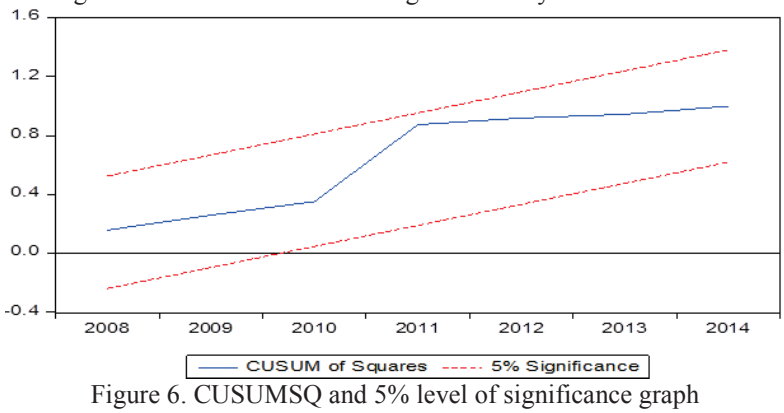

Figure 6. CUSUMSQ and 5% level of significance graph

The calculated F-statistics for the cointegration test is displayed in Table 4.9. The calculated F-statistic (F-statistic = 6.8261) is higher than the upper bound critical value at 1 percent level of significance using restricted constant and no trend. This implies there is evidence of a long-run relationship between the time-series at 1 percent significance level.

Table 4.9. F-statistic of Cointegration Relationship

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	*Significance Level*	I(0)	I(1)
F-statistic	6.8261	*10%*	1.99	2.94
k	6	*5%*	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

The empirical results of the long-run model are shown in table 4.10 as per the cointegrating equation 9 The estimated coefficients show that ANSR is directly related to lagged values of LNANSR, LNHC and LNRP and differenced values of LNEE and LNTOT and DUM3. Thus, the post-election violence from the 2007 general elections had an impact on sustainable development.

D(LNANSR) = 0.1885 -1.2643LNANSR(-1) -0.1647LNHC(-1) + 1.0750LNUER(-1) + 2.7460LNRP - 0.5325LNEE(-1) + 0.1118LNRGDP -1.0971LNTOT(-1) + 0.0213D(LNHC) -2.5944D(LNUER) - 2.4185D(LNEE) + 0.2886D(LNTOT) -0.1473 (LNANSR - (-0.1303LNHC(-1) + 0.8502LNUER(-1) + 2.1719LNRP(-1) -0.4211LNEE(-1) + 0.0884LNRGDP(-1) -0.8678LNTOT(-1) + 0.1491) + 0.1195DUM3) (9)

Table 4.10. Estimated long-run Coefficients of the ARDL Approach

Dependent Variable: D(LNANSR)				
Selected model: ARDL (1,0,1,0,0,0,1) Case 2: Restricted constant and No trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNANSR(-1)*	-1.2643	0.3329	-3.7975	0.0042
LNHC(-1)	-0.1647	0.0685	-2.4043	0.0396
LNUER (-1)	1.0750	0.7748	1.3875	0.1987
LNRP**	2.7460	1.2498	2.1972	0.0556
LNEE(-1)	-0.5325	1.3727	-0.3879	0.7071
LNRGDP**	0.1118	0.1367	0.8176	0.4347
LNTOT(-1)	-1.0971	0.8701	-1.2608	0.2391
D(LNHC)	0.0213	0.0994	0.2141	0.8352
D(LNUER)	-2.5944	1.3045	-1.9888	0.0779
D(LNEE)	-1.2643	0.3329	-3.7975	0.0042
D(LNTOT)	-0.1647	0.0685	-2.4043	0.0396
DUM2	1.0750	0.7748	1.3875	0.1987
DUM3	2.7460	1.2498	2.1972	0.0556
C	0.1885	0.8429	0.2236	0.8280

(*) p-value incompatible with t-bounds distribution; (**) variable interpreted as Z=Z(-1)+D(Z)

4.3.6. Results of error correction model (ECM)

The results of the error correction model for trade balance are presented in Table 4.11. Only two of the coefficients in the ECM are statistically insignificant, LNHC and LNTOT while the rest of the values, LNEUR, LNEE, DUM2, DUM3 are statistically significant. The results of ECM show that the coefficient of UER (-2.5944) is equal to its long-run coefficient while the coefficient of EE (-2.415) is less than its long-run coefficient. The coefficient of the error correction term (ECT) is equal to -1.26 and is statistically significant (p-value = 0.0000) thus the speed of adjustment is fast implying a high rate of convergence to equilibrium in the following year by 126%. According to Bannerjee et al. (1998), a highly significant error correction term further confirms the existence of a stable long-run relationship. In addition, the ECM can explain 93 per cent of fluctuation of ANSR while other variables not included in the estimated model explain 7 per cent of the variation.

Table 4.11. Error Correction Representation for ARDL Model

Dependent Variable: D(LNANSR)				
Selected model: ARDL (1,0,1,0,0,0,1)				
Case 2: Restricted constant and No trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNHC)	0.0213	0.0318	0.6700	0.5197
D(LNUER)	-2.5944	0.5813	-4.4631	0.0016
D(LNEE)	-2.4185	0.7620	-3.1738	0.0113
D(LNTOT)	0.2886	0.2970	0.9718	0.3565
DUM2	-0.1473	0.0204	-7.2188	0.0000
DUM3	0.1195	0.0231	5.1768	0.0006
CointEq(-1)*	-1.2643	0.1283	-9.8530	0.0000
R^2	0.9274	Durbin-Watson stat	2.3869	
Adjusted R^2	0..9002	F-statistic	6.8261	

(*) p-value incompatible with t-bounds distribution

4.4. Discussion

The estimated long run equation under table 4.10 shows that lagged values of household consumption per capita (LNHC(-1)) have a negative and significant effect on adjusted net savings rate. This implies that past values of household consumption per capita (LNHC(-1)) results in a change in current values of adjusted net savings rate (LNANSR) negatively. Thus, a one percent increase in past values of household consumption per capita (LNHC(-1)) results to a decrease to adjusted net savings rate by 0.1647 percent. This is consistent with Pardi et al. (2015) and Phimphanthavong (2014) studies that show the importance of savings over consumption to achieve sustainability. By this, it implies that capital stocks that are sustained by savings should surpass the consumption of goods and services that this capital stock produces. More so, past values of unemployment rate (LNEUR(-1)), energy efficiency (LNEE(-1)) and terms of trade growth (LNTOT(-1)) results in a change in current values of adjusted net savings rate (LNANSR) positively, negatively and negatively respectively. Thus, a one percent increase in past values of unemployment rate (LNEUR(-1)) results to an increase to adjusted net savings rate by 1.075 percent which is consistent with Bande & Karanassou (2010) study that showed an inverse relationship between savings, thus investment, with unemployment rate. A one percent increase in past values of energy efficiency (LNEE(-1)) results to a decrease to adjusted net savings rate by 0.5325 percent which is consistent with the hypothesis that energy efficiency does not contribute to environment sustainability because energy efficiency will increase profitability of firms which will in turn increase productivity which will then demand more energy. A one percent increase in past values of terms of trade growth (LNTOT(-1)) results to a decrease to adjusted net savings rate by 1.0971 percent which is consistent with the hypothesis that an increase in terms of trade will lead to a decrease in savings. The level values of resource productivity (LNRP) and real GDP per capita growth (LNRGDP) results in a change in current values of adjusted net savings rate (LNANSR) positively. A one percent increase in current values of resource productivity (LNRP) results to an increase to adjusted net savings rate by 2.746 percent which is consistent with Malenbaum (1978) intensity-of-use hypothesis that shows Kenya is at its nascent stage of resource use. A one percent increase in current values of real GDP per capita growth (LNRGDP) results to an increase to adjusted net savings rate by 0.1118 percent which is consistent with theory of marginal propensity to save where savings expand from the increasing of income attributed by GDP. As a result, an increase in the growth of real GDP per capita results in an increase in the amount of savings.

In the short run, unemployment rate and energy efficiency have a significant short-run impact on sustainable development as shown in table 4.11. The negative short run impact of energy efficiency is consistent to Pardi *et al.* (2015) for Malaysia data, Boos & Müller-Holm (2013) for 71 developing countries and 87 industrialized countries and Carbonnier *et al.* (2011) for 108 countries where 33 are lower income countries, 41 are lower middle-income countries, and 34 are upper middle-income countries. More so, the negative short run impact of unemployment rate can be explained by the fact that with increased unemployment it means that people have less money thus will need to utilize savings to cater for current expenses thus depleting national savings. The error correction term is high and significant highlighting the stability of the long-run relationship between the variables.

5. Conclusion

5.1. Summary

The objective of this study is to identify and investigate the determinants for sustainable development and the specific objectives were to; investigate economic, environmental and social determinants of sustainable

development in Kenya; assess to what extent household consumption per capita, unemployment rate, resource productivity, energy efficiency, terms of trade and real GDP per capita can be used to determine sustainable development in Kenya; and observe the direction and magnitude of sustainable development in relation to variations in household consumption per capita, unemployment rate, resource productivity, energy efficiency, terms of trade and real GDP per capita.. The study applied an autoregressive distributed lag (ARDL) model on annual data for adjusted net savings rate, household consumption per capita, unemployment rate, resource productivity, energy efficiency, real GDP per capita and terms of trade for the period 1991 to 2014.

The result of the ADF unit root tests demonstrated that all series are integrated of order one I(1) making it suitable to carry out an ARDL approach. Thereafter, a conditional ECM was carried out to ascertain the lag length to use for the ARDL model using the Schwarz criterion (SC) which suggested an optimal lag of one. The result of the conditional ECM showed a stable model that did not suffer from serial correlation nor heteroscedasticity indicating that a long run cointegrating equation exists. Thus, ARDL (1,1,1,0,1,0,1) was modelled using Schwarz criterion (SC) with restricted constant of the form of two dummy variables to explain 1992 general election with multi-parties and 2007 post-election violence and no trend. The F-bounds test confirmed existence of the long run cointegrating equation and CUSUMSQ confirmed stability of the coefficient estimates. More so, ARDL (1,1,1,0,1,0,1) was found not to suffer from serial correlation nor heteroscedasticity thus leading to the modelling of short run vector ECM (VECM). VECM showed that energy efficiency and real GDP per capita growth negatively affect sustainable development proxied by adjusted net savings rate. Household consumption per capita negatively and significantly affects adjusted net savings rate with a coefficient of 0.1647. This shows that household consumption per capita determines sustainability in the long run in Kenya. In the long run, unemployment rate resource productivity, energy efficiency, real GDP per capita and terms of trade do not statistically determine sustainability. Since all variables used in the study are logarithmic, they can be interpreted as elasticities. Thus, sustainability is relatively more elastic with respect to household consumption per capita in the long run.

More so, the study tested the stability of the equilibrium via VECM on ARDL (1,1,1,0,1,0,1) model and found that the ECT carries the correct sign (negative) and is statistically significant at 5 percent with the value 1.2643. This implies that in any instance of disequilibrium, the variables will converge towards an equilibrium path by 126 percent to the long run equilibrium position in the following year. The coefficient of the error correction terms of unemployment rate and energy efficiency have a negative sign and are statistically significant depicting a convergence from the long run equilibrium. The significant error correction terms for unemployment rate and energy efficiency imply they Granger-cause one another in the long run.

5.2. Conclusions

The study revealed that in tandem with existing literature, the social dimension of sustainability plays a significant role in furthering sustainability in the long run. In the short run, both energy efficiency and unemployment rate have a significant negative contribution to sustainable development. This implies that for sustainability to be achieved, policy makers need to focus on social and environmental dimensions of sustainable development in the short run so that they can pave a development pathway that is both progressive and sustainable. More so, in the long run, social dimension features highly in ensuring that the progress achieved is translated to increase in individual wealth thus alleviating poverty.

5.3. Recommendations

The study proposed the following recommendations:

1. Given that the sustainable development is greatly affected by the social dimension for the Kenyan economy, there needs a shift from a consumption economy to a savings economy through encouragement of personal savings, retirement savings through tax reliefs from savings and by increasing deposit savings rate.
2. Secondly, any effort invested in efficient use of energy use through policies that reduce energy subsidies, provide incentives for utilities that are energy efficient such as smart metering, enforce energy efficiency standards while at the same time limiting the increased use of energy by using renewable energy sources is proposed.
3. Thirdly, a contractionary fiscal policy is proposed to reduce public deficits and lower private indebtedness so as to reduce natural unemployment rate.

5.4. Suggestions for further research

Assessment of sustainability is significant in creating robust development frameworks for countries. This cannot be limited to just determining predictors of sustainable development in Kenya but to other areas as well such as:

1. Forecasts of these determinants and/or other determinants of sustainable development.
   I suggest development of an aggregate sustainability stability index for Kenya using sustainability data.

The aggregate sustainability stability index would build on previous work by aggregating microeconomic, macroeconomic and international factors indicative of sustainable development performance into a single measure of sustainability stability. The index can be tested on its successfulness in capturing key periods of sustainability instability during the sample period and reflected a general improvement in stability. More so, Monte Carlo simulations can be used to provide a one-year ahead forecast of sustainability stability in an effort to assist policymakers in determining the future state of vulnerability.

2. Cross-country analysis using panel data techniques of East African countries on these determinants and/or other determinants of sustainable development.
   I suggest carrying out an investigation of the determinants of sustainable development using ANSR as a proxy to sustainable development. Panel data on developing countries in sub Saharan Africa can be used. The main interest of the research would be to explore how different variables or indicators affect ANSR. The Hausman test can be utilised to check weather fixed effect model is more appropriate or random effect model.

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