FISCAL DECENTRALISATION AND TECHNICALLY EFFICIENT

SUSTAINABLE PUBLIC DEBT IN KENYA

BY

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DECLARATION

Declaration by the Candidate

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I dedicate this work to my late parents Nicodemus and Dorothy.

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ABSTRACT

Kenya's public debt sustainability has continuously worsened over recent years yet the country's debt is still classified as sustainable. At the same time, the process of fiscal decentralisation has intensified in the country since its official initiation in 2013. That worsening public debt sustainability position contrasts with the position held in devolution literature that fiscal decentralisation makes the management of public funds more efficient, manifested by improvements in public debt sustainability. This contrast presented a knowledge gap, which this research sought to fill in. The study made a move away from measuring public debt sustainability, traditionally used to evaluate a country's debt-carrying capacity and to justify or denounce increases in government borrowing. It moved towards making such evaluation by use of the technical efficiency of sustainable public debt. Its main objective was to establish the effect of fiscal decentralisation on the technical efficiency of sustainable public debt in Kenya. The specific objectives of the study were to determine the effect of revenue decentralisation on the technical efficiency of sustainable public debt; to determine the effect of the expenditure decentralisation on the technical efficiency of sustainable public debt and to determine the effect of fiscal-transfers decentralisation on the technical efficiency of sustainable public debt. The study was thus anchored on the economic theory of technical efficiency. Using a causal research design, a panel data analysis was made on secondary data collected over the period 2013 to 2021, using document and records based research tools from a census enquiry of all the 47 counties of the country. It employed the stochastic frontier analysis technique on the debt-sustainability assessment model developed by Evsey Domar. The findings of the research were: that between 2013 to 2021, public debt sustainability worsened from 39.8 percent to 69 percent; the technical efficiency of sustainable public debt averaged 12.5 percent ranging between 87.5 percent and 0.05percent. Over the period, revenue decentralisation ($\beta = 0.143$, $p = 0.439$) and expenditure decentralisation ($\beta = 0.122$, $p = 0.000$) were found not to improve the technical efficiency of the sustainability of public debt. Conversely fiscal transfer decentralisation was found to raise the technical efficiency ($\beta = -17.224$) and was statistically significant ($p = 0.000$). It was concluded that while expenditure decentralisation worsened the technical efficiency of achieving an optimal sustainable public debt level, fiscal transfers decentralisation improved it and overall, the technical efficiency was very low. Additionally, the observed downward trend in fiscal transfers over this period exacerbated the poor technical efficiency of the sustainability of public debt. The study provides useful information for fiscal decentralisation policy and recommends that future research examine the relationship between the technical efficiency of sustainable public debt and the different forms of fiscal transfers used in the country.

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ABBREVIATIONS AND ACRONYMS

CEIC: Census and Economic Information Center

CG: County Government

COK: Constitution of Kenya

CPIA: Country Policy and Institutional Assessment

D-W: Durbin Watson Test

FD: Fiscal Decentralisation

FDI: Foreign Direct Investment

GCP: Gross County Product

GDP: Gross Domestic Product

GOK: Government of Kenya

IBRD: International Bank of Reconstruction and Development

IMF: International Monetary Fund

KHRC: Kenya Human Rights Commission

KNBS: Kenya National Bureau o Statistics

LDCs: Less Developed Countries

LH: Leviathan Hypothesis

MPK: Marginal Product of Capital

OECD: Organization for Economic Co-operation and Development

OLS: Ordinary Least Squares

OSR: Own Source Revenue

SFA: Stochastic Frontier Analysis

SPAN: Social and Public Accountability Network

SSA: Sub Saharan Africa

TE: Technical Efficiency

UNRISD: United Nations Research Institute for Social Development

VIF: Variance Inflation Factor

OPERATIONAL DEFINITION OF TERMS

This is to give meaning to terms and concepts used in the study to make them quantifiable and statistically useful in relation to the study.

Central Government Public Debt: all liabilities that require payment or payments of interest and/principal by the debtor country to the creditors at a date or dates in the future (Ricardo & Varinia, 2004).

Country Policy and Institutional Assessment: a set of criteria used to assess a country's policy and institutional framework with regard to its effectiveness in poverty reduction and growth stimulation (Marcello Estevão *et al*, 2020)

County Primary Balance: ratio of the excess of county government revenue over its expenditure to the excess of central government revenue over its expenditure (Barbados, 2020)

County Public Debt: the portion of the central government public debt apportioned prorata to each county based on the county population size of the August 2019 population census

Decentralisation: the devolution or reassignment of specific powers 'with all of the administrative, political, and economic attributes that these [powers] entail from central government to decentralised government entities which are autonomous within their own geographic and functional spheres of authority (Breuss & Eller, 2004)

Decision Making Unit: any entity evaluated in terms of its abilities to convert inputs into outputs (William *et al*, 2011)

Devolution: the transfer of both political and administrative decision-making powers and authority to the decentralised government entities - like counties in the case of Kenya (Kilelo *et al*, 2015)

Economic Growth: Average growth rate of real GDP per capita (Breuss & Eller, 2004)

Fiscal Decentralisation: the reform of the system of expenditure functions and revenue source transfers from the central to decentralised government entities (Feruglio, 2007)

Fiscal Transfers: the transfer of finances from the central government to lower government levels (Feruglio, 2007)

Government Size: expenses incurred by the central government to operate and capital projects as compared to total government income (Bagaka, 2008)

Gross County Product (**GCP) - for Kenya**: Counties' average contribution to Gross Domestic Product in Kenya (Wankuru, 2019)

Gross Domestic Product (**GDP)**: the total market value of all final goods and service produced within a country in a specific period - usually a calendar year (Black *et al*, 2013)

Leviathan Hypothesis: – the hypothesis that the size of the central government reduces, *ceteris paribus*, the greater the degree of decentralisation of both revenue and expenditures (Golem, 2010)

Optimal Sustainable Public Debt: the frontier of the technically efficient sustainable public debt = the level of public debt, which ensures equality between the present value of future primary surpluses and the current level of public debt thus maximising welfare (Vogel, 2014).

Optimising Sustainable Public Debt: attempts to attain the level of public debt, which ensures that the present value of future primary surpluses equals the current level of public debt thus maximising welfare (after Vogel, 2014)

Own-source Revenue: government income that is from sources other than borrowing for example taxation, trading, fees and fines (Black, Hashimzade, & Myles, 2013)

Primary Balance Deficit: the financing gap created when projected expenditure exceeds available revenues (County Debt Management Strategy Paper, 2022).

Public Debt Management: the process of establishing and executing a strategy for managing the government's debt in order to; raise the required amount of funding, achieve its risk and cost objectives, and to meet any other objectives set by government (County Debt Management Strategy Paper, 2022)

Public Debt Management: the process of establishing and executing a strategy for managing the government's debt in order to raise the required amount of funding at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk (Shakira & Annalisa, 2015)

Robust Standard Errors: OLS estimator that converges asymptotically to the true value even when the variance of the errors of the regression is not constant (Taboga, 2021)

Sustainable Public Debt: one that maintains the ratio of public sector net worth to the economic output at its current level giving the country solvency in the ability to service its debt obligations as they fall due without disrupting its budget implementation (ICPAK, 2018)

Technical Efficiency of Sustainable Public Debt: the extent of attainment of the level of public debt which ensures that the present value of future primary surpluses equals the current level of public debt thus maximising welfare (after Vogel, 2014)

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter presents the background to the study, and a detailed outline of the main variables of the research including sustainable public debt and the elements of fiscal decentralisation. It gives an outline of the theoretical link between the technical efficiency of sustainable public debt and fiscal decentralisation. It explains the nature of the problem presented by the topic, describing why the issues require to be elucidated. In this chapter, the general and specific objectives, research hypotheses and significance of the study are discussed. The justification for carrying out the study is also given.

1.2 Background to the Study

1.2.1 Public Debt

Public Debt is a phenomenon experienced by all economies as a result of borrowing. Borrowing is made necessary by the desire to improve living standards. Higher standards of living are reached in conjunction with the attainment of other macroeconomic government objectives, which include among others, the raising of the level of employment, the control of inflationary pressure, the alleviation of external trade deficits and the stimulation of general economic growth among others. The neoclassical economists led by John Maynard Keynes first proposed the process by which the government takes measures to influence the direction and level of economic activity with the aim of achieving its macroeconomic objectives. These measures are carried out through the adjustments to borrowing, taxation, income collection and expenditure to manipulate aggregate demand and are therefore more commonly referred to as demand side policies. According to these economists, when private savings prove

to be inadequate for converting investment into production, debt financing can be a useful tool for manipulating the aggregate demand in the economy in order to stimulate the desired macroeconomic objectives and raise living standards. To achieve macroeconomic objectives such as the stimulation of economic growth and raising the employment levels, the government can apply economic expansionary measures on the aggregate demand so as to raise the levels of consumption by households and firms. Low taxation and low borrowing lead to an increase in the consumption and firm investment levels resulting in an increase in the aggregate demand and consequently a stimulation of production. With increased production, there will be a rise in the real gross domestic product over time (economic growth). There will also be a rise in employment since the increase in production will mean an increase in the demand for workers. On the other hand, a deliberate excessive government revenue collection over and above its expenditure for example, is a form of economic contractionary measure applied on the aggregate demand which can realize the reduction in inflationary pressure and a reduction in the external trade deficit among other macroeconomic objectives which the government may have aimed for. High government borrowing levels (and high tax levels) reduce consumption and investment in the economy as the level of money supplied falls. A reduction in consumption and investments causes a fall in aggregate demand. When the aggregate demand falls, there will be a lower inflationary pressure and a lower demand for foreign goods resulting in less importation and a reduction in any deficit in the balance of payments (Anderton, 2009).

This means that the government of a country that uses such adjustments must keep adjusting the amount of money it spends in comparison to that which it collects through taxes in order to manipulate the aggregate demand with the ultimate aim of maintaining and improving the standards of living of its people as well as catering for its

developmental needs. Consequently, in those cases where the government wishes to contract (reduce) economic activity it institutes those measures that reduce the aggregate demand - it can use either excessive taxation or borrowing. Ideally in these cases, when the government opts for borrowing it ought to ensure that its mainstream public revenues avenues such as taxes and duties can potentially cover the expenditure if it is keep the debts sustainable. In other words, whenever the government undertakes to raise its expenditure above its taxation it ought to avoid recklessly borrowing what it spends. This is why, while proposing the deliberate use of such demand-side policies, which involve the fiscal measures of changes in government revenue and expenditure, the classical economists, insisted that sound public financial policies and institutions must support such measures. These policies and institutions were meant to be a form of lookout for mitigating possible outlier effects of the government measures and to smooth out the negative effects of economic shocks that would otherwise be made worse via the said policies.

Leo Holz and Aloysius Uche Ordu point out how the decentralised government entities facilitate these institutional preconditions for the ability to possess the capacity to effectively collect revenue for themselves and plan (as well as execute) successful expenditure programmes. They go on to list these prerequisite conditions as inclusive of the following. A stable political environment, an effective autonomous decentralised government entity and the institutional capacity at the central as well as the decentralised levels of government. They also mention a high degree of government accountability, an effective democratic election infrastructure at all levels of government and the capacity to raise adequate levels of revenue locally from within the jurisdiction of the decentralised government entity (Ordu, 2021). A decentralised government system in possession of these institutions is said to have the capacity to

manipulate it budget in such a way that even if it were to borrow, it would have little problem in servicing the loans (Gómez-Puig & Sosvilla-Rivero, 2017).

An ideal situation in any government's budget would be one where it is not forced to borrow. 'Acceptable' fiscal deficits would then be those that were deliberately incurred in the course of controlling and directing the economy towards a contractionary path with the objective of lowering inflation of lowering deficits in international trade balances. However, in most instances governments are faced with public sector deficits because their expenditures overrun the revenues that they rake in from these conventional avenues due to planned as well as unintended reasons. These deficits are then covered by borrowing which puts the country into public debt such public debts can become a burden for the country when it comes to repaying. Such are the cases for developing countries, where borrowing is not usually used as contractionary fiscal policy tool of controlling the economy. For these countries debt plays the dual roles of filling in the capital gap to enable such countries to carry out much needed development projects and also the role of a stop gap measure in filling in perennial budgetary deficits. Borrowing and public debt take the place of taxation as a source of revenue. In the end borrowing is either voluntarily carried out to influence economic performance or involuntarily to cover for an insufficient collection of funds. One may debate whether borrowing is justified or not and how much can safely be borrowed as a maximum amount. Questions also need to be considered which look at how the government ought to conveniently finance or service the public debt. This is because unmitigated borrowing and unplanned repayment patterns can prove detrimental to an economy – particularly to an economy from the developing world. For countries which rely on tax revenue to pay their debts, poor repayment programmes can lead to situations where

they cannot repay. This may occur in such periods when the tax revenue falls short of expenditure needs for long periods. The situation deteriorates into a debt crisis.

Given the common occurrence of government fiscal deficits arising from the ever present fiscal policies instituted by government, borrowing and public debt is more of an expectation than a possibility in todays fisccal management precesses. In 2009, Aybarç gave criteria which have come to be used commonly in the description of public debt. The first of these is a classification of public debt that is based on the date of maturity of the debt. Classified in this manner, public debt can be seen to be either short-term, medium-term or long-term. According to Aybarç, short-term public debt or floating debt is debt which is repayable within one year. They are incurred through Government issuing of treasury bills and treasury guaranteed bonds. The maturity or repayment period for medium-term public debt ranges from one year to five years. On its part, long-term public debt matures after five years and is incurred through the issue of government bonds. The second criterion used by Aybarç to categorise public debt is the origin or the source of the borrowed funds. In which regard public debt is classified as being internal in cases where it is received from the country's own national resources. Otherwise it is referred to as external - in cases where it is acquired from the resources of a foreign country. A further distinction is made between voluntary debt which is taken by the government at its own discretion and obligatory debt which the government is forced into taking by circumstances such as the occurrence of an economic crisis (Aybarç, 2019).

Given the varied nature of public debt classifications, a 'suitable' definition of public debt that specifies which of these criteria is taken into account needs to be given. Therefore, this study incorporated in its meaning of public debt, both internal and

external debt. Internal borrowing has the effect of lowering the aggregate demand, employment and growth levels in the country. This is because it has a contractionary effect on the aggregate demand as it takes the liquidity away from the consumer and the investor firms in the economy, two of major components of aggregate demand. With a reduction in consumption levels and in the investment levels by firms, the aggregate demand falls. Following the reduction in the aggregate demand, there is low production and therefore low output (decrease in real GDP or economic growth), the slowing of production also leads to a fall in employment as firms' demand for workers thins out. With a slow-down in investment, growth and employment, internal borrowing ultimately reduces the government's future potential to raise tax revenue and even to carry out further future internal borrowing. Once the capacity to raise revenue internally is paralysed, long run outcome of the initial internal borrowing for such a government will be to borrow externally. External and internal borrowings are connected not just in their cause but also in their effect – the burden of repayment; and therefore the waiver in the definition of public debt in this study with regard to the motives for taking the loan and its maturity period. Such a distinction would have little effect on the burden of loan repayment in terms of its implication on the sustainability. For this study therefore, public debt meant the aggregate value of liabilities that obligate the payment of the principal sum borrowed by the government and the chargeable interest at the end of the relevant fiscal year (Aybarç, 2019).

In literature, the measurement of public debt is made in both absolute as well as in relative terms. In absolute terms, public debt is measured as an outstanding amount at the end of the relevant fiscal year. In relative terms, public debt is measured in comparison to some other economic variable. A common practice in literature is to relate public debt to the repayment ability of the borrowing nation. In this way, public

debt is measured with emphasis on the degree of its sustainability. It makes a comparison of the debt burden to the country's economic potential and specifically its potential ability to pay off the debt and even to take on more debt. The most commonly used relative measure of debt in literature is the ratio of public debt to GDP (Dabrowski, 2016). The public debt to GDP ratio offers an evaluative view of the quality and reliability of the government's fiscal policy. This definition was adopted in this study to describe the county public debt.

In 2022 Siniša Mali, Lenka Maličká incorporated population size in the measurement of fiscal decentralisation where they found the relationship between fiscal decentralisation and sustainable public debt in the European Union region to be statistically significant and inverse. They found that the strength or intensity with which fiscal decentralisation inversely influenced the sustainability of public debt was dependent on the population of each country (Mali & Maličká, 2022). On the strength of the Siniša Mali, Lenka Maličká (2022) study this research adopted the measure of county public debt by a pro-rata apportioning of the central government public debt to the counties based on the county populations as of the August 2019 census. In effect, the public debt was measured as per capita public debt based on county population ratios. It is noteworthy to point out that the level of fiscal decentralisation influences the quality and reliability of government's fiscal policy (Bohn, 2005). This occurs when the decentralised governments are forced into spending a certain proportion of the amount of revenue they collect on the decentralised government entities. In effect, such governments have an expenditure pattern that differs from that of governments that do not have decentralised systems. Carrying this extra expenditure obligation, decentraliced governments may require more revenue to spend than can be collected from their own people (in other words, expenditure with borrowing).

In line with the relative definition of public debt and for the purpose of interrogating the variables used in the study the model developed by Evsey Domar in 1944 was adopted. The basic form of this model as given by Bilan (2010) is in common use in literature for assessing the sustainability of public debt. It was used to formulate the econometric model for the study. Based on this equation, the total public debt in a given year was taken to be the sum of the debt outstanding from the previous period, plus the real interest charged on it, reduced by the primary budget balance – assuming that the primary balance was at a surplus as in equation 1.1 (Bilan, 2010):

$$D_t = D_{t-1} + rD_{t-1} - (G_t - T_t)$$

$$D_t = (1-r)D_{t-1} - P_t \text{ ...Equation 0.1}$$

Where: D_t = total amount of real public debt in year t

D_{t-1} = total amount of real public debt in year previous to year t

r = real interest rate charged on public debt

P_t = the primary balance, in period t worked out as: the real non-interest government expenditure including transfers and capital expenditures (G_t) minus the real government revenues (T_t)

1.2.2 The Traditional Borrowing Criterion and the Technical Efficiency of Sustainable Public Debt

The sustainability of public debt is currently used to gauge a country's debt carrying capacity. It is considered viable for a country to take on more debt even if it was already heavily indebted, provided it public debt was sustainable. In 2021, Kenya was in such a position (Marcello Estevão *et al*, 2020). Over the years, the level of Kenya's public debt had risen continuously (Oyugi & Chiraerae, 2011) as is illustrated in figure 1.1.
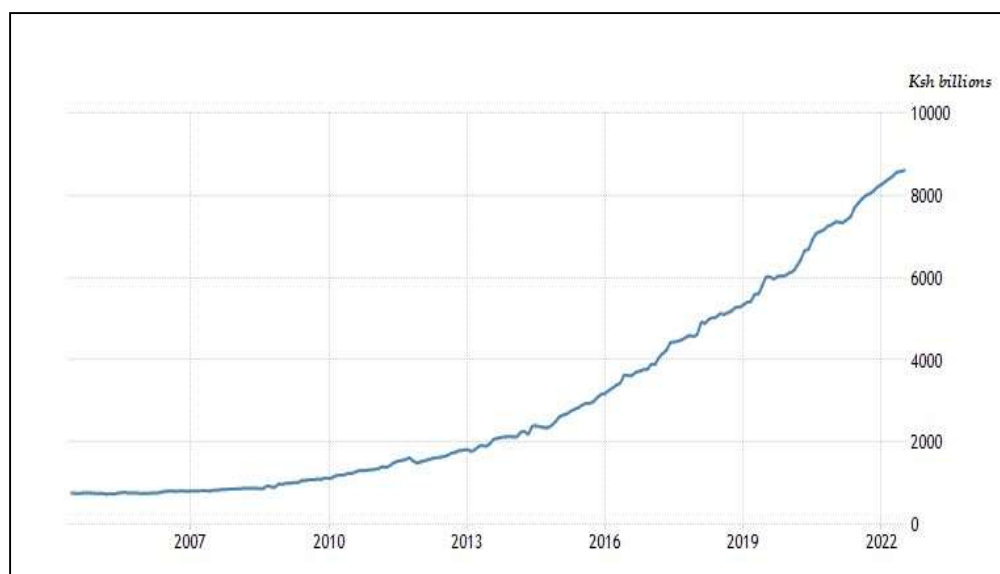
Figure 1.1: Kenya Public Debt Trend

Source: Central Bank of Kenya, 2022

The rise in the public debt was for the most part a reflection of the deficits that occurred in the government's budgeting process throughout these years. According to Fedelino *et al* (2021), these deficits particularly over the tail end of the period illustrated, were driven in part by government spending on large infrastructure projects and in part by the COVID-19 global economic shock in 2020 that caused significant declines in export and economic growth for the country. The economic growth rate in particular showed a very significant fall in Kenya from 5.40 in 2018/2019 down to -0.32 in 2019/2020 (Fedelino *et al*, 2021). The combination of these factors contributed to the increase in the level of the country's public debt over the years, and so contributed negatively to the country's public debt sustainability status. By June 2021, about half (4,523.54 billion Kenya shillings) of Kenya's public debt totaling 8,744.79 billion Kenya shillings, was owed to external creditors. Kenya's sustainable public debt in this period at an average of 56.9 percent, rose above the IMF recommended threshold of 50 percent in 2015 and stayed above it from then on. Worse still, the data observed showed the trend to be stretching further away from this threshold overtime. Despite all this, as at

June 2021, Kenya's public debt was said to be sustainable (Fedelino *et al*, 2021). Based on the IMFs CPIA, Kenya's debt carrying capacity as at October 2019 was adjudged to be intact. Given this position, this study endevoured to refine the criterion of an economy's debt carrying capacity by using the efficiency of the sustainability of public debt instead of just the sustainability.

Public debt is sustainable if it is at a level that maintains the ratio of the public sector net worth to the economic output at its current level. This gives the country solvency and the ability to service its debt obligations as they fall due without disrupting its budget implementation (ICPAK, 2018). To be able to service its public debt obligations in time will require that a nation ensures that the present value of its future primary surpluses equals the current level of public debt thus maximising welfare (Vogel, 2014). An assessment such as that made for Kenya in October 2019 (Marcello Estevão *et al*, 2020) and in June 2021 (Fedelino *et al*, 2021) that it its debt carrying capacity is strong, is more often than not shored up by other arguments to make it more convincing. One such common argument is that since the primary balance cannot be kept at a surplus indefinitely as a measure to combat the possibility of falling into public debt, a specified maximum of public debt must never be breached. Analyses around this threshold would indicate that any debt level below this threshold can be easily controlled through fiscal policy to ensure that it is sustainable: debt levels above this limit would definitely be considered as unstable with regard to their sustainability (Debrun *et al*, 2019). The traditional governance principle with regard to public debt management is centered on keeping the public debt sustainable. Based on such assessments, governments could easily fall into a trap where they borrow beyond the recommended thresholds with the hope of putting up appropriate policies to mitigate against negative effects of their borrowing. However, in such situations the occurrence of external shocks may render

such policies ineffective (Soyres *et al*, 2021). In an effort to show clearly the degree of safety available to a country that is already burdened with public debt in making additional borrowing, literature also relies on markers such as those set down by international financial institutions the IMF or the World Bank for various economic regions of the world. These markers in many cases indicate the existence of borrowing margins which appear contradictory to the observable economic conditions. For example, Soyres, Kawai and Wang contend that country specific characteristics such as governance instability and debt investors' portfolio have a bearing on the actual effect of increases in public debt (Soyres *et al*, 2021). To avoid such situations and render a criterion that is suitable for use as an alternative principle of public debt management and as an indicator of the safety margin of borrowing for governments, this study used the technical efficiency of optimum sustainability of public debt.

From the sustainable public debt one can project its most optimal level when the prevailing circumstances are taken into consideration. Achieving technically efficient sustainable public debt is equivalent to optimising sustainable public debt. The optimal level of sustainable public debt is the current level of debt that offsets the present-value of a country's future primary surpluses under the prevailing circumstances so as to maximise welfare. For this study, the circumstances chosen were the varying degrees of fiscal decentralisation variables. This study measured the effect of the changing levels of fiscal decentralisation on the degree to which the equality between the current level of Kenya's public debt and the present-value of its future primary surpluses was best attained. The technical efficiency (TE) of sustainable public debt was given by equating the observed to the expected (optimal) sustainable public debt as in equation 1.2:

$$TE = \frac{\text{Observed Sustainable County Public Debt}}{\text{Optimal Sustainable County Public Debt}} \times 100 \ldots \text{Equation } 0.2$$

Where:

the sustainable public debt $= \frac{\text{County Public Debt}}{\text{Gross County Product}} \times 100$,

the county public debt = the portion of the central government public debt apportioned pro-rata to each county based on the ratio of the county's population and

the gross county product = each county's average contribution to Gross Domestic Product. Its sum was equivalent to the country's GDP since it was the aggregate of each counties' average contribution to Gross Domestic Product in Kenya.

1.2.3 The Linkage between Fiscal Decentralisation, Technical Efficiency and Sustainable Public Debt

The common conclusion reached in devolutionary discourses is that fiscal decentralisation achieves an improvement in the provision of public services by the decentralised government entity. This implies that fiscal decentralisation is seen as a means of gaining higher levels of efficiency in public service provision. In economic theory, the concept of efficiency is defined in three basic forms. A brief consideration was made of these different forms of efficiency in economic theory to justify the form of efficiency that was adopted for modeling this study. The forms of economic efficiency are: productive efficiency, allocative (Pareto) efficiency and technical efficiency. In economic theory, the most productively efficient level of output is said to be attained at levels of output associated with the least cost of production. These will be at that point of output where the average cost of production equates the marginal cost of production. This will also be the point when average cost is at its lowest level both in the short run as well as in the long run. This condition will hold regardless of the particular type of market structure that the firm will be operating in, whether perfectly

competitive or uncompetitive in nature (Anderton, 2009). In this study, between the years 2013 and 2021, the effects of fiscal decentralisation on the attainment of that level of public debt, that ensured that the present value of future primary surpluses equal the current level of public debt was determined. In this regard, finding the productively efficient sustainable public debt would involve finding the level of public debt whose average costs were at their lowest. The intention of this research being to confine itself to the mainstream methodology of the study of the topic, the optimal sustainable public debt was measured, as in the earlier studies on the topic, in its relative terms (Golem, 2010). One way of grounding the analysis on productive efficiency would imply determining the lowest average cost of the county public debt-to-GCP ratio. The 'cost' of the debt would have had to be defined, variegating the selection of measurement of sustainable public debt from that in common use in literature (Battaile *et al*, 2015).

Allocative efficiency is achieved when the average revenue of production equates the marginal cost of production. This occurs where the value placed by the consumers on a unit of a good consumed as shown by the average revenue is equal to the cost of producing that unit. For this to be true, then allocative efficiency is attained when each consumer cannot better his consumption position without making another consumer worse off – in which case this type of efficiency is then referred to as Pareto efficiency (Anderton, 2009). For this study, Pareto efficiency would have been best suited as a tool for analysis had the study set out to consider the benefit derived from optimal sustainable public debt. This would have been helpful to determine a level of equilibrium where the benefit from the optimal sustainable public debt was allocated in such a way that all the "beneficiaries" received the exact value that they wanted the debt to give them and in the quantities they considered to be the right quantities. Given that public debt is actually an economic "bad", it would have been equivalent to the

determination of a level of equilibrium where the loss from the public debt was apportioned in such a way that all the losers from the distribution of the public debt got exactly what minimal loss they expected. In addition, they should have of necessity got them in the values they all considered to be the right quantities. This would be a position where it would not be possible to make any single loser worse off without making another better off by shifting the disadvantageous effects of the sustainable public debt between them. This line of enquiry was not in direct congruence with the objectives the study set out to achieve.

While both of these avenues could have been used the choice was made to model the study on technical efficiency as the central economic theory. Technical efficiency in economic theory is defined from two points of view (Black et al, 2013). An input oriented point of view defines technical efficiency as the obtaining of a given output from a process that minimises the employment of inputs. In relation to this study, the conclusion reached in devolution literature can be interpreted to mean that gains are made in the amount saving on public resources that are employed in public service provision during a given period. The conclusion therefore is thus reached that fiscal decentralisation creates savings on resources employed in public service provision without reducing the quantity or quality of the said services. The result then is the movement of the economic aggregates towards the optimal level of sustainable public debt. That is, that by decentralising the budgetary aspects of government, economic performance can be improved (which may be manifested as a rise in the annual real national income) without raising the government's expenditure level. Both of these factors ought to lead to a lower need for government borrowing at the same time as the national output improves which could result into a more sustainable public debt

position. This is the position that equates future primary balance surpluses to current public debt.

On the other hand, the output oriented interpretation of technical efficiency in economic theory views it as the maximisation of a predetermined objective or output from a given amount of inputs (Black *et al*, 2013). Based on the output oriented interpretation of technical efficiency, one can interpret the conclusion reached in devolution literature to mean that through fiscal decentralisation, a fixed financial outlay of government resources can be used to improve the provision of public services. This would result in increases in the level of national output. With rising real income at a fixed government size, the expectation should also be a better sustainable public debt position.

A linkage can thus be traced between the technical efficiency created on service provision through fiscal decentralisation and the technical efficiency to be achieved on optimal sustainable public debt through the proper management of the primary balance as is illustrated in figure 1.2:
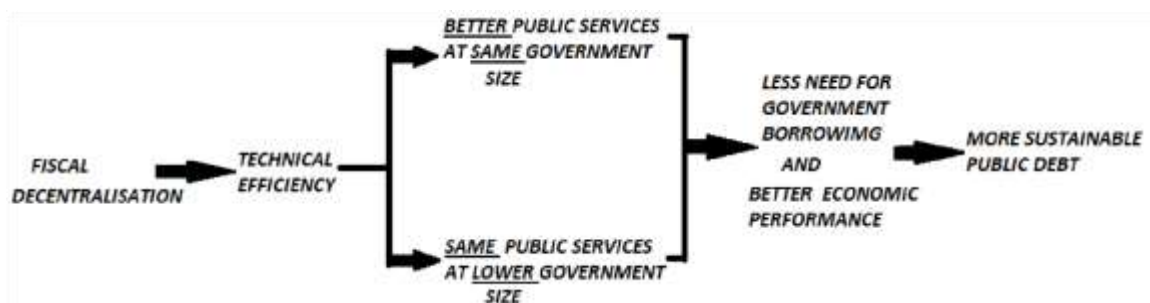
Figure 1.2: The Linkage between Fiscal Decentralisation, Technical Efficiency and Public Debt

Source: Author, 2022

Following from this, it is clear that in order to understand the effect of fiscal decentralisation on the technical efficiency of public service provision, one needs to

determine whether or not fiscal decentralisation creates a "saving" if any in the resources employed by the government in providing public services. In other words, one needs to determine the 'improvement" in the provision of public services that is attributable to fiscal decentralisation if any. Only then can he be able to analyse the effect of fiscal decentralisation on the technical efficiency of public service provision.

Both of the input and output oriented interpretations of technical efficiency are relevant in an analysis of technical efficiency changes in the public debt sustainability. From the viewpoint of the output oriented interpretation of technical efficiency, one can consider the achievement of technical efficiency in public debt sustainability to refer to putting in place policies and structures that enhance the achievement of the optimal level of the sustainability of public debt. Policies that move the sustainability of public debt towards an optimal level given some constant intervening factors such as the prevailing interest growth rate differential and primary balance outlay. Alternatively, using the input oriented view he would be considering the adjustment of the factors influencing sustainable public debt in a manner and direction that would be appropriate to maintain the sustainable public debt at its optimal level. Either way, it points to the introduction of suitable institutions and policies some of which may include or be connected in some way to fiscal decentralisation.

This study's interpretation of technical efficiency in analysing the sustainability of public debt pivoted on the input oriented view. From this view of technical efficiency, the interest rate charged on the debt, the economic growth rate and the primary balance were the key factors of analysis that were taken to be the 'inputs in the process of producing' an optimal sustainable public debt. It was assumed that improved public debt sustainability is reflected in the 'minimisation of these inputs' in the bid to optimise

a given output level namely, sustainable public debt. The input minimisation process involves the establishment of sound policies to favourably adjust interest rates, growth rates, government income and government expenditure towards attaining the optimal sustainable public debt.

Possible policies that can be put in place to minimise the difference between the interest rate charged on the debt and the economic growth rate include actions such as sourcing for the lowest interest loans or renegotiating interest rates on the one hand and measures to stimulate economic growth on the other. Technical efficiency will have been achieved if the excess of the interest rate paid on borrowed funds over the economic growth rate creates a solvent position with regard to repaying the public debt. It will even be better, in the terms of technical efficiency, if the solvent position can be maintained as close as possible to its optimal level. Unabated government borrowing reduces this optimality in sustainable public debt. It can cause the public debt-to-GDP ratio to tend towards infinity and to consequently increase the tax burden of servicing the public debt. Excessive borrowing can lead to technical inefficiency and a debt overhang, which can adversely affect the growth and development of the economy. This is why, to avoid this, many modern economists believe that technical efficiency in public debt management centers on its solvency. In other words, public debt must eventually converge to its initial level if it is to be held in a sustainable position. This helps alleviate the increase in the tax burden, which would otherwise fall too heavily on the citizenry to bear and lower their standards of living.

The comparison of the government's income to its expenditure or the primary balance can also a key consideration in the determination of the amount of 'saving' that can be created by the minimisation of government financial outlay to improve the provision of

public services and optimise sustainable public debt. This determination concerns the assessment of the government's ability to self-finance its sum-total expenditure alluded to in literature as the size of government or the primary budget balance. It is a comparison of the government expenditure to its revenue raised without resorting to borrowing. Silvia Golem (2010) makes a detailed review of some of the empirical studies that have been made on the topic of fiscal decentralisation (Golem, 2010). A sample of the review is extracted in Appendix 1. In this review, the predominant use of these variables to measure government financial outlay conveys the key position they take in the formulation of government fiscal policy (Hallwood & MacDonald, 2008). If one is to find out whether the institution of these policies indeed leads to technical efficiency (as reflected by the improvement in public debt sustainability) through their possible effects on the primary balance, one has to establish the relationship between the government's own-source revenue to its expenditure on service provision and its effect on public debt sustainability over time.

It so happens when in the analysis of the primary budget balance, comparing the public revenue to the public expenditure, most governments are found not to have an excess of income over expenditure. Instead, most governments experience deficits in their primary balances as their expenditures exceed their incomes. Governments cover these deficits through public borrowing. Due to this fact, the examination of whether or not fiscal decentralisation enhances input oriented technical efficiency (and by extension improvements in sustainable public debt), is not about examining a surplus in the primary balance (a positive value of excess the of government own-source revenue over its expenditure). Instead it reverts to examining a deficit in the primary balance (a negative value of the excess of government expenditure over its own-source revenue). This is the main cause of public debt. The analysis of the management of the

government financial outlay or the primary balance therefore becomes inextricably intertwined with the analysis of the management of the primary deficit or public debts.

In summary, fiscal decentralisation is seen to positively influence the level of technical efficiency. This in turn goes to reduce the deficits experienced in the primary deficit. A reduction in the government outlay reduces the primary balance deficit and in turn enhances the technical efficiency in the field of public finances (Engineer, 1990). This should enhance the attainment of an optimal sustainable public debt position. Effectively, a measure of technical efficiency gains in sustainable public debt is because of technical efficiency gains from fiscal decentralisation. Given the fact that there are seldom any primary surpluses in national budgets and in their stead, there is a prevalence of primary deficits, which are invariably covered by public debt, the technical efficiency gains from fiscal decentralisation on attaining and maintaining sustainable public debt optimality may instead be measured by the sustainability of public debt. In other words, the failure to minimise the excess of government expenditure over its income (the cost inputs), inevitably leads to the inability to achieve optimal sustainable public debt (it leads to technical inefficiency). Similarly, inadequate or inappropriate measures to minimise the excess of the interest rates paid on borrowings over its economic growth rates (the cost inputs), inevitably leads to technical inefficiency in terms of the inability to achieve optimal levels of sustainable public debt

1.2.4 Fiscal Decentralisation and Public Debt Sustainability - Sub-Saharan Africa and Kenyan Profiles

During the colonial era in the Sub-Saharan African region, power was highly centralised in the colonial authority. Expectedly, in the period immediately after independence in

the 1960's, most Sub-Saharan African countries retained the centralised form of government for purposes of continuity of governance and institutional establishment. This was on the reasoning that the newly independent nations required rapid economic and social transformation, which could best be achieved through central policy making and planning (Conyers, 2007). Some years after independence however, particularly in the early 1980s, many governments in Sub-Saharan Africa found a fallacy in this reasoning and began to adopt decentralisation which they believed would improve the quality of public service provision and enhance economic growth (Battaile *et al*, 2015). The advent of fiscal decentralisation in the region, particularly in the 1980s, was accompanied by a widening of the gap between total public expenditure and own-source revenue. The rising deficit was reflected in a surge in borrowing levels by the sub-Sahara African countries as can be seen from the data illustrated in figure 1.3.
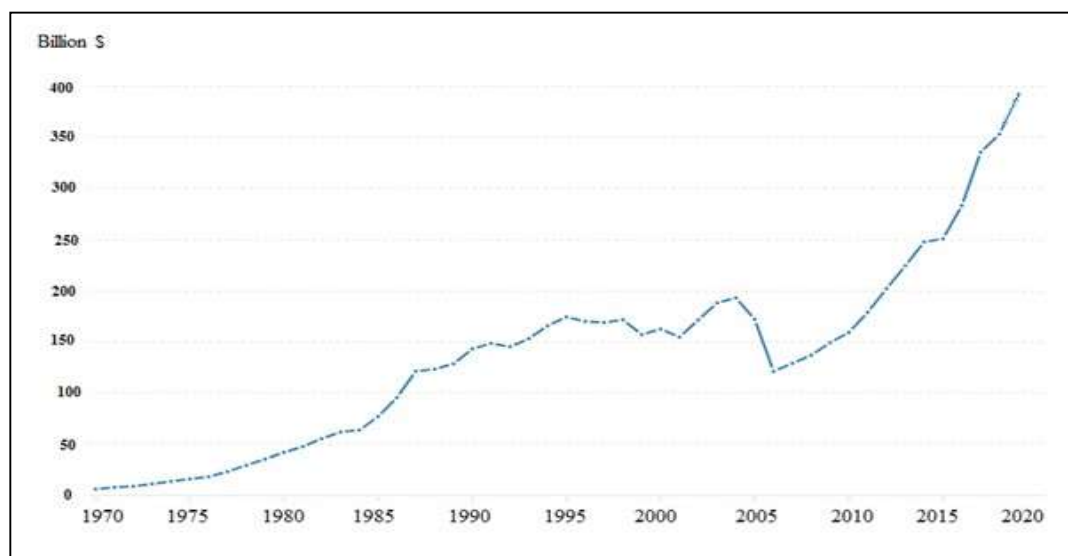
Figure 1.3: Sub-Saharan Africa Aggregate External Debt (1970-2020)
Sources: Greene and Khan, 1990 and IBRD, 2020

As the size of the public debt rose, so did the percentage of total GDP spent in servicing the public debt (The National Treasury and Planning, 2018).

Table 1.1 compares the percentage of total income spent by Sub-Saharan African countries in servicing public debt in the period prior, to the period after the proliferation of fiscal decentralisation.

Table 1.1: Sub-Saharan Africa Rate of External Debt to GDP (1970 - 1990)

YEAR	Debt-to-GDP Ratio BEFORE INTENSIFIED Fiscal Decentralisation	YEAR	Debt-to-GDP Ratio AFTER INTENSIFIED Fiscal Decentralisation
1970	14.1 percent	1982	38.7 percent
1975	17.1 percent	1985	51.2 percent
1980	27.2 percent	1986	74.8 percent
		1987	81.6 percent
		1990	110.3 percent

Source: IBRD, 2020

The table shows that unlike in the period immediately after the independence of these countries in the early 1970s when the centralised forms of government were still the norm, the ratio of public debt-to-GDP rose steeply as fiscal decentralisation intensified from the early 1980s. This means that the burgeoning of the level of public debt in Sub-

Saharan Africa was marched by deterioration in the ability of the region's countries to sustain public debt and consequently, a possible deterioration in their ability to attain their optimal sustainable public debt levels. In a period that overlaps the one used in this study, the sustainability of the public debt of Sub-Saharan African countries as measured by the ratio of their public debt to GDP is shown by figure 1.4 to have worsened between 2008 to 2018.
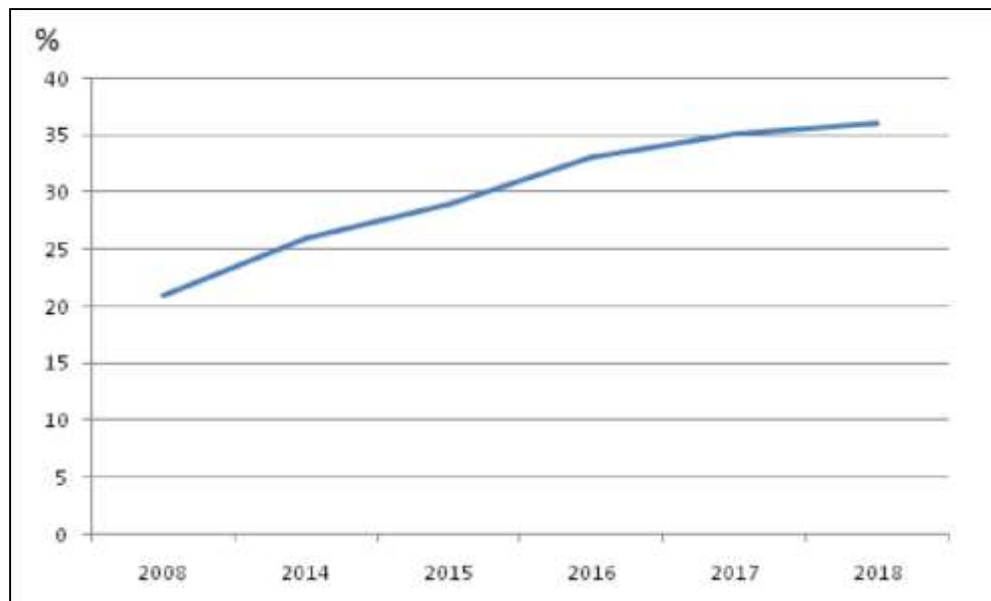
Figure 1.4: Sub-Saharan Africa Percentage of Public Debt-to-GDP
Source: World Bank, 2019

In Kenya, like in the other Sub-Saharan African countries, there was a gradual increase in the level of decentralisation from the time of independence. At independence in 1963, Kenya put in place a sought of devolved form of government with eight semiautonomous provinces known as *majimbo* until it was abolished 1964 in favour of a more centralised form of government. Later in the1990s, a weak form of decentralisation was again adopted with the institution of what was known as the Civil Service Reform Programme and Action Plans (Nassiuma, 2015). Decentralisation gradually gained ground particularly through the process of intergovernmental fiscal transfers from the central government to the decentralised government entities.

The decentralised government entities to which the fiscal transfers were targeted at that time were officially designated as districts. Some of the funds transfers included the Special Rural Development Programme (SURD) instituted in 1971; the District Focus for Rural Development (DARED) established in 1983, the Secondary Education Bursary Fund (SELF) and the Road Maintenance Levy Fund (RALF) both set up in 1993. Others set up in the period 2002 to 2014 were: The Constituency Bursary Fund,

the Free Primary Education Fund, the constituency HIV/AIDS Fund, the Roads Maintenance Levy Fund, the Rural Electrification Levy Fund, the Women Enterprise Fund, the National Development Fund for Persons with Disability and the Poverty Eradication Fund. These fiscal transfers from the central government of Kenya to the decentralised entities is summarised in table 1.2:

Table 1.2: Inter-governmental Fiscal Transfers in Kenya (2013 – 2019)

Year	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Transfer (million KS)	195,665	231,059	276,223	305,016	331,805	360,086
Absolute Increase		35,394	45,164	28,793	26,789	28,281
Percent Annual Increase		18.1 percent	19.5 percent	10.4 percent	8.8 percent	8.5 percent

Source: Silas, Wawire, and Okelo (2018)

From the information in this table, it is evident that the level of fiscal decentralisation in the form of fiscal transfers to the sub-national governments in Kenya increased progressively over those years. Mwiathi, Wawire, Perez and Okelo (2018) give additional information on the nature of fiscal decentralisation in Kenya in this period. They found that on average, between 2002 and 2014, each district received 2.127 per cent of the total intergovernmental transfers of funds from the central government to the districts. Over the same period, the decentralised government's expenditure as a percentage of the total central government expenditure stood at a mean of 0.145 per cent (Mwiathi *et al*, 2018).

Fiscal decentralisation in Kenya at this time was not absolutely one sided though as there was some evidence of revenue collection activities carried out by the decentralised government entities. Mwiathi and others note that between 2002 and 2014, the ratio of the revenue that a decentralised government in Kenya had collected by itself to its total

revenue (given by the sum of its own collection and transfers received from the central government) averaged 37.72 per cent (Mwiathi *et al*, 2018). One can therefore conclude that there was a sustained rise in the level of fiscal decentralisation in the country albeit with a heavy leaning towards expenditure decentralisation more than the decentralisation of revenue collection. The whole process of gradual fiscal decentralisation in Kenya culminated in the formal adoption of a decentralised system of governance in 2010. At this point, forty-seven counties were established as the first level of administrative subdivision of the nation (Kaburu, 2013). At this time, the formation of the counties was motivated more by politics than by other human development agenda. There was little regard to population distribution when the boundaries for the counties were laid down. This is indicated by the wide inter-county population disparities shown by the last census taken in 2019 ranging from 143,920 people in Lamu County to 4,397,073 people in Nairobi (KNBS, 2019).

Over the years, including the period after the official adoption of the decentralised system of government in Kenya in 2010, there has been a continuous deterioration in the level of public debt sustainability measured by the ratio of county public debt-to-GCP. Figure1.5 shows a long-term view of this public debt sustainability position in Kenya for the period after 2010 projected to 2025.
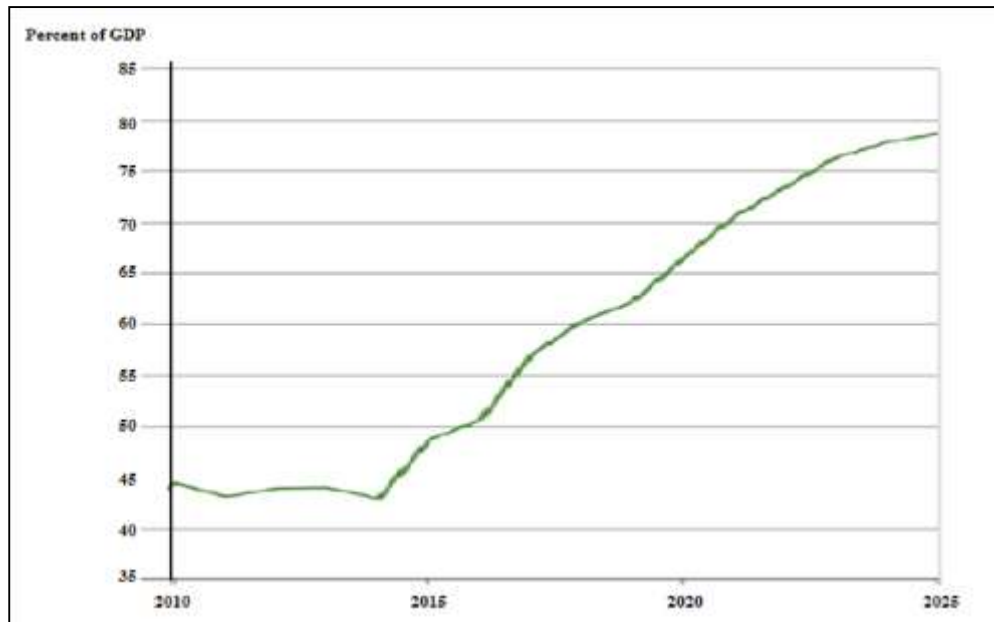
Figure 1.5: Kenya Public Debt-to-GDP Ratio 2010-2025
Source: World Bank Report, 2020

This deterioration in the sustainability of public debt must have had an effect on the country's ability to attain the optimal sustainable public debt level. In the 1970s, fiscal decentralisation was not rigorously adhered to in the country; and was exhibited mostly in the form of fiscal transfers from the central government to the decentralised entities. During the period public debt sustainability levels were relatively stable (Ajayi & Khan, 2000). As can be observed from table 1.3, the public debt sustainability trend after 2010 when fiscal decentralisation was the official form of governance in the country clearly compares poorly to the better levels of public debt sustainability attained in the 1970s. In the period after 2010, public debt sustainability levels were not only worse, they were also much more pronounced in the sharpness with which they worsened.

Table 1.3: Kenya's Public Debt-to-GDP Ratio Comparison for Selected Years

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Debt-to-GDP Ratio	29	28	35	40	41	45	39	43	45	48

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Debt-to-GDP Ratio	39.9	42.1	44.5	45.9	50.2	54.5	56.1	59.2	62.6	68.6

Source: Ajayi and Khan, 2000: CEIC, 2020

In comparison to figure 1.5, figure 1.6 on the same subject matter of public debt sustainability focuses on the period selected for this study (2013 to 2021).
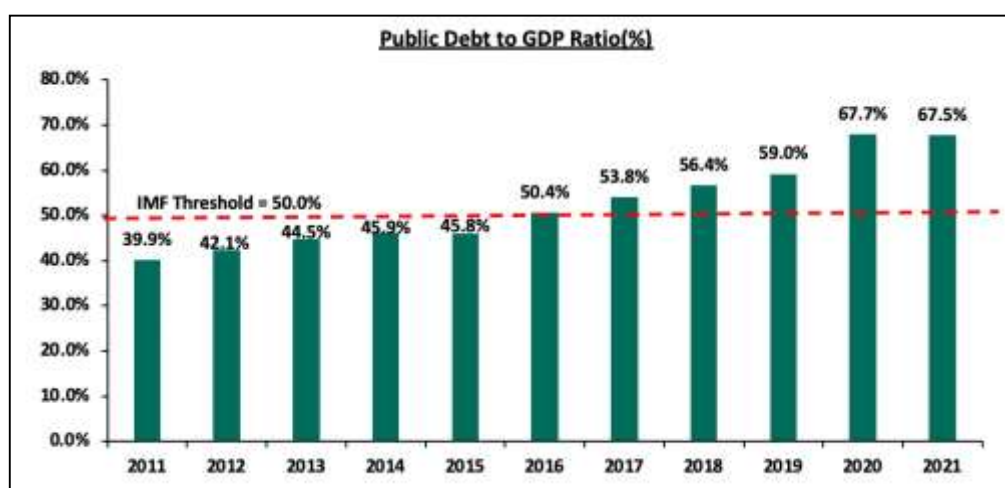
Figure 1.6: Kenya's Average Total Public Debt Growth Rate
Source: Cytton Investments, 2021

Both figures show the deteriorating trend of public debt sustainability in the country particularly after 2013, the year in which fiscal decentralisation begun to be officially implemented in the country.

From these statistics, it would appear that there may exist some relationship between the levels of fiscal decentralisation and the levels of sustainable public debt. This study intended to establish the existence of this relationship and the nature of the extent to

which fiscal decentralisation might influence the nation's ability to keep its sustainable public debt levels at an optimum level.

1.3 Statement of the Problem

Nations that take up fiscal decentralisation are driven to doing so by a variety of motives that range from socio-political to economic reasons. In the studies on devolution, the main argument advanced for the adoption of fiscal decentralisation has been the economic reasoning that it creates greater technical efficiency in the provision of public goods and services (Savage & Lumbasi, 2016). Based on theories that originate from such studies such as the accountability theory, most countries adopting fiscal decentralisation believe that a fiscally decentralised system ensures autonomy for the decentralised sub-government entities, promoting accountability and ownership of fiscal policies so as to realise technical efficiency gains (Feruglio, 2007). This argument rests on two precepts. First, that individuals residing in one fiscally decentralised region possess similar tastes with regard to preference of consumption patterns; which tastes differ from those of individuals residing in other regions. Effectively these needs, not being as diverse as the nationwide needs, can be met more cheaply should expenditure be decentralised. Second, that individuals within a given fiscally decentralised region have a better command of the knowledge of the costs and benefits of public services within their region and with this superior information on local needs comes stronger incentives to address them (Bagaka, 2008).

We can surmise from these conclusions in devolution literature that the result of fiscal decentralisation from an input oriented view of technical efficiency, is seen to be the institution of sound policies which generate accountability as manifested by an improvement in the provision of public goods and services by the decentralised

subgovernment entities. These sound policies ought to translate into improved fiscal management and reduction in fiscal deficits possibly even resulting in fiscal surpluses for the county governments. At the central government level, fiscal deficits are covered by both internal as well as external borrowing, which is the reason for the creation and the increase in public debt. Ultimately however, the deficits are a county government responsibility since this public debt is collectively paid for from resources (the Gross County Product) collected from the county governments.

Technical efficiency in public service provision is in effect synonymous with technical efficiency in public debt management by the county governments. To attain a level of technical efficiency in public service provision, various variables can be manipulated through county government policy. These include interest rates and economic growth rate as well as county government income and expenditure. Interest rates and economic growth rate are the very same variables by which the technical efficiency in optimum public debt management may also be defined. The technical efficiency in county government public service provision and by extension in their public debt management, can be described in terms of how well the county governments are able to minimise the expenditure of their income in providing a given amount and a given quality of public services. It must be borne in mind that the income of the counties whose expenditure is to be minimised includes borrowed funds (the public debt) of which the counties had a part in the making. Thus, county government public debt management policies are geared towards achieving the most technically efficient position of sustainable public debt. This is a level of current public debt that can be fully offset by the present-value of future primary balance surpluses. This unique break-even point is the least that is expected of an acceptable debt management policy. The extent to which the government is unable to attain this barest minimum of technical efficiency level translates into

suboptimal debt management policy. There are any number of ways this bare minimum may fail to be attained. According to Si Guo, Yun Pei and Zoe Xie (2022) in a study on Spain, decentralised sub-governments over borrow in anticipation of receiving funds from their central government; and to counter the expected future over borrowing by the decentralised sub-governments, the central governments then over transfer funds to decentralised sub-governments in advance. Consequently, fiscal decentralisation widens vertical fiscal imbalances raising both decentralised sub-governments' and central governments' debts (Guo *et al*, 2022).

It is clear from such analyses that the efficient public service provision by the county government is related to the technical efficiency of its public debt management. That is, the technical efficiency in service provision created by fiscal decentralisation at the county government level, can be viewed as microeconomic contribution to the macroeconomic process of the management of the optimum level of sustainable public debt at the national government level. The technical efficiency in county public debt management can then be viewed in terms of how well the county government is able to manage any excess of its expenditure over its income while providing a given amount and a given quality of public services. If public service provision by the county government is efficient, to the extent that it creates savings in the central government outlay (and reduces the central government's need to borrow), then public debt sustainability by the central government, will be improved. Briefly, devolution literature affirms the existence of a positive relationship between fiscal decentralisation and the technical efficiency in public service provision. This pre-supposes that fiscal decentralisation could lead to the technical efficiency of the management of public debt by the county governments and hence the technical efficiency in the optimisation of county sustainable public debt and aggregately central government public debt.

In Kenya, two facts have become evident from what can be observed of the fiscal environment over the past decade: empirical evidence shows that the level of public debt has risen very sharply and the country's public debt sustainability status has deteriorated over these years. These facts have occurred simultaneous with the intensification of fiscal decentralisation. These and the conclusions made in devolution literature leads to two contentions: First, there was a demonstrated contrast between findings in research and empirical observation. The affirmation in devolution literature that fiscal decentralisation could lead to the technical efficiency in the optimal level of sustainable public debt starkly contrasts with the actual public debt sustainability status in the country which has deteriorated over the same years that fiscal decentralisation has been in implementation. Public debt sustainability has deteriorated from 39.9% debt as percentage of GDP in 2011 to 67.5% debt as percentage of GDP in 2023 (Cytonn, 2020). This suggests that fiscal decentralisation may after all not have stimulated accountability and technical efficiency to enhance better public debt sustainability in Kenya. Necessary evidence to clear up this supposed contradiction was lacking. This study therefore intended to address this disparity by establishing the effect of fiscal decentralisation and one such measure of macroeconomic stability - the optimal sustainable public debt in Kenya. The study focused on this gap of lack of statistical evidence to test, for Kenya, what effect fiscal decentralisation may have on the technical efficiency in the management of public debt and its optimal level of sustainability.

Secondly, the ever-worsening trend in the public debt sustainability position for Kenyan and indeed for most Sub-Sahara African countries has been observed. Indeed, postulations of the public debt sustainability position for these countries are set to worsen in the future given the prevailing and predictable macroeconomic conditions. Despite these adverse conditions, there are international agencies that suggest that these

countries including Kenya still sit in positions that are conducive for continued borrowing – suggestions that do not seem to be supported by empirical fact (Fedelino *et al*, 2021). Based on the IMF composite indicator, the CPIA, factors such as, real GDP growth, remittances, international reserves and world growth Kenya's debt carrying capacity as at October 2019 was adjudged to be intact. The CPIA rates from a weak one to a strongest six, and so with a CPIA of 3.12 in 2019 (above the 3.05 IMF threshold), Kenya was given a "clean bill of health" to keep borrowing despite her heavy indebtedness. This form of rating may not necessarily be conclusive for making public debt management decisions since the criteria it uses is wide-ranging and not specific to debt management. Its criteria incorporate social tenets such as gender equality, social protection and environmental stability (Marcello Estevão *et al*, 2020). Studies focus on the sustainability of public debt as the ultimate objective of public debt management to date.

It is because of this that this study introduced an alternative criterion of a country's ability to take on more public debt without tipping over into the unwanted position of deterioration of economic welfare for its citizens from borrowing. This study used the technical efficiency of sustainable public debt instead of just the sustainability of public debt. Therefore, this study sought to formalise the knowledge on the technical efficiency of sustainable public debt in the country - as effected by fiscal decentralisation.

1.4 Objectives of the Study

1.4.1 General Objective

Although Kenya's public debt sustainability status has been observed to be deteriorating, this status is still labelled as sustainable and acceptable for purposes of

taking on more foreign loans. This study sought to use an alternative principle of public debt management other than the sustainability of public debt, an alternative criterion for debtcarrying capacity. It aimed to analyse the effect of fiscal decentralisation on the technical efficiency of attaining the optimum level of sustainable public debt in Kenya

1.4.2 Specific Objectives of the Study

The study sought to achieve the following specific objectives:

1. To determine the effect of the interest-growth rate differential on the technical efficiency of sustainable public debt in Kenya.

2. To evaluate the effect of the primary budget balance on the technical efficiency of sustainable public debt in Kenya.

3. To assess the effect of the revenue-decentralisation on the technical efficiency of sustainable public debt in Kenya.

4. To determine the effect of the expenditure-decentralisation on the technical efficiency of sustainable public debt in Kenya.

5. To evaluate the effect of fiscal transfers-decentralisation on the technical efficiency of sustainable public debt in Kenya.

1.5 Significance of the Study

This study was significant from both the theoretical as well as the practical perspectives. Theoretically, it aimed to address the problems encountered by developing nations like Kenya, which are in the process of refining a newly adopted fiscal decentralisation system, by developing recommendations, which may help in this refinement process. Indeed, such a process cannot be said to be fully developed at any point in time given its susceptibility to human manipulation (Welham & Hart, 2016). Therefore, continuous refinement is needed even for those nations, which may otherwise be considered fully

decentralised systems. From the practical perspective, particularly for newly decentralising governments in the developing world, the study may make the achievement of an optimal level of sustainable public debt an integral part of their macroeconomic stability objectives which currently focuses on the strengthening of the fiscal balance (Moussé & Razafimahefa, 2015).

This study may make it possible to formulate policy as to the direction or nature in which fiscal decentralisation can be effectively carried out. This can be the decentralisation of revenue gathering (taxation) and/or the decentralisation of public expenditure decisions. The effects of decentralisation of revenue collection and of public expenditure may be are important inputs of the policy making process. The policymaking process inputs ought to minimise the government's financial outlay in the bid to increase technical efficiency in service provision (and effectively, maximise the economic benefits to be reaped from a well-managed public debt status). For example, it may be possible to make the most suitable policies with regard to deciding between whether to decentralise expenditure or to decentralise revenue generation. One may also make decisions with regard to the proportions in which the two ought to be the decentralised while also managing of public debt and make debt as sustainable as possible, as a country fiscally decentralises (Bahl, 2008).

Besides formalising the relationship between fiscal decentralisation and macroeconomic stability in the form of the sustainability of public debt in Kenya, the study should also serve to provide an offshoot for further research in the area. The findings of this research can serve as a basis for interrogating the nature of the relationships between various variables and the technical efficiency of sustainable public debt.

1.6 Research Hypotheses

The study tested the following hypotheses connected to the debt carrya-foregoing objectives:

H_{o1}:   There is no statistically significant relationship between the interest-growth rate differential and the technical efficiency of sustainable public debt in Kenya.

H_{o2}:   There is no statistically significant relationship between the primary budget balance and the technical efficiency of sustainable public debt in Kenya.

H_{o3}:   There is no statistically significant relationship between revenue-decentralisation and the technical efficiency of sustainable public debt in Kenya.

H_{o4}:   There is no statistically significant relationship between the expenditure decentralisation and the technical efficiency of sustainable public debt in Kenya.

H_{o5}:   There is no statistically significant relationship between fiscal transfers decentralisation and the technical efficiency of sustainable public debt in Kenya.

1.7 Justification of the study

Despite the significant number of studies carried out on the subject of fiscal decentralisation, only a few studies have been found by reviewers to be comprehensive and comparative enough (Cabral, 2011). It is as a result of this that the absence of a generalised perspective that formalises the primary impact of fiscal decentralisation on macroeconomic stability is pointed out (Breuss & Eller, 2004). One important macroeconomic objective of an economy is the maintenance of the sustainability of its public debt. This is a measure of the stability and the effectiveness of its fiscal policy (Soyres *et al*, 2021). It was the aim of this study to contribute to literature on the impact of fiscal decentralisation on macroeconomic stability by interrogating the effects of

fiscal decentralisation on one such measure of macroeconomic stability – namely optimal sustainable public debt.

This study measured sustainability of public debt but with the intention of giving a more specific determination of this sustainability. This determination would be useful for evaluating the borrowing ability of a country that is already in debt. It did this by measuring the technical efficiency with which the optimal level of the sustainable public debt was achievable. This novel measure was to make the safety margin for government borrowing clearer than simply deciding whether or not any additional borrowing would still leave the debt at a sustainable status. For example, given the ever-worsening trend in the public debt sustainability position for many Sub-Sahara African countries, this measure can be used in decisions involving additional borrowing of public funds. The use of this novel measure of the sustainability of public debt would also provide a suitable foundation for formulating alternative principles of public debt management – one that would have the attainment of a technically efficient optimal sustainable public debt and not just sustainable of public debt as its aim. This is a point of interest of lending institutions such as the International Monetary Fund and the World Bank.

Given the apparent contrast between the deteriorating public debt sustainability status and the presupposition made in literature that fiscal decentralisation could lead to technical efficiency of sustainable public debt management, the study put itself to the task of providing the necessary evidence to fill up this gap of lack of statistical evidence for Kenya. It tested what effect fiscal decentralisation had on the technical efficiency in the management of public debt and its optimal level of sustainability.

1.8 Scope and Limitations of the Study

Without disregard for the multidimensional view of fiscal decentralisation (comprising of political decentralisation, administrative decentralisation and fiscal decentralisation), this study focused on the fiscal aspect of decentralisation. It conducted a panel data study for data collected over the period between the year 2013 when fiscal decentralisation officially took off in the country and the present, 2021, for a quantitative assessment. The study combined two basic theoretical considerations: first, it determined the optimal level of public debt sustainability for Kenya with regard to economic growth and government size; it then assessed the effect of fiscal decentralisation on this optimal level of public debt management level.

The outcome variable in this estimation of technical efficiency of sustainable public debt – was measured using the observed percentage of county public debt to GCP, to its optimal expected level. In effect, the study assessed the extent to which Kenya measured up to the optimal threshold of sustainable public debt as the degree of fiscal decentralisation varied over the years. In other words, it determined the extent to which fiscal decentralisation affects the level of technical efficiency, of public debt management. It used theoretical arguments such as market failure, the principal agency theory and public choice theory to provide a foundation for making inferences on the relationships between the variables under consideration in the hypotheses; namely interest-growth rate differential, the primary balance, fiscal decentralisation and public debt sustainability.

This study adopted the panel data research design. For analysis, data was required for the chosen variables annually from 2013 to 2021 throughout the forty-seven counties. This process was hindered by the fact that although data was needed from the counties

on a county by county basis, the data for some variables was available only at the central government level. This was due to the fact that these variables are macroeconomic concepts for which only macroeconomic data is kept at the central government level. It was also due to the fact that fiscal decentralisation had only been officially introduced in 2013 as such there was a scarcity of data on such variables at the county level. These variables included data for public debt and the interest rates. Although the county governments borrow funds, data on such borrowing was not relevant as per the operational definition of public debt for this study. Public debt is a macroeconomic concept and as such data for this variable was available at the central government level but not at the county level. For the same reasons, it was also true for data on the interest rates charged on the public debt.

This hurdle was overcome by making a pro-rata apportionment of the central government data on public debt to the counties. The assumption was that the sum of the apportioned county government public debt aggregated to the central government figures. Another assumption made with regard to the measurement of the variables was for the annual interest rate data observed for the central government debt. Each county paid interest on its apportionment of the public debt at the same rate as that charged on the aggregate central government debt. Consequently, the interest rate data was collected as charged on the central government public debt, as this is the rate ultimately paid by the counties.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature, relevant to the objectives of the study. More specifically, the chapter links the theoretical concepts and the empirical findings on public debt sustainability and on fiscal decentralisation to the problem of the investigation that was carried out. A theoretical review focusing on the factors of the solvency or sustainability of public debt is done in relation to the economic concepts of technical efficiency and market failure alongside the public choice theory and the principal-agency theory. A summary of the reviewed literature is presented, and research gaps emanating from the critique of the reviewed empirical studies are identified.

2.2 Review of Key Concepts of the Study

In devolution literature, fiscal decentralisation is viewed as a restructuring of the economic system by a government with a view to achieving a greater level of efficiency in the delivery of public services and by extension greater macroeconomic stability. The implication is that fiscal decentralisation enhances the technical efficiency of the government in managing public income and expenditure. A stable and efficient macro economy is manifested by among other things, a solvent and sustainable public debt position. The interest charged on public debt, the economic growth rate and the primary balance are the most common factors used in most works of literature when analysing the solvency and sustainability of public debt. The relationship between these factors and public debt sustainability is usually discussed using the fiscal reaction function. This study adopted the use of the same factors and the reaction function.

It was founded on the economic concept of technical efficiency. This concept was analysed by contrasting it to market failure in which inefficiency is exhibited. This section describes the concepts reviewed in this study.

2.2.1 Public Debt Sustainability and Optimality

A number of factors connected with borrowing and public debt influence both the county and the central government fiscal policy. These include the effect of the interest charged on the debt and the effect of the GDP growth rate. The interest rate charged on the debt raises the burden of public debt while rising rates of GDP growth lower the burden. GDP growth rate is also the main indicator of a government's ability to repay the public debt. This is because debt is repaid from the available income, which for the case of the central government is represented by its GDP; and in the case of the county government by its GCP. The conclusion reached in literature that fiscal decentralisation is a means of achieving an improvement in the technical efficiency of managing government budget, is indicative of the government's public debt solvency level. This is equivalent to its technical efficiency in covering the public debt that is necessitated by deficits that occur in its primary balance whenever the government spends more revenue than it collects.

According to Gottschalk (2014) the sustainability of public debt optimality is fully anchored on the principal of solvency. The principal of solvency in turn is founded on a number of sub-principals, the first of which is the need for liquidity. Liquidity refers to the requirement for the country to possess a value of assets that is adequate to meet its debt repayment obligations on time as they arise. A country that is short of an immediate means of making a repayment on its debt will be unable to not just eventually pay off its debt obligations but it will also find it very difficult to acquire additional debt

should an urgent need for the same arise while it still holds an unserviceable outstanding debt balance. Secondly, the attainment of the principal of the solvency of public debt is upheld by the sub-principle that the country needs to avoid becoming economically vulnerable on account of its debt. Such vulnerability may arise when the country's level of public debt forces it to negatively interfere with and adjust its already laid out economic plans; diverting resources towards unplanned repayment of debt from previously planned purposes of economic development (Gottschalk, 2014). Conclusively, sustainable public debt optimality relies on the basic principle of maintaining solvency, which can be attained through maintaining liquidity and avoiding economic vulnerability.

Since the attainment of these principles depends upon the level of output in the economy, economists define sustainable public debt policy as one that maintains the ratio of public sector net worth to the economic output at its current level. If these conditions are met, maintaining optimal levels of sustainable public debt will be possible and the necessity for taking 'firefighting' measures such as increasing taxes, decreasing spending or issuing of currency to counter situations of public debt unsustainability will be avoided. Maintaining an optimal sustainable public debt therefore invariably concerns maintaining solvency for the government or guaranteeing the government's ability to meet its longterm financial obligations given the financial conditions it is facing, without the need to undertake policy adjustments that are economically implausible like debt defaulting or debt renegotiation or even debt repudiation (Gottschalk, 2014).

The government has to set up policies that allow for public debt to remain at an optimal sustainable level which means maintaining liquidity and avoiding possible vulnerability

arising from public debt. To do this the country must ensure that its current level of public debt always equals the present value of its future primary surpluses (Curtaşu, 2011). In essence, this is an inter-temporal definition of solvency in which, the sum of the initial amount of debt and the present value of future primary expenditure equal the present value of the future stream of revenue. The makers of policy on public debt face the main challenge of ensuring that public debt is sustainable in the long run. They must take measures that ensure that the nation is able to efficiently make use of borrowing as a source of funds for development for an indefinite period. Over a period of time, a deterioration of the public debt solvency position (moving it away from its optimal position) would indicate a rise in technical inefficiency in public debt management, all other factors held constant. In such a situation, public debt sustainability would tend towards being less optimal. Under a devolved system this is true for both the central government as well as the decentralised government entities because on the fiscal decentralisation platform, borrowing is a common source of income for both entities. The central government is forced to borrow when the nation is faced with a primary deficit. Such a deficit would in some way have been caused by the central government honouring its financial obligations to the decentralised entities (Bahl, 2008). Borrowing also serves the decentralised unit's authorities well when the sum of their own-source revenues and fiscal transfers received from the central government fall short of their local expenditure requirements (Welham & Hart, 2016).

According to Gottschalk (2014), equating the country's current level of public debt to the present value of its future primary surpluses, which is critical for the maintenance of an optimal sustainable public debt, relies on certain specific tenets if it is to hold. The first of these is ensuring that the public debt-to-GDP ratio never exceeds a certain threshold. An upper limit of borrowing is to be set and maintained. Unabated borrowing

without due consideration for the ability to repay is dangerous and negates stability. When borrowing, an upper bound X, should therefore be set for the exercise so that the public debt-to-GDP ratio never exceeds it as in equation 2.1 (Gottschalk, 2014):

$$D_t = D_{t-1} + rD_{t-1} - P_t \leq X \text{ for all t years ...Equation 0.1}$$

It is when this threshold is overrun that the debt becomes a burden rather than a tool for development. Excessive debt or a debt overhang can cripple the economy. It can necessitate an economic re-structuring that may disrupt the smooth implementation of economic plans and policies already set down. In particular, high real interest rates and a resultant debt overhang can lead to a vicious cycle of debt such as is shown in figure 2.1.
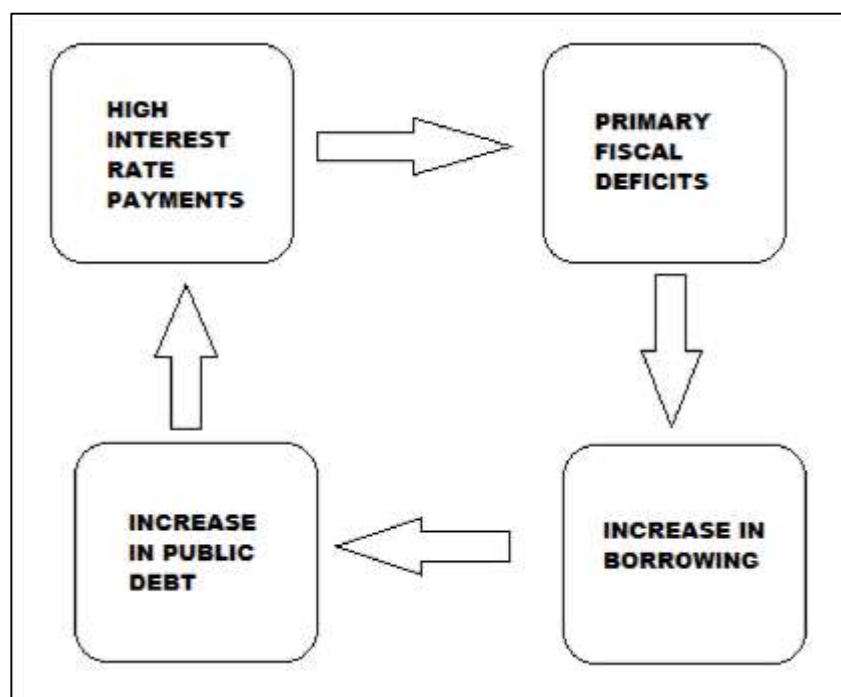
Figure 2.1: Vicious Cycle of Debt
Source: Gottschalk, 2014

The amount at which this limit upper of borrowing is fixed depends on a composition of certain important factors, which vary for different countries. Of these, the most common is the nation's current ability to repay the debt given by the nation's existing

level of GDP, or for the county, its existing level of GCP. As a result of this, the borrowing limit is not set in absolute monetary terms but in relative terms of the county's apportionment of public debt-to-GCP ratio.

According to Cytonn (2020), while the International Monetary Fund (IMF) recommends this limit to be set at a level of 50 percent of GDP, Kenya has set its own limit at 30 percent of GDP. However, empirical observation shows that Kenya's borrowing has been above both the nationally recommended limit of 30 percent as well as the 50 percent of the IMF for all the years since 2013; it has also been borrowing above the IMF recommended limit since 2015 (Cytonn, 2020). In most of the emerging economies and the less developed nations however, empirical evidence shows that debt ratios are held below this boundary. This implies that unlike for Kenya, meeting this condition has not been a problem for these countries. Debt sustainability problems in these regions instead seem to arise from lack of sufficient liquidity.

The second pillar on which the equating the country's current level of public debt to the present value of its future primary surpluses rests is avoiding an indefinite postponement of the repayment of public debt and the interest charged on it. That is, the government must not fall into what is known as the ponzi game trap. This is a debt position that is maintained by a country taking up new debts to pay off older ones. Falling into the ponzi game trap is avoided when the condition in equation 2.2 is met (Escolano, 2010).

$.\text{Lim}_{n \grave{e} = \infty}(1+\lambda)^{-n} d_o = 0 \ldots$ Equation 0.2

d_o being the initial debt,

n being the years during which the income is received in the future

while in r in $\lambda = \frac{r-g}{1+g}$ = real interest rate in period t

and g = real GDP growth rate from $t-1$ to t

The ponzi game condition is a short-term cure of an insolvency problem. Conclusively, to attain the ideal position in the long run where public debt is considered solvent, an indefinite postponement of debt and interest payment should not be allowed because a borrowing country will eventually need to entirely rid itself of its public debt. If this condition were to be violated, then it would mean that debt and interest are actually being paid through adding debt. This would cause the interest payable (r in equation 2.2) to grow as fast as or even faster than the growth in the debt ratio (d_o in equation 2.2). For the present value of public debt to fall and eventually be eliminated, the debt ratio should not be allowed to grow at a higher or even equal rate with the growth in the interest rate.

The eventual elimination of the present value of public debt requires the fulfillment of the last basis of the solvency principle. This is the condition that the existing debt, including accumulated interest, must be kept at a level that is payable in full through future fiscal surpluses. This third basis of solvency means that that the growth-adjusted interest rate should be positive as shown by equation 2.3 (Escolano, 2010):

$d_0 = \sum_{t=1}^{\infty}(1+\lambda)^{-t}p_t$ …Equation 0.3

$\lambda = \frac{r-g}{1+g}$: r, g and d_0 remain as earlier defined in equation 2.2

p = future primary balances

t = the years during which the future primary balances are received.

For Dabrowski (2016), the country must envisage a situation where it possesses adequate fiscal surpluses in the future to be sufficient for paying back and completely offsetting its existing debt. The primary surpluses made in the post borrowing future,

should be sufficient to offset the debt necessitated by current primary deficits. This means that the target of government fiscal policy should be a positive net present value for all future primary balance. A situation of perpetual deficits and indebtedness is not tenable with solvency with regard to the management of public debt (Dabrowski, 2016). In essence this means that should the government run a primary deficit in future, the stock of debt will grow at a rate higher than that of the interest rate; whereas, if the government runs a primary surplus in the future, the stock of debt will grow more slowly than the interest rate. Since public debt is solvent only in the inter-temporal sense, it is important that this condition be met.

All said, the factors, which influence the size of the public debt though complex and interlinked, can be generally classified into economic, political and structural factors. The economic factors such as government fiscal policy and the economic activity levels are linked to the socio-political factors such as security (Samia & Hanen, 2017). Given such complexities, one cannot settle on a debt level that can be considered as the "acceptable" level of public debt. Neither can one settle on a generally agreed level of the fiscal deficit that may have caused the acquisition of that particular debt. This inefficacy is attributable to the effects of globalisation and the irregular business cycles through which all economies go (Dabrowski, 2016).

Globalisation takes many forms including increased international trade and increased movement of capital or foreign direct investment (FDI). The extent of its effects is never similar for any two countries resulting in the disparities that different nations may consider to be an "acceptable" public debt level. However, the effects of globalisation and business shocks do not diminish the fact that excessively high levels of public debt are undesirable for any country in any way, because their burden can impede economic

growth and sustainable development. Public debt has to be well managed. Amassing debt, without proper debt management policies, can have the potential of driving an economy into liquidity problems especially for less developed economies, which are characterised by low and volatile public revenues. For such economies, large debt burdens minimise the possibility of future borrowing which could become a great necessity in times of genuinely serious fiscal distress (Ricardo and Varinia, 2004). Hence, the need for managing public debt at optimally sustainable levels cannot be overemphasised.

This study was an attempt to discover the extent to which the Kenyan government has sorted out these complex factors to meet the conditions for remaining solvent; conditions that are required for the efficient management of its public debt position and whether or not this augments her efforts to optimise the sustainability of its public debt.

2.2.2 Interest Rate, GDP Growth Rate and the Primary Balance

In his work, Curtaşu (2011) notes the absence in literature of a clear theoretical benchmark for assessing public debt sustainability. Even so, he points out some of the criteria commonly used in literature to make this assessment as including the primary balance, the real economic growth rate and real interest charged on the debt (Curtaşu, 2011). The assessment of public debt sustainability is commonly based on maintaining the stability of the level of the debt by ensuring that the cost of the interest rate charged for the debt does not exceed the rate of economic growth. In this study, the assessment of the sustainability of public debt was determined by two basic relationships after Escolano (2010), namely:

  i.   the current year's (year t) public debt accumulation in equation 2.4:

  $\Delta \mathrm{d}_t \equiv d_t - \lambda d_{t-1} - p_t$ …Equation 0.4

in which: Δd represented the change in the level of public debt over two consecutive time periods, λ represented the difference between the interest paid on public debt and GDP growth rate, p represented the primary balance and t denoted the time period

    ii.   the fiscal reaction function in equation 2.5:

$$p_t = \kappa + \Gamma p_{t-1} + \rho d_{t-1} \ldots \text{Equation 0.5}$$

in which t denoted the time period, k was a constant, Γ was a coefficient in fiscal balances of the nature $0 < \Gamma < 1$

and ρ, the changes (involving surpluses or deficits) made to the primary balance p, in response to variations in the public debt, d. Public debt was then defined as sustainable at a level d^* if $\rho > \Gamma*(1 - \lambda)$, d^* being given by equation 2.6:

$$d^* = \frac{-k}{\rho - \Gamma*(1 - \lambda)} \ldots \text{Equation 0.6}$$

In these relationships, the rate of economic growth is reflected as the change in the level of the real gross domestic product of a country and it is the main indicator of the country's ability to service its debt from its own resources. The interest rate on the other hand is a signal of the amount of burden or difficulty underlying the repayment of public debt. The interest rate determines the speed with which the debt could increase if it was not repaid as preplanned. Its increase is also an indicator of the speed with which the debt sustainability ratio can worsen. This is because the higher the interest rate is, (compared to rate at which GDP grows) the more it pushes up the public debt-to-GDP ratio. Were the real interest rate to be higher than the rate at which GDP grows, the public debt-to GDP ratio would rise, lowering the possibility of attaining the level of optimal sustainable public debt. On the other hand, the possibility of attaining the level of optimal sustainable public debt would improve if the real interest rate were to be lower than the GDP growth rate.

On its part, the primary balance actually embellies the definition of the public debt – namely that public debt is borne of deficits in the primary balance. The fiscal reaction model developed by Evsey Domar is a more specific interpretation of the fiscal reaction function in equation 2.5:

$$p_t = \kappa + \Gamma p_{t-1} + \rho d_{t-1} \dots \text{equation 2.5}$$

It incorporates three criteria to show how governments react to their debt burdens with a view to achieving their macroeconomic objectives. It is a fiscal reaction model governing the relationships and dynamics of the public debt ratio and these factors - the real interest, the economic growth rate and the primary balance - as in equation 2.7 (Curtaşu, 2011):

$$d_t = (1 + \lambda t) d_{t-1} - p_t + \varepsilon \dots \text{Equation 0.7}$$

Where: d_t = the size of public debt in year t

$\lambda = r - g$

r = real interest rate in year t; paid in year t on the debt stock outstanding at the end of year $t-1$

g = real economic growth rate between year $t-1$ and year t

d_{t-1} = the balance of public debt from the previous year

P_t = primary balance surplus in year t

This model was adopted for use in this research to determine how Kenya's fiscal decentralisation policies have affected its reaction to the public debt position, specifically its reaction to the optimisation of a sustainable public debt position. The public debt-to GDP ratio (public debt as a percentage of the GDP) shows the ability of any government to pay its public debt – a nation with a decentralised system of

government not being an exception. Therefore, to measure sustainability, the fiscal reaction function is shown as a ratio of GDP.

The primary balance is of significant importance in the fiscal reaction model. It refers to the excess of government income over its expenditure, excluding gross interest payments on public debt. However, in this study the primary balance was assessed in its net value such that the interest payments were interpreted to represent interest paid less interest received on assets in other words, it represented the net interest payments. In this study therefore, the primary balance referred to the overall balance of public debt plus net interest payments. The dynamics governing the relationship between the primary balance and the public debt-to-GDP ratio were formally analysed, based on equation 2.4 after Escolano (2010):

$d_t = (1 + \lambda_t)\, d_{t-1} - p_t \ldots$ equation 2.4

Where: d_t = sustainable public debt

$\lambda = \frac{i - \gamma}{1 + \gamma}$ Given: γ = nominal GDP growth rate between periods t–1 and t.

i = nominal interest charged and paid in period t on the outstanding public debt at the end of period t-1

p = primary balance

For the period 1 to N:

$$d_N = d_0 \prod_{t=1}^{N} (1 + \lambda_t) - \sum_{t=1}^{N} \left[\prod_{i=t+1}^{N} (1 + \lambda_i) \right] p_t$$

If λ_t is assumed to be constant over time such that $\lambda_t = \lambda$

$$d_t = (1 + \lambda) d_{t-1} - p_t$$

$$d_N = d_0 (1 + \lambda)^N - \sum_{t=1}^{N} (1 + \lambda)^{N-t} p_t$$

and

$$d_o = (1+\lambda)^{-N}d^N + \sum_{t=1}^{N}(1+\lambda)^{-t}p_t$$

or alternatively as in equation 2.8 (Escolano, 2010):

$$d_t - d_{t-1} = \lambda d_{t-1} - p_t$$

$p_t = d_{t-1}(1+\lambda) - d_t$...Equation 0.8

From: $d_t = (1+r-g)d_{t-1} - p_t + \varepsilon$

Letting: r - g = λ

we get equation 2.9:

$d_t = (1+\lambda)d_{t-1} - p_t + \varepsilon$ ...Equation 0.9

It is evident that if the primary balance were to be a surplus, the net public debt would

fall. A deficit in the primary balance would on the other hand cause the net debt to rise.

One can conclude that public debt-to-GDP ratio depends on the real interest rates, real

economic growth rates, and fiscal adjustments, related as follows:

Changes in the real interest rate will have a positive impact on the debt ratio illustrated

by equation 2.10.

That is, for interest rates: $d_t = \frac{r_t}{1+g_t}d_{t-1}$, ...Equation 0.10

On the other hand, changes in the real growth rate will have a negative impact on the

debt ratio as will changes in the primary balance - that is, for the growth rate d_t will be

defined by equation 2.11 and equation 2.12:

$d_t = -\frac{g_t}{1+g_t}d_{t-1}$ ...Equation 0.11

and for the fiscal policy primary balance, $d_t = -p_t$ ...Equation 0.12

In summary, based on Bilan (2010), a number of scenarios can be arrived at:

Case 1: if g > r and p < 0: An excess of economic growth rate over the real interest rate on public debt with an accompanying primary deficit.

This will lead to a more sustainable public debt position as in equation 2.13

$$d_t = d_{t-1} = d^* \ldots \text{Equation 0.13}$$

$d^* = \frac{p}{r-g}$ denotes a stable level of public debt

Where: d_t denotes public debt in period t

d_{t-1} denotes debt in period t-1

Case 2: if g > r and p > 0: An excess of economic growth rate over the real interest rate on public debt with an accompanying primary surplus.

This leads to a more sustainable public debt position as the GDP-to-public debt ratio will fall and tend towards the stable level (d^*).

Case 3: if g < r and p < 0: An excess of real interest rate on public debt over economic growth rate with an accompanying primary deficit.

This leads to a less sustainable public debt position as the level of public debt increases continuously.

Case 4: if g < r and p > 0: An excess of real interest rate on public debt over economic growth rate with an accompanying primary surplus:

This will lead to a more sustainable public debt if d(r-g) ≤ s or if primary surpluses are sought after vigorously such that it results are more significant than the negative effect on debt sustainability due to the interest rate exceeding the economic growth rate; otherwise, it will lead to unsustainable public debt (Bilan, 2010). These scenarios lead to the conclusion that the main factor defining the sustainability of public debt is

whether or not the interest rate charged on the debt exceeds the rate of economic growth. Consequently, the fiscal reaction function was estimated using these variables. The real interest rate, real growth rate and the county primary balance were regressed on the optimal level of county public debt-to-GCP ratio.

Optimising sustainable public debt involves taking actions that ensure that solvency is maintained; in other words, ensuring that the government has just the right amount of revenue to repay its debt at all times. These actions revolve around making decisions about fiscal adjustments by the government from year-to-year to increase or decrease the deficit or surplus that may exist in the primary balance.

2.2.3 The Relationship between Fiscal Decentralisation, Economic Efficiency and Welfare Economics

The price mechanism presumes the achievement of allocative, productive as well as technical efficiency as its outcome. However, the failure of the price mechanism to achieve these forms of efficiency results in public "bads". These are cases where overproduction of goods and services is undertaken in disregard of the accompanying social negative externalities and their effects. The government may overproduce using a large deficit in its primary balance with the consequence of a large unsustainable public debt.

In the quest to solve the basic economic problem or the problem of allocating scarce resources in such a way as to maximise benefit, the capitalist free market system is the most commonly deployed system. Adam Smith envisioned such a system to be one that is self-regulating. He saw the price mechanism system as one composed of self-interested individuals transacting for their personal gain only for the unintended outcome of those transactions to turn out to be an ultimate gain for the wider society.

The price mechanism system, in his view would achieve this unexpected goal through the working of the 'invisible hand of the market' (Biernat, 2010). Through the price mechanism, the 'invisible hand of the market' would supposedly solve the common economic problem. The price mechanism system would answer the questions on economic choice regarding what to produce, how to produce it and for whom to produce. These questions, which form the core of the economic goal of the entire system focus on the technical efficiency with which the society employs its scarce resources in production. How well the market system does actually answer these questions is the measure of the technical efficiency of the system.

Scarce resources are said to possess an allocative technical efficiency status when the resource allocation has been done in such a way as to produce those commodities that the members of society want to be produced and in the quantities in which the members of society want them to be produced. It is only at this point also referred to as the Pareto efficient point, that all the members of society (or economic agents like consumers and producers) will be optimally satisfied. Optimal satisfaction is reached when one economic agent's satisfaction level cannot be improved without worsening the satisfaction level of another agent. In the context of this study, scarce resources will have been optimally distributed when they have been allocated in such a way that public debt is kept at a level that leaves all the members of society optimally satisfied. Therefore, an allocation of scarce resources is only Pareto efficient if it is not possible to make one economic agent strictly better off without making another economic agent strictly worse off when adjusting the public debt sustainability status.

Restated, assume one feasible resource allocation position at a particular public debt sustainability status represented by $x_i \in F(e)$ and a set of feasible allocations, $y_i \in F(e)$ to

represent all other feasible allocations. The allocation $x_i \in F(e)$ will be said to be Pareto

efficient only if all the members of the society consider it to be at least as beneficial as

$y_i \in F(e)$; that is that $y_i \geq x_i$ or y_i is at least as preferable as x_i (Jehle & Reny, 2011).

Where in this statement:

i represents the members of the society, $i=\{1, \ldots, I\}$, each member $i \in I$, having a

preference relation denoted by $\geq I$. The benefit derivable by the members of society at

a particular status of public debt sustainability being represented by e, such that each

member of society can derive the benefits $e \equiv (e_1, \ldots, e_I)$ from different statuses of

public debt sustainability.

The benefit derivable by individual members of society cannot exceed the sum total of

the benefits available $x \in F(e)$. In other words, only the set of feasible allocations of the

scarce resources to the management of public debt are relevant.

These are given by equation 2.14:

$F(e) \equiv \{ x / \sum_{i \in I} x^i = \sum_{i \in I} e^i \}$ ...Equation 0.14

for, x and y = allocation vectors, $x \equiv (x_1, \ldots, x_I)$, $y \equiv (y_1, \ldots, y_I)$.

Were $x_i \in F(e)$ to be allocatively inefficient or Pareto inefficient, another feasible

allocation point with regard to the maintenance of a sustainable public debt level such

as $y_i \in F(e)$, would exist. At this allocation point, at least one member of the society

would be able to derive a higher benefit than at $x_i \in F(e)$ without a different member of

the society being worse off. The member of society who would be better off could be

able to change the allocation point by relinquishing to a different member of the society,

i, an amount of benefit y_i for x_i. Nobody would complain because the equilibria, x_i and

y_i are both feasible and every member of the society would still be left at least as well off as they were at x_i.

Instead, the exchange would have placed one member of the society strictly better off. This would mean that the initial allocation point, $x_i \in F(e)$ was not a Pareto efficient point of allocation. For individual firms, the allocatively efficient point of production falls where the value placed by members of society on a product (as shown by the price they are willing to offer for it or the average revenue) is equal to the cost of producing the last unit of that product (or its marginal cost).

In this analysis, the point $x_i \in F(e)$ would represent a level of allocation of resources that indicate a given amount of allocation to private expenditure which then avails the remaining resources $y_i \in F(e)$, for a given level of public service provision and a given amount for public debt repayment (representing a specific status of sustainable public debt). Thus the levels of allocation would influence the repayability of public debt and its sustainability. The allocation levels may in turn be influenced by fiscal decentralisation. Allocative efficiency is achieved when marginal cost equates average revenue (Anderton, 2009).The price mechanism system also presumes an achievement of the state of productive efficiency. In this sense, the most efficient point of production by firms is at their lowest point of the long run total average cost. In a perfectly competitive market situation, this optimal point of production falls where the marginal cost of production of a firm equates its marginal revenue of production. Firms in perfect competition are not only productively efficient in the long run, they are also allocatively efficient. This is due to the fact that in the long run, they produce at the point of output where their marginal costs, their marginal revenues and their average revenues are all equal.

In a non-competitive situation, the equilibrium level is achieved at a point lower than the level where the marginal cost of production of a dominant firm equates its marginal revenue creating market failure in the form of a deadweight or welfare loss. This is because monopolies have market power and can increase price to reduce consumer surplus. Such limitations are inversely related to the amount of public sector requirements from members of the public. The need for the government to revert the portion of the consumer surplus taken by monopolists back to the consumers, rises in direct relation to the power of the monopolies. In this case also, fiscal decentralisation may influence resource allocation when through the decentralised governments intervention is made in the price mechanism system. For example, if the county governments were to better foster the entry of new firms in the market than the central government, the level of monopoly power would be better arrested leading to improved private services which is in fact enhances less government expenditure and more sustainable public debt. Productive efficiency that is concerned with producing goods at the lowest cost does not necessarily imply the achievement of allocative efficiency because while productive efficiency is concerned only with analysing the potential output, allocative efficiency is concerned with analysing the distribution of goods in addition to analysing the potential output. This additional concern of allocative efficiency requires the consideration of the preferences of agents in the economy in analysing this form of efficiency.

Technical efficiency is also necessary for allocative efficiency to be achieved. Technical efficiency refers to the relationship between resource inputs and the output of final goods and services. A technically efficient society will optimise the use of available resources, such that the least amount of resources is used to produce the most outputs. The capitalist economic system by making the assumptions of the existence of

a large number of economic agents, the sale of a homogeneous product, the free flow of market information among the numerous agents as well as voluntary free entry and exit of producer agents embeds itself in the principle of competition as its main pillar of analysis. Given the existence of perfect competition this economic system theoretically envisages a position of the attainment of all the forms of efficiency in the long-run. However, government interference in the form of fiscal decentralisation may influence resource allocation and efficiency levels and this is what this study sought to determine.

This research pivoted upon the technical form of efficiency. It considered the attainment of technical efficiency in its input oriented sense. If fiscal decentralisation is viewed as a form of intervention in the price mechanism system to achieve this efficiency, the study strove to show how it would impact on either the inputs of production or on production output. In other words, the study considered the effect of fiscal decentralisation on efficiency – which efficiency would impact the provision of public goods and hence the sustainability of public debt.

For the study, the input that would be minimised are the appropriate policies which have a bearing on fiscal decentralisation and on the government's fiscal outlay. The output is the optimisation of sustainable public debt. In a long-run competitive price mechanism situation, the marginal cost of production, should equal the marginal revenue as well as the average revenue and the average cost. It is a state where productive, allocative and technical efficiency is attained. This study was anchored on this fact of economic theory – the state of attainment of all the forms of efficiency. It therefore assumed a long-run condition in a perfectly competitive price mechanism situation. Ultimately, the study focused on technical d efficiency to observe how the

minimisation of the government fiscal outlay affected the attainment of an optimum level of sustainable public debt,

Although the capitalist economic system is supposed to allocate scarce resources efficiently through the process of the price mechanism, it may instead lead to market failure or to the non-achievement of any or all the forms of technical efficiency. In other words, market failure is an indication of the failure of the price mechanism system to allocate scarce resources efficiently through the price mechanism. The non-achievement of technical efficiency in the price mechanism system implies a loss of social welfare. The argument for government intervention in the price mechanism system is that it leads to a movement towards a more efficient allocation of resources generating in the process a reduction in the social welfare loss. It is an attempt to raise technical efficiency on the macroeconomic plane such as in raising the sustainability of the public debt.

It is assumed that more social welfare can be recovered from a state of market failure through fiscal decentralisation where those that make expenditure decisions at the decentralised government entity level are considered to be more knowledgeable about and more responsive to conditions on the ground at the local decentralised level. As such, they are seen to be best equipped to equate the marginal costs of expenditure to the value placed on these expenditures by the local consumers. This would be the value output of goods and services by local consumers measured by the price local consumers are willing to pay for the expenditure items, in other words, the average revenue (to equate the marginal costs to the marginal revenues at the point where the average costs are at their lowest). This attainment of technical efficiency will follow from a reduction in government fiscal outlay in the process of service provision. Following the

achievement of technical efficiency there should also be efficient macroeconomic management of public debt. The failure of the price mechanism system to attain technical efficiency is exacerbated by the malfunctioning of government agencies, which are put in place supposedly to act as benevolent agents in the interest of retaining technical efficiency. These same agencies instead fail to restore technical efficiency when those placed in charge of managing them act in ways that benefit their personal interests and not the society.

To analyse how the price mechanism in the price mechanism system fails to efficiently allocate scarce resources, one can consider the purpose of the establishment of an economic system. An economic system is formed by the association of persons whose common aim is that of choosing the most appropriate way in which to answer the economic puzzle of unlimited wants and scarcity of means. Such a system can lean toward a centrally planned economic system or toward free a market economic system. The question of how well the laissez faire system (a price mechanism system devoid of government intervention) solves the basic economic problem of efficient allocation of scarce resources, can partly be answered by considering that market failure always exists in some form or other in the system of price mechanism resource allocation.

The market fails when the price mechanism system allocates resources inefficiently such that the social welfare of the economic agents is not maximised or a failure to achieve social goals (Lipsey, 1992). It can be measured by the extent to which the social economic welfare fails to be maximised. In other words, the size of the opportunity cost created because of resources not being allocated to their most optimal use; in this case it is measured by the extent of the failure to attain the level of optimal sustainable public debt. There is always some degree of government involvement in the process,

regardless of whether the economic system of choice allocates resources through the market price mechanism or through government controlled planning. In a price mechanism situation, the government intervenes to increase the level of technical efficiency in the economy following the occurrence of market failure by transferring resources to industries where average revenue (or Demand) exceeds marginal cost from industries where it is less so (Anderton, 2009). It can be argued that fiscal decentralisation is one such form of government intervention, which restructures the economic system with this end result in mind. As mentioned before, the government in its effort to intervene in market failure may itself fail because of various reasons.

2.2.4 Inefficiency, Fiscal Decentralisation and Optimal Sustainable Public Debt

The institution of fiscal decentralisation may be construed as an interventionist measure taken by such governments in the free market system which employs the price mechanism process to allocate scarce resources. This intervention may be seen as an effort to remove the effects of the inefficiency created by such a system. One such possible effect is the inability to contain the increase in government size and the associated budgetary primary deficits which raises borrowing levels (public debt) and thus decreases the sustainability of public debt. These measures may not be successful.

The outcome of market failure is the inadequacy of the price mechanism to optimise social goals. One such goal is the equitable distribution of income among economic agents. In economic theory, the outcome of the process of the price mechanism involves a situation in which people whose skills are in higher demand relative to their supply receive a much higher income for their productive efforts than those whose skills have a low demand relative to their supply. This situation creates an income inequality gap and a society that is economically divided. Fiscal decentralisation supporters opion that

the process alleviates such inequality by redistributing funds more equitably (Anderton, 2009). They argue that by disbursing funds are from a central pool to the decentralised decision-making entities according to the level of need or poverty, fiscal decentralisation reduces the inequality gap. They contend that this improvement in the equitability of income distribution is a check on price mechanism inefficiency (Goer & Seiferling, 2014).

Social market failure is also evident where the free play of demand and supply allows for the production and distribution of any product provided that demand for it exits – including demerit goods. Both consumers (representing the demand side of the market) and producers (representing the supply side of the market) are rational optimisers – each group aiming to maximise self-gain. Whatever the consumers wish for and are willing to pay for to maximise their utility, the firms will provide to maximise their profits. This raises the need for paternalism or the need for protecting individuals from each other (for example, protecting vulnerable unsuspecting consumers from unscrupulous producers and traders). Sometimes because of this same reason of instant responsiveness of supply to demand that characterises the price mechanism system, there arises the need for protecting individuals from themselves (for example, protection of individuals from the negative effects of addictive betting and gaming). Government intervention through protection from such demerit goods is an attempt at reintroducing technical efficiency in the price mechanism system. Although the government is the one expected to play this paternalistic role, one can view the ever present fiscal deficits and the associated public debt as a public "bad" to be found in the government fiscal management process. It follows that this public "bad" requires to be minimised. Fiscal decentralisation may be viewed as an attempt to carry out this minimisation procedure. This is to say that one may consider the process the process of

fiscal decentralisation as a deliberate intertemporal public "bad" minimisation measure over time.

Another social indicator of market failure is the inability of the capitalist system to meet certain necessary social obligations. Contracts negotiated in the price mechanism system are mutually beneficial to the parties involved in the sense that both buyer and seller settle on a mutually acceptable price. In such circumstances, society or the state need not interfere with these 'private' arrangements. However, some economic activities are regarded as social obligations and cannot be allowed free 'private' negotiation between the parties concerned. Contracts involving such activities must be enforced along certain specific guidelines that are socially acceptable. In such cases, government intervention is justified as it represents an attempt to rectify the failure of the price mechanism to achieve technical, allocative and productive technical efficiency and as a result, the failure to achieve social goals (Anderton, 2009). Whether it is in redistributing income or protecting individuals from each other and from themselves; whether it involves enforcing socially acceptable specific guidelines to govern transactions whose effects bear negative social connotations, government intervention is aimed at redirecting a diversion from a desired position of technical efficiency.

Ultimately, such a redirection could generate a movement towards technical efficiency in public debt management. Fiscal decentralisation is regarded in devolution literature as one of the means by which the government intervenes in the price mechanism system to correct the social form of market failure or inefficiency. The proponents of fiscal decentralisation argue that paternalism as well as the enforcement of socially acceptable guidelines on contracts may be better practiced by the decentralised entities of government in a fiscally decentralised system. Here, the argument basing on the

assumption that such decentralised government entities would be more knowledgeable about the needs of their local citizenry than would a central government (Welham & Hart, 2016).

Fiscal decentralisation may also or may not be associated with the reduction in other manifestations of inefficiency. These include the immobility of factors of production, which occurs when the reallocation of resources of production between different production lines and / or between different areas of specialisation face costly friction. Labour for example is said to be geographically immobile if it is resistant to regional relocation. It is also said to be occupationally immobile if workers cannot move from one type of occupation to a different one cheaply. In such a situation, there results inefficient resource allocation since factor mobility is a necessary condition expected as a response to price changes in the market to move resources to where they are most valued in terms of regional or skill reassignment (Lipsey, 1992).

The presence of fiscal decentralisation may or may not enhance the geographical mobility of resources and possible optimisation of public debt sustainability by creating competition between various decentralised government entities. The decentralised government entities compete for resources by making their income collection (taxation) vis-à-vis their expenditure methods attractive to investors, workers and other owners of resources. Competition is likely to be more intense in a decentralised government set up. For example, the decentralised government entities are less likely to invest in long term projects like the training of their own labour force (given the risk of eventually losing it to rival decentralised government entities). They would rather 'poach' ready-made resources from other decentralised government entities (at any cost that is lower

than the costs of training, researching or saving), enhancing the mobility of labour and other resources (Cabral, 2011).

Fiscal decentralisation may or may not also have an effect on alleviating other forms inefficiency such as unstable markets and missing markets. Consequently, it may significantly influence the technical efficiency of the optimisation of sustainable public debt. In unstable markets, the key role of price in the price mechanism system that of signaling the direction of resource allocation fails. An example of this is manifested in the cobweb theorem applicable to the agricultural industry, where a particular season's output level moves in tandem with the signal given by the immediately preceding season's prices. The current season's output level continuously overshoots and undershoots the current season's demand level causing surpluses or shortages in the current season. Besides unstable markets, missing markets inefficiency also exist in the price mechanism system. Missing markets refers to the collective consumption of nonrival, non-excludable public goods, which promotes the free rider problem, and the consequent non-provision of the public goods.

Consumers will be willing to take utility from the provision of a product for which they will be unwilling to pay because the non-rival and non-excludable nature of provision of the product allows them to partake of its consumption without being identified and charged individually for it. It could be that fiscal decentralisation may or may not bring the financial decision making process 'closer to the action' at the decentralised government entity level where unstable and missing markets become more keenly felt, identified and dealt with. It could also be argued that fiscal decentralisation achieves this through more public participation in the financial decisions of the decentralised government entities (Fischer & Pfäffli, 2018).

It is on the basis of this keener public participation that one may say that the fourth manifestation of inefficiency in the form of externalities may be addressed. Closer participation by the decentralised government entities may allow intervention for externalities to take place not only at an earlier point in the decision-making process but also in a better manner, than may be done by a central government. Externalities are the existence of discrepancies between private costs and social costs; and between private benefits and social benefits of the economic activities of production and consumption. These discrepancies cause an over-production as well as an under-consumption of goods and services in the price mechanism system. In both cases, the private owners of productive resources and private consumers engage in production and consumption respectively are at the equilibrium points of their activities where the marginal private costs of these activities equate the marginal private benefits. These points of equilibria in production and consumption are not acceptable for the welfare of society who would rather have the marginal social costs of production of the said activities equate their marginal social benefits. The society always suffers a deadweight loss to the extent that the private producers' or consumers' equilibrium is higher (in the case of overproduction) or lower (in the case of under-consumption) than the society's desired equilibrium. The deadweight is an inefficiency that drives the economy towards increased public debt. It has a telling negative effect on the optimisation of sustainable public debt.

It is possible that the decentralised entity, being closer to where the effect of the deadweight loss is felt, and under the keener, more direct scrutiny of the local taxpayers, is better placed than the distant central government, to address it (Cabral, 2011). The same can be said for; the existence of asymmetric information that also presents itself as a manifestation of inefficiency. Asymmetric information necessitates unwarranted

coping with risk in situations where sellers or buyers in pursuit of self-gain misallocate resources by channeling them to uses not indicated by the price mechanism. One of these two parties, armed with more information than the other about the transaction they are entering, sets out to ensure that (scarce) resources are allocated in such a way that he benefits and not in such a way that the allocation maximises total benefit to society. For example, by recommending a medical procedure, which is unwarranted by his patient's condition in order to benefit from the medical fees to be paid by the medically ignorant patient, a medic forces the misallocation of scarce resources to the unnecessary medical procedure instead of a more 'deserving' engagement (Lipsey, 1992).

Market imperfections and market impediments cause inefficiency which devolution literature contends may be reduced with the introduction of fiscal decentralisation. It is possible that following this reduction of technical inefficiency, the management of sustainable public debt will improve to make move towards its optimal point. It is also possible that fiscal decentralisation will raise the rate, precision and promptness of the response of economic activity to price indicators in terms of factor mobility and unstable markets by bringing income and expenditure decisions closer to the consumers – to the decentralised government entities. The same could be said of provision of public goods and the reaction to negative externalities and asymmetric information. However, it is possible that fiscal decentralisation as a form of government intervention can itself fail to address technical efficiency in the allocation of scarce resources. The ultimate consequence may be instability in the macroeconomic conditions in the country such as operating at suboptimal levels of sustainable public debt. The analysis of market failure and technical inefficiency may be explained using the concepts of the principal-agency relationship as well as public choice.

2.3 Review of Theories used in the Study

2.3.1 Public Choice Theory, Technical Inefficiency and Sustainable Public Debt

The price mechanism system fails to allocate resources efficiently and results in the negative effects of market failure. The government is then forced to intervene in the price mechanism to remove the unwanted effects of market failure. A demand-side analysis of the aim of such intervention can be made within the conventional median-voter model under the assumption that the government is a benevolent social-welfare maximiser. The maximisation of social welfare theoretically forces the government's supply of expenditure into a perfectly elastic position; so that the exact amount of government expenditure is eventually determined by level of demand for government expenditure in the economy (Golem & Lena, 2014). Under the assumption of the benevolence of the government, it therefore appears that the members of the public have unlimited access to the supply of government expenditure. However, the government may fail to achieve this unlimited goodwill.

One reason why government intervention may fail arises from the fact that governments are made up of the same self-seeking individuals (as observed by Adam Smith) of which society is made. This can be concluded from a study of the theory of Public choice. From this theory, one discerns how politicians in the government, acting as agents of the public (who make up both the demand as well as the supply side of the market) concentrate on making decisions which favour their own rent collection. Individuals who are in government act outside the acceptable guidelines when they use their political power to make decisions on items such as public expenditure that give more weight to values that are favourable to them, in disregard of the importance needed to be put on the same values as dictated by the market forces.

When making decisions in this manner, activities that those in power do not like are given less weight than their true market value (as measured by their market price); while giving greater weight than the market price to those activities that favour them (Mueller, 2014). Since it is generally assumed that when the market fails and inefficiency occurs, the government will intervene and act in such a way as to raise economic welfare towards reestablishing technical efficiency and reducing social welfare loss, an argument can be made to have fiscal decentralisation viewed as a form government intervention. Fiscal decentralisation creates the existence of many levels of government which, according to Baskaran (2009), supervise each other's financial activities. It also brings authorities in charge of taxation and expenditure decisions nearer to local politicians to enhance the supervision of these decisions. Fiscal decentralisation reduces the fiscal illusion of the consumers-voter making him more aware of his true tax burden. Additionally, consumers-voters in adjacent decentralised decision-making units can more easily compare their relative positions and penalise their sub-national government for excessive and wasteful spending. Thus, it enforces the presence of competition among the decentralised government units resulting in more transparent decentralised budgets.

Politicians at the decentralised government decision making unit indulge their consumers (voters), and reduce the size of expenditures so as to minimise the probability of not being re-elected. This process, it is thus concluded, leads to improvement in the technical efficiency with which the financial decisions of the government are made and delivered both at the central government level as well as at the decentralised government entity level (Baskaran, 2009). One would therefore expect government expenditure in the economy to vary inversely with the extent of fiscal decentralisation. This demand-side perspective shows a positive effect of fiscal

decentralisation on the size of government and consequently on the sustainability of public debt. The argument is that it enhances technical efficiency and because of the improvement in technical efficiency, there is higher likelihood of achieving a more sustainable level of public debt.

However, from a different perspective of the theory of public choice, while fiscal decentralisation may be championed as a measure that is supportive of the removal of inefficiency resulting from social market failure, it has a major shortcoming. This is the fact that all government decision makers including those at the sub-national level are selfseeking and will not allow the benefits of technical efficiency which may arise from fiscal decentralisation to be realised. An analysis of the 'theory of public choice' can show that fiscal decentralisation may instead raise the level of inefficiency. Public choice theory analyses government taxation (income) and expenditure. Members of the public or consumers, who are the voters, represent the demand side while politicians represent the supply side. The politicians make the decisions about taxes and expenditure and they have to 'sell' these decisions to the consumers or voters. The consumers want to maximise their net benefits from the government to get high quality, large quantity public services with minimal taxation, and the government is supposed to facilitate this. However, this does not always happen because the politicians in government also strive to maximise their votes and stay in power or to maximise individual gains from the power they possess.

Members of the public are also moved by the system to push it towards inefficiency. While fiscal decentralisation may increase the technical efficiency and quality of government services by tailoring them more consistently to the needs of consumervoters, it may also, through strengthening the citizens' trust in a more closely

supervised government, create a higher demand for more public goods and services, thereby raising government expenditure. Additionally, the more financially decentralised the system will be, the greater the potential for public influence; and the greater the number of interest groups among the general public there will be. In other words, the more autonomous (genuinely decentralised) the government is, the more the trust that is generated in the public, the stronger their demands via their interest groups and the more willing the politicians to answer to groups' demands for more government expenditures. (Golem & Lena, 2014).

The failure by government to achieve the desired technical efficiency effects of decentralisation underpins the inevitable undesirable costs which result from the suboptimal combination of the political fiscal and administrative elements of decentralisation as proposed by the Soufflé theory (Parker, 1995). According to Oates (2005), these costs that reflect technical inefficiency, stem from the loss of macroeconomic control by the central government. The central government loses control over infrastructure development when it hands over discretionary spending power to the decentralised government entities. For example, politicians at the decentralised units will favour the interests of the decentralised unit when making decisions about expenditure even where such interests are not economically viable. While the central government is interested in capital investments that have national benefits, such as national roads, decentralised governments focus on investments that yield only local regional benefits.

The result is, that in this way fiscal decentralisation process fails to achieve important nationwide economic equal growth objectives which fact causes unbalanced regional growth. Compounding this is the fact that in promoting self-interest, most central

governments decentralise expenditure without simultaneously decentralising revenue collection (Oates, 2005). By collecting revenue from all the decentralised regions and then redistributing part of it back to the regions in what it deems to be the most equitable way possible, the central government in effect enhances inequality. Richer regions which would have collected more revenue had they been given more leeway to do so, end up contributing less to the central government's coffers. This is because they would have collected more if they knew they were to spend on themselves.

With the one-ended type of fiscal decentralisation where the expenditure is less decentralised than revenue collection, the richer regions end up receiving more than they deserve from the central pool of funds in the reverse transfer from the central government, which comes after the collection process. Politicians at the decentralised government decision-making units will favour expenditure and tax decisions which have popular results in the short run in order to win votes even if such decisions will prove to be unwise in the long run (Anderton, 2009). This will create technical inefficiency because fiscal decentralisation fixes the central government in a legal agreement to share collected revenue with the decentralised government entities. This arrangement renders the central government inflexible in making timely macroeconomic adjustments throughout the larger economy. From the point of view of technical efficiency, the central government's influence on the macro economy, which is needed to achieve its macroeconomic objectives, is thus greatly inhibited.

One can draw some conclusions from this sampling of the general technical efficiency loses paid by a nation in fiscal decentralisation. It is evident that the process faces fiscal pressures, which in some way must negatively affect the technical efficiency of service provision in the economies with decentralised government systems and consequently

the ability of the governments of such economies to maintain their solvency with regard to optimal public debt obligations. The costs associated with fiscal decentralisation indicate that the process creates a disparity in the aims of the central and the decentralised governments, disparities that reduce the central government's ability to manage public expenditure and investment - a reality that could have critical negative consequential repercussions on attainment of the optimality of sustainable public debt.

Fiscal decentralisation may inadvertently reduce savings in the country by taking resources from the central government where their expenditure would be geared towards productive investment and moving to decentralised entities where expenditure is mostly made on consumer goods. For these nations that are practicing the decentralised government system, (which, judging by the "recent" rise in the popularity of decentralisation in the world is a significant number of nations), the process at its beginning makes available large amounts of funds to inexperienced financial managers at the decentralised government level. These managers could mismanage the funds because of their inexperience or for political reasons. The result of this is the necessitation of increased expenditure by the central government through policing the management of funds at the decentralised level and to redeploy mismanaged or misappropriated funds. Consequently, deficits become more likely to result in the central government primary budget, which, more often than not, are covered by increases in public debt. This may very well negatively affect the government's solvency with regard to public debt sustainability since this trend of happenings goes against the conditions necessary for maintaining this solvency. Whichever way the government intervenes, there may result limitations in its endeavour to correct market failure as observed in the form of allocative and social misallocation of resources. The politicians referred to in the public choice theory include those in the central

government as well as those in charge of the decentralised government entities. Failure of government intervention to remove inefficiency due to the assumptions of the public choice theory may mean failure to optimise sustainable public debt.

2.3.2 Principal-Agent Theory, Technical Inefficiency and Sustainable Public Debt

Besides the public choice theory, the principal-agency theory can also be used to analyse the price mechanism failure. The principal-agency theory clarifies how market imperfections and market impediments create distortions in the role of price in the market. Apparently, these distortions may be reduced through fiscal decentralisation. The principal-agency theory is often used to describe public governance setups. It proposes a relationship between a 'principal' owner of an idea who has a clear expectation of the goal of his idea and an agent he has mandated to obtain the said goal. The theory concerns the ability and the level of achievement of the intended goals by the agent (Jensen & Meckling, 1976). The success with which the goals are achieved depends on power positions and flow of information between the principals and the agents (Masanyiwa *et al*, 2013).

In both the top-down and the bottom-up models of the theory, the ultimate principals are the members of the public while the politicians are the agents as shown in figure 2.2 (Mewes, 2011).
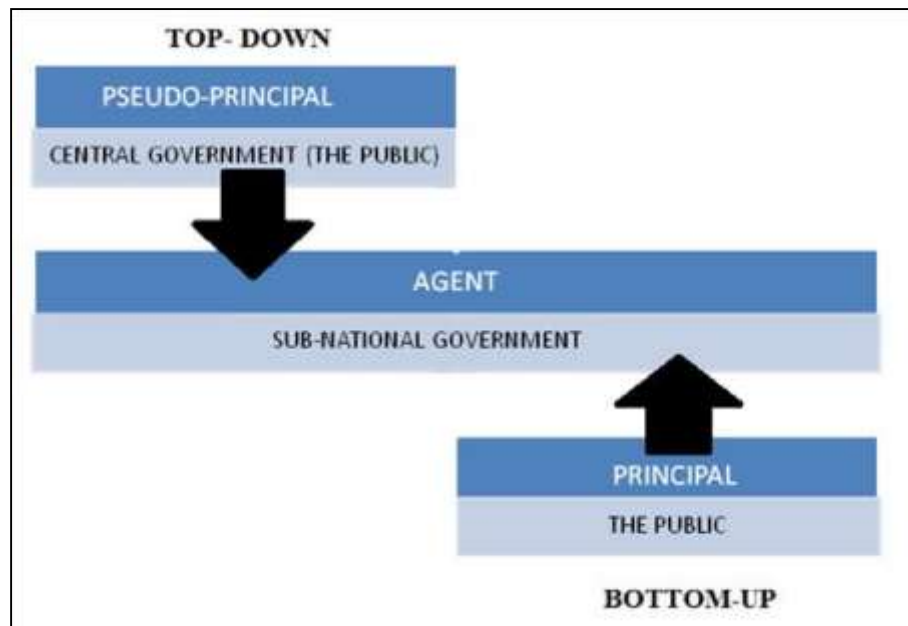
Figure 2.2: Fiscal Decentralisation and the Principal-Agent Theory
Source: Author, 2022

In a top-down model of the principal-agency theory, the politicians at the decentralised decision making unit being can be considered to be the agents where the central government acting as the benevolent representatives of the citizenry are the principals (making the citizenry the ultimate principals). Such situations occur for example when the central government disburses finances to the decentralised governments for development investment. Although in this top-down model the central government holds the expectations over what should be attained, the ultimate principals are the members of the public since the central government is supposed to be acting for the benefit of the common citizenry.

Applied to fiscal decentralisation background, in the top-down model, the principal (the central government) has placed obligations on the decentralised government entities with expectations as to the achievement of certain national financial interests; having a benevolent national outlook as compared to the competitive and antagonistic stand of the decentralised government entities. On the other hand, in the bottom-up model of the

theory, decentralised government politicians can still be taken to be the agents and they are expected to be acting in the interest of their principals. The decentralised government entities and their decision-making organs become the agents while the principals are the citizenry.

Either way, the ultimate principals are the citizens who are consumers of services provided by either level of government. They are the direct principals in the bottom-up model and the indirect principals in the top-down model seeking to promote public welfare. The ultimate agent going by either model is the decentralised government entities (Kayode, 2013). In either model, the politicians' rent seeking behavior (considered in the public choice theory) impacts unfavourably on the ultimate principals – namely the members of the public. Under the Principal Agent theory politicians in the sub-national government entities, being agents, seek their mandate from and are supposed to act as the representatives of the public.

Fiscal decentralisation is expected to deliver to them an improved decision making platform that enhances technical efficiency in service delivery. This by extension is then expected to result in better fiscal policies that enable the attainment of an optimal sustainable public debt management. However, the agents fail to do this due to their selfseeking behavior (De & Renzi, 2007). In other words, given their lack of loyalty and professionalism; and without proper control measures being put in place, the government agents at the decentralised entity decision-making level may fail to synchronise their personal goals with the goals of the citizenry (Davis *et al* , 1997).

The principal-agency theory explains the opportunistic behavior of the politicians as the cause of failure by agents to achieve their principals' goals hence reducing the capacity to maintain an optimal sustainable public debt. Decentralised government entities'

failure to effectively deliver public services is in this sense is attributable to some of the people who hold political sway interfering in the resource allocation process for their personal gain. This is to say that the technical efficiency of the public service delivery process may be distorted when politicians and bureaucrats being potential benefactors, collude with decentralised entity decision making agents to twist the outcome of the process in their favour (Kamara *et al*, 2012). The success of the principal in the bid to secure his goals through the agent therefore all boils down to the ability to achieve accountability. The argument that those who stand for fiscal decentralisation say leads to greater accountability becomes debatable when this theory is considered. The habit of maximising self-benefit by the agents has to be reined in if the principal's goals of efficient service provision and attainment of optimal sustainable public debt are to be met effectively (Gailmard & patty, 2012).

One way in which the failure of the central governments in attaining technical efficiency and social goals may be manifested is in their inability to manage optimal sustainable public debt. In the face of market failure, the public choice theory and the principal agent theory, society should not rely on the price mechanism system and the price mechanism alone to achieve technical efficiency as well as other goals aimed at optimising material living standards.

2.4 Empirical Literature Review

The literary work that has been done on the subject of public debt has established the nature of the relationships between public debt and other key variables in the macro economy with which it relates. The relationships between public debt and other variables such as: the interest rate charged it, economic growth, the excess of interest

rates (charged on debt) over GDP growth rates as well as the primary balance have been established.

2.4.1 The Size and Sustainability of Public Debt

The level of public debt has generally risen globally in the past decade. In Europe for example, as a result of the 2007-2008 financial crisis, the debt ratio increased from 66.2 percent of GDP in 2007 to 90.7 percent of GDP in 2015 (Belguith & Omrane, 2017). This did not necessarily put the countries involved in conditions of unmanageable levels of debt. Different countries were able to sustain different levels of debt depending on their growth profile and the credibility and quality of the relevant institutions that were charged with developing or implementing public debt policy. According to Sow and Razafimahefa (2017), nations that have strong well-established budgetary institutions can benefit from fiscal decentralisation as opposed to those nations whose institutions are weak and can be easily distabilised by internal and external shocks (Sow & Razafimahefa, 2017).

When incurring public debt, the people of less developed countries, of which the decentralising economies of Sub-Saharan Africa and Kenya are a part, have as their central aim, not just the need to increase their Gross Domestic Products, but also the overall aggregate development of their economies. They will only have experienced overall aggregate development from borrowed funds if there will be a reduction or elimination of poverty, inequality and unemployment accompanying the growth in the Gross Domestic Products of their economies (Todaro & Smith, 2012). This simultaneous unidirectional movement of these variables has not been the experience of the less developed countries from their borrowing over the recent past. The less developed countries instead have experienced a continuous fall in standards of living

brought about by persistent poverty, inequality and unemployment. They have had to live with mounting foreign debt problems that have forced them to cut back on their economic and social programmes, which, by their very definition are already limited. A study done for South Africa for example found out that the country had to raise the level of public debt just to offset shocks in real GDP growth that had caused decreases in employment, investment levels, government revenues and government savings (Makau *et al*, 2018). Given that most of these debts are advanced by developed nations, as the less developed countries pay off these debts, the inevitable ultimate result is an increase in living standards in the developed world simultaneous to a decline in the living standards in the less developed countries (Kumar, 2016).

One cannot set up an all-encompassing model that captures the intricacies of public debt management, but the sustainability of the public debt can still be analysed. Public debt is said to be sustainable when the indebted government is able to meet its debt financial obligations without having to resort to unfeasible or undesirable policies (Debrun *et al*, 2019). In most cases, a country's solvency or ability to pay will depend primarily on its government's level of own-income. The government's level of own-income is in turn directly related to the country's GDP from which it raises its tax. The government being sovereign can also create fiat money to meet its financial obligations as a solution to the country's solvency problem. However, this later solution has a negative counter effect of raising the general level of prices in the economy. Eliminating this second solution to avoid the possible stimulation of inflation, the solution to a country's solvency problem and the sustainability of public debt reverts back to the government' ability to cover its expenditure using the income it has collected by itself. Should the income collected prove to be inadequate then the excess expenditure must be covered through borrowing. The sustainability of public debt and the ability to hold this sustainability at

its optimal level therefore ultimately boils down to the debt–to–income (GDP) ratio (Alesinay & Passalacquaz, 2015).

For Sub-Saharan Africa, increases in public debt often spell difficult economic times given their low-income generation capacities. For these countries, like for all developing countries, the best form of debt management begins with the restriction of the level of debt to meet the first condition of remaining solvent given by equation 2.1 (Martner & Tromben, 2004):

$D_t = D_{t-1} + rD_{t-1} - P_t \leq X$ for all t years …equation 2.1

This is because the sustainability of debt is all about the ability to pay the debts from the country's revenue or its real GDP. A good indicator of public debt sustainability for countries in Sub-Saharan Africa is the extent to which they rely on exportation – particularly the exportation of primary products as their source of revenue and as their debt repayment base. From the 1980s, as shown on figure 2.3 there was a rise in the proportion of export revenue used in the servicing of debt in these countries.
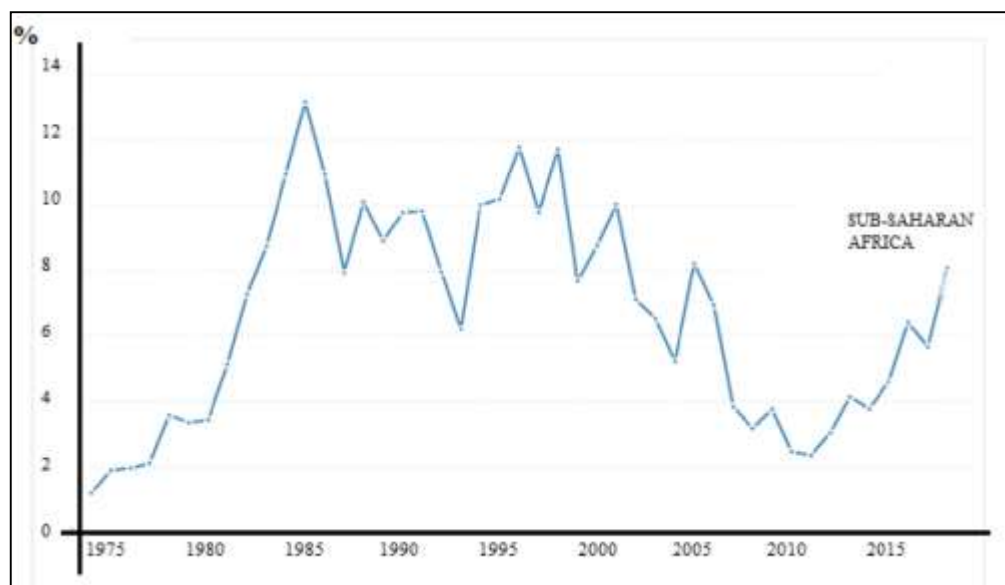
Figure 2.3: Sub-Saharan Africa Debt Servicing Percentage of Income
Source: IBRD, 2020

This is the point in time when fiscal decentralisation took an upturn in Sub-Saharan Africa, as compared to the 1970's (the period immediately after independence) when these countries still practiced centralised forms of government in their majority. Zimbabwe for example, is one such country which being highly dependent on primary commodities, had its current account negatively affected by exposure to shocks in the terms of trade. However, the country's public debt sustainability assessment revealed it to be sustainable over the medium to long term (Makau *et al*, 2018). A study made in Kenya by Fedelino, Kaufman and Estevão (2021) found the public debt to be sustainable and capable of achieving the desired ten percent GDP economic growth threshold by 2030 as planned by the government. Kenya's current debt-carrying capacity is evaluated as medium although her risk of debt vulnerability is considered as being high. This is because of high deficits from the past as well as deterioration in debt solvency and liquidity following the global COVID-19 shock. The global COVID-19 shock caused a sharp decline in export and economic growth. The government of Kenya is addressing this high risk situation through fiscal policies that are geared at countering susceptibility to export and exchange rate shocks (Fedelino *et al*, 2021).

2.4.2 Interest Rate, Economic Growth Rate and Public Debt

Various studies demonstrate a positive relationship between interest rate charged on total borrowings and internal public debt levels. Many of these use the neoclassical production function to demonstrate this theoretical link between interest rates and internal debt in the context of the standard Cobb-Douglas production function given by equation 2.16 (Engen & Hubbard, 2005):

$Y = AK^{\propto}L^{1-\propto}$ …Equation 0.1

Where L = labor units, A = a coefficient for multifactor productivity, and $\propto$ = coefficient on capital and labour.

They conclude that based on an aggregate production function for the economy, government internal debt crowds out or reduces private capital and as a result it creates an increase in the marginal product of capital. Consequently, the internal interest rate (*r*) determined by the marginal product of capital *(MPK)*, increases as capital *(K)* is decreased, or is crowded out by public debt (*D*),

The total return to capital in the economy (MPK).(K) as a share of output, (Y), is given by:

$$\propto = \frac{(MPK.K)}{Y}$$

The internal interest rate is then determined by:

r = MPK

or $r = \propto \left(\frac{Y}{K}\right)$

$r = \propto. A. \left(\frac{Y}{K}\right)^{1-\propto}$

Conclusively, the level of internal public debt determines the level of the capital stock that then determines marginal productivity of capital and the internal interest rates level. Any exogenous increase in internal government debt (*ceteris paribus*) leads to an increase in internal interest rate as in equation 2.16:

$$\frac{\partial r}{\partial D} = \frac{\partial r}{\partial K} \cdot \frac{\partial K}{\partial D} = \frac{\alpha(1-\alpha)Y}{K^2} > 0 \qquad 0 < \alpha < 1 \text{ and } Y, K > 0 \text{ ...Equation 0.2}$$

This means that the variability of internal interest rate depends on the government budget deficit (David & Francesca, 2012).The higher the internal interest rates rise, the more likely the government will be willing take on external loans and pay it off at the

same or at a lower rate of interest. Therefore, considered from this point of view, internal interest rates have a negative effect on total public debt levels.

Several other studies on public debt sustainability have considered the excess of the interest rate paid for public debt over the growth rate. These studies have demonstrated the existence of a negative relationship between this variable and public debt levels. In one such study, Barrett (2018) asserts that so long as the excess of the interest rate is negative, there is no maximum sustainable debt limits. A negative excess is expected to favour the sustainability of public debt while a positive excess is expected to impact on the sustainability of national debt negatively (Barrett, 2018). In the OECD economies with stable sustainable public debt statuses for example, empirical evidence shows that interest rates have persistently been below growth rates. According to Edward Gambler and John Saluki (2019), stability in public debt sustainability prevailed even in the mid 1990's till the mid 2020's when growth rates did not exceed interest rates by much due to lower inflation targets that were adopted in most of these economies (Gamber & Seliski, 2019). Checcherita-Westphal and Semeano (2020) agree with this in their finding that, before the COVID 19-crisis, countries across euro area exhibited a strong negative tendency in their interest-growth rate differential but this is not likely to continue for long post COVID 19. They therefore call for caution in these countries in this area, especially those with high debts, in their fiscal policy conduct over the medium term (ChecheritaWestphal & Semeano, 2020). The negative or low interest rates experienced in the EOCD nations from the 1980s has been seen by many economists to be a situation that would be synonymous with a favourable level of sustainable public debt. This, they argue is because it presents a situation where public debt bears no "fiscal" cost. In reality though, this has not always been the case. Instead, those nations that exhibit high levels of public debt and primary balance deficits have

empirically been found to be more likely to have high interest-growth rate differentials (European Commission, 2021).

A point valid for consideration is whether individual levels of interest rates and economic growth rates ought to be considered separately when evaluating their influence on the sustainability of public debt rather than considering the effect of the difference between them as has traditionally been the case in literature. Considering the relationship between economic growth rate alone and public debt, one may note that low levels of GDP growth rate limit the government's ability to manipulate the primary balance (particularly toward increased expenditure over revenue collection). Further, in such situations the government will be unable to carry out any meaningful reforms targeting the boosting of long term economic growth or to cut its spending. Studies on the relationship between public debt sustainability and economic growth rates invariably report a negative relationship between the two. A study by Calderon and Fuentes (2013), of the Latin America and the Caribbean nations, revealed a strong negative relationship between growth rate and public debt. It concluded that high levels of public debt caused low levels of economic growth even though the adverse economic growth rate effect may be mitigated by having strong institutions, high quality domestic policies and outwardoriented policies (Calderón & Fuentes, 2013).

A similar study in the Euro area supported the view that public debt always has a negative influence on the long-run economic growth rate of the Euro area member states.

It pointed out though that the short-run relationship may be positive (Gómez-Puig & Sosvilla-Rivero, 2017). Ugo Panizza and Andrea Presbitero (2013) further affirmed the position that high levels of public debt are negatively correlated with high economic

growth rates. However, they added two important insights. Firstly, that when public debt was below 90 percent of GDP, there was no link between debt and growth; and secondly, that although it was evident that public debt was negatively correlated with economic growth, there was no evidence of causality between the two variables. They observed that no study has made a strong case for a causal relationship going from public debt to growth, allowing for the possibility that it could in fact be economic growth that influences the level of public debt (Panizza & Presbitero, 2013).

As far as the Sub-Saharan Africa region is concerned, studies covering the countries in the region show the same negative relationship between public debt and economic growth rate. They give some conclusions about the causes of this relationship; including the fact, that investors in Sub-Saharan Africa are 'crowded out' due to the increase in the external debt overhang and so loose the incentive to invest (Lyoha, 1999). Another reason offered for this state of affairs is the rising debt servicing ratios in countries in this region, which reduces the availability of resources that could be otherwise be used for investment and growth in these countries (Iqba & Kanbur, 1997). In Kenya's case, since her independence, the country has experienced the same negative relationship between external public debt and economic growth rate as shown in the findings of several studies. In a study of data spanning the period 1963 to 2015, Achwoga (2016) found that economic growth rate in Kenya was negatively and significantly related to external debt but positively and significantly related to domestic debt (Achwoga, 2016). Another study by Were (2001) covering the period 1970 to 1995, confirms this relationship and the existence of a debt overhang problem in Kenya. The findings of this research indicate that external debt accumulation had a negative impact on economic growth rate and private investment (Were, 2001). More recently, in an analysis of data for the period between 1996 and 2015, Gicheru and Nasieku (2016)

who found a negative relationship between external public debt and economic growth for this period affirmed the relationship yet again. Taking into account the source of the debt (whether internal or external), their findings mirrored those of Achwoga in 2016; that a statistically significant positive relationship exists between internal public debt and economic growth, while a negative relationship exists between external debt and economic growth in Kenya (Gicheru & Nasieku, 2016).

2.4.3 The Primary Balance and Public Debt Sustainability

A study on the fiscal reaction of governments to movements in the level of their public debt by Mendoza and Ostry in 2007 revealed that overall, there is a positive and statistically significant relationship between primary fiscal balances and public debt for both emerging and developed economies. They observe that the relationship weakens as level of a country's public indebtedness rises regardless of its level of development. This they say does not preclude the possibility of there being a positive relationship between deficits in the primary balances and public debt (Mendoza & Ostry, 2008). Some exceptions show a contrasting position. For example in India, it was found that out of the twenty states in that nation, only ten experienced a positive reaction of debt sustainability to the institution of primary surpluses (Curtaşu, 2011).The existence of these relationships gives the underlying reason why countries manipulate their primary balances in varied ways to make their debt positions solvent.

Studies attest to the use of the primary balance to this end. For example, Bohn (1998) found that between 1916 and 1955 the United States regularly raised its primary surplus or lowered its primary deficit in response to its public debt-to-GDP ratio to keep its public debt in a sustainable position (Bohn, 2005). In 2005 De Mello observed the same behavior for Brazil in the period 1995 to 2004, where both the central and the

decentralised levels of government in that country adjusted their individual primary budget surplus targets in accordance to changes in their indebtedness (Mello, 2005). The use of the primary balance to manage the public debt does not necessarily end in the desired result. On the opposite end to such success is the example of the Romanian economy which according to Stoian (2008), did not respond well to changes in its debtGDP ratio from 1991 to 2005 when it made adjustments to its primary balance to secure its weakened debt sustainability position (Stoian, 2008).

In most cases there has been observed a definite relationship between the primary budget balance and the public debt sustainability level. The centrality of the primary balance in public debt sustainability management is highlighted by the rule set in 1992 by the European Union nations at the Maastricht Treaty. The rule was set as a precondition for countries to have membership in the Economic and Monetary Union (EMU). The condition set was that all the members of the union had to maintain their public debts at 3 percent of their primary deficits. A study by Curtaşu (2011) reveals that in the period 1991 to 2012, some of these countries were able to follow through on these conditions but the majority could not, with the average public debt growth rates of those nations which failed to achieve the threshold, exceeding their average economic growth rates. This left governments exposed to solvency risk in many of these countries.

It is important for government to take corrective measures in reaction to economic shocks such as the COVID-19 pandemic, as a way of managing the possible explosive negative effects of such shocks on the public debt position. In SSA from the early 2010's, there was a concerted effort to reduce primary fiscal deficits by the countries in this region. These economies used measures such as lowering of government

expenditure coupled with stimulation of economic growth rates to achieve this objective. The reduction of the primary fiscal deficits was greatly boosted by the receiving of debt reliefs, particularly for the very low incomes countries. Consequently, Sub-Saharan Africa's public debt-to GDP ratio declined during this period. Even so, the primary balances in SSA exceed those required to keep public debt at sustainable levels in many of the countries. Currently, those SSA countries with high debt burdens have balances which are above those needed to reduce public debt-to-GDP ratio to sustainable capping. In most of these countries the main factor that has been determining whether or not public debt is sustainable has been the interest-growth rate differential, rather than the manipulation of the primary balance (Ncube & Brixiová, 2016).

For Kenya, William Ng'ang'a, Chevallier and Ndiritu (2016) found that the primary balance is positively related to public debt. They also conclude that fiscal consolidation measures have a negative effect on economic growth and by extension a negative effect on macroeconomic stability including public debt sustainability. This, they assert is because of the positive relationship of debt uptake to long-run GDP growth (Ng'ang'a *et al*, 2016). According to Paribus (2022), the interrelation between the interest growth rate differential and the primary balance also has an effect on the sustainability of public debt. He notes that over a given period of time, provided the growth rate exceeds the interest rate levels, the public debt will remain sustainable even if the government runs a deficit in its primary balance.

The primary balance will be as in equation 2.17:

$$(r\text{-}g) = \frac{D}{GDP} \ ...\text{Equation } 0.3$$

where: r-g = the interest growth rate differential

$\frac{D}{GDP}$ = the level of sustainable public debt

In other words, should the interest rate exceed the growth rate levels the government will be forced to create at a primary surplus if it hopes to maintain stability in the sustainability of its public debt. Any increases in the interest rates payable on public debt reduces the luxury the government has of running a primary deficit balance (Paribus, 2022). Besides, governments whose primary balances are in deficit face significantly higher borrowing cost than those experiencing surpluses.

2.4.4 Fiscal Decentralisation and Public Debt Sustainability

There has been a general rise in the number of countries taking after devolution and fiscal decentralisation as a system of government in the world over the last three decades. In fact, according to Feruglio (2007), over the past twenty years fiscal decentralisation has been adopted in over eighty-five countries throughout the world, with different countries instituting the system to different levels. This trend has been fuelled by both political as well as economic factors (Feruglio, 2007). Tom Hart and Bryn Welham (2016) describe decentralisation as a multidimensional process involving the devolution of specific powers from the central government to autonomous decentralised government authorities. They highlight three major components of a decentralised system namely: the political, the administrative and the fiscal aspects. These components overlap one another. The political component of decentralisation concerns the transfer of policymaking authority to the decentralised level of government. The administrative dimension of decentralisation concerns the transfer of functional responsibilities to the decentralised government. The fiscal component, relates to the sharing of policy and implementation procedures on financial matters between the two levels of government. This fiscal aspect of fiscal decentralisation revolves around the extent to which the decentralised government entity is authorised

by the central government to collect its own revenue and to design and implement its own expenditure programmes (Welham & Hart, 2016). It reveals the public finance dimension of the intergovernmental relationship, addressing the delegation of service provision through the system of revenue collection and expenditure functions from the central to decentralised government entities (Feruglio, 2007).

A conceptual model, known as the Soufflé theory of decentralisation, suggests that these essential elements of decentralisation (political, fiscal, and administrative), must be combined in an optimal manner with regard to the prevailing conditions for a successful carrying out of a decentralisation process (Parker, 1995). Any suboptimal combination of these elements (too much of one and too little of any other given the prevailing conditions) inevitably leads to some undesirable outcomes or costs which are a sure sign of technical inefficiency. That said, the fiscal component of decentralisation is in itself a key element of any decentralisation programme, the improper implementation of which can result in the same costs or technical inefficiency that is envisaged by the Soufflé theory (Feruglio, 2007). One commonly used way of determining the degree or level of fiscal decentralisation is by considering the degree of leeway, which the decentralised government entity is given by the central government to carry out its own revenue collection and its own expenditure programmes. This means finding out the amount of revenue collected by the decentralised government entity and the amount of its expenditure and then comparing it (as a percentage) to the central government revenue and the central government expenditure respectively. Additionally, fiscal decentralisation is also defined by the amount of fiscal transfers from the central government to the decentralised government entities.

Globally, the proportion of expenditure by decentralised entity to expenditure by the central government is currently above an average of 10 percent. It varies however for different areas. For example, on average, it is above 40 percent for the Nordic countries and 32 percent for European OECD countries. In Asia and Latin America, this proportion lies close to 20 percent and it is between 14 percent and 26 percent for the transition economies. These dynamics of fiscal decentralisation in Europe were laid out by a World Bank report in 2013 in which it was also recorded that in 17 of the 27 member states, the share of sub-national spending in total expenditure reached more than 30 percent (European Commission, 2013).

According to the report expenditure, decentralisation in this region improved the primary balance of the central government. Considering that budget balances have a bearing on the need to borrow and create public debt, it is notable that the report added that in cases where decentralisation was skewed towards sub-national entities collecting their own revenues the budget balance improved. On the other hand, where decentralisation was carried out in the form of sub-national entities receiving income from central government transfers (one which is not accompanied by sub-national entity financial responsibility) the budget balance worsened. This is in agreement with what Si Guo, Yun Pei and Zoe Xie (2022) conclude, that the decentralisation of revenue collection results in lower total government debt, whereas expenditure decentralisation leads to higher total government debt (Guo *et al*, 2022). However, the 2013 World Bank report concluded that adverse implications on budget balances did not come from the process of decentralisation but from a poor design of the decentralisation process (European Commission, 2013).

While increasing the sub-national governments' income, the decentralisation of revenue collection, decreases the central government's income. This process narrows the vertical fiscal imbalances so that the central government then has less need to transfer funds to the sub-national governments. Consequently, the central government's need to borrow falls, thus improving the status of sustainability of public debt. On the other hand, higher expenditure decentralisation increases the sub-national governments' spending responsibilities vis-à-vis the central government's share, hence widening the vertical fiscal imbalance between the two tiers of government. Although the central government's public spending falls, the increase in monetary transfers (from the central government) more than offsets the smaller spending (by the sub-national governments). As a result, the central government will be obligated to make larger amounts of fiscal transfers to the sub-national governments, inducing borrowing and holding all else constant, making the status of sustainability of public debt in the country worse (Guo, Pei, & Xie, 2022).

In another study also covering the European countries by Thushyanthan Baskaran in 2009, it was found that fiscal decentralisation in the region leans more towards expenditure decentralisation then revenue-collection decentralisation. The study found that the higher the level of expenditure decentralisation was, the lower the public debt-toGDP ratio became. It also found that there is a positive relationship between the size of the fiscally decentralised entity (sub-national government) and the public debt-to-GDP ratio. The study thus concluded that fiscal decentralisation in general and expenditure decentralisation in particular improved the public debt sustainability position (Baskaran, 2011).

It was established by Si Guo, Yun Pei and Zoe Xie (2022) that in general, there was an inverse relationship between the central government fiscal transfers and the amount of public debt. It was observed that the central government increased its fiscal transfers to local governments with the aim of offsetting vertical imbalances between the central government income and the sub-national government income and also with the aim of offsetting the horizontal fiscal imbalances between the sub-national government incomes. As such transfers were increased in Spain the total government debt became larger. It was established that the reason for this trend was that the central government transferred funds to the sub-national governments in excessive amounts over what was immediately needed (over-transfers) in the anticipation of expected future need by the sub-national governments to have shortfall of funds for expenditure in future and to fend of possible future borrowing when such shortfalls occur. In the end, as the decentralised government entities become more and more reliant on the fiscal transfers and both decentralised government entity debt and the central government debts rise, the over-transfers leads to over borrowing by the central government itself and a rising level of technical inefficiency (unsustainability) of public debt. Therefore, in agreement with empirical evidence, instead of reducing the vertical imbalances between the central government and the decentralised entities, the report explained that fiscal decentralisation in the end widens the vertical fiscal imbalances as the decentralised entity governments become more certain of receiving the fiscal transfers. Consequently, the debts of both the decentralised government entity and that of the central government rise. The public debt rises with the possibility of exacerbating the difficulty of sustaining public debt (Guo *et al*, 2022).

Overall, fiscal decentralisation, raises the risk of removing fiscal discipline form the decentralised counties when fiscal transfers are made to the decentralised government

units from a common pool at the central government without due diligence. Due to this, the decentralised government entities never bear the full cost of their expenditure. The result is an over spending by the decentralised entity in anticipation of getting funds transferred to it from the central government. Additionally, the skewed nature of fiscal decentralisation also worsens of the public debt situation given that in most countries it is more expenditure oriented than revenue-collection oriented. The result is an overall increase in the vertical imbalance and a deficiency in the nationwide revenue collection (an increase in the overall fiscal deficit) and a higher public debt (Niko Hobdari, 2016).

Just like in other parts of the world, fiscal decentralisation has become popular in many African countries over the last three decades (Ruggier *et al*, 2018) such that by the year 2000, most of this region's countries had some form of decentralised government in place; and currently, fiscal decentralisation is prevalent in Sub-Saharan Africa (Ribot, 2002). However, the degree of fiscal decentralisation in Sub-Saharan Africa is much lower in comparison to other regions of the world. If one were to evaluate the degree of decentralisation using the proportion of decentralised entity's expenditure to the total national public expenditure, as did Fritz and Markus in 2004, he would find this to be true (Fritz & Markus, 2004). For the Sub-Saharan Africa countries, the proportion of decentralised entity's expenditure to the total national public expenditure is less than 5 percent in 19 of the 30 countries in this region in 2002 (Ndegwa, 2002). This is shown in table 2.1 where the degree of fiscal decentralisation in the thirty fiscally decentralised countries in Africa South of the Sahara is measured as the proportion of the total national public expenditure controlled by the decentralised entity's authorities.

Table 2.1: Degree of Fiscal Decentralisation in Sub-Saharan Africa

Degree of Fiscal (Expenditure) Decentralisation	Number of Countries	Name of Country
above 10 percent (very high)	1	South Africa
5-10 percent (high)	4	Nigeria, Uganda, Zimbabwe, Cote d'ivoire
3-5 percent (moderate)	8	Kenya, Rwanda, Ghana, Tanzania, Senegal, Burundi, the Congo Republic, Congo DRC
Below 3 percent (low)	17	Niger, Chad, Sierra Leone, Central African Republic, Benin, Angola, Mozambique, Mali, Zambia, Namibia, Eritrea, Burkina Faso, Madagascar, Ethiopia, Cameroon, Malawi, Guinea

Source: Ndegwa, 2002

Out of the thirty countries in this region at that time, only South Africa compared favourably to the average proportions found in the other parts of the world of 10 percent, even so, only falling into lowest level of this world average. Just as in other parts of the world, in sub-Saharan Africa, fiscal decentralisation is characterised by a much higher level of decentralisation of expenditure compared to decentralisation of revenuecollection (Fritz & Markus, 2004).

The aims of fiscal decentralisation in the Sub-Saharan African countries range from the promotion of efficient government spending (Ruggier *et al*, 2018) to the need for a more acute nature of responsiveness to the needs of poor local people (Cabral, 2011). Put together, it is all about macroeconomic stability. There are divergent positions for developing countries with regard to the extent to which these aim has been achieved in particular with regard to the relationship between fiscal decentralisation and macroeconomic stability such as can be measured through the technical efficiency of sustainable public debt sustainability. In Edgardo and others 2018 stated that in SubSaharan Africa, fiscal decentralisation is associated with higher rates of

macroeconomic stability. They however caution that this position is only true where there exist strong financial institutions. Their findings agree with the observation that the nature of fiscal decentralisation in Sub-Saharan Africa is relatively unproportional with expenditure being more decentralised than revenue collection (Edgardo *et al*, 2018). As regards the effectiveness of fiscal decentralisation on the attainment of its generalised main aims namely efficiency improvement in service provision, equity and poverty alleviation in sSub-Saharan Africa, an underachievement has been reported (Dickovick & Wunsch, 2014). Such failure has been explained away by various reasons including: the limitation of transfer of funds to decentralised entity, the restriction of revenue collection by the decentralised entity and the lack of appropriate planning and legislation at the decentralised entity level. It has also been reported that expenditure decentralisation significantly reduces public indebtedness, whereas tax decentralisation and vertical fiscal imbalances are insignificant (Cabral, 2011). Empirical evidence does not support the assertion that fiscal decentralisation creates efficiency in Sub-Saharan Africa.

As shown in table 2.1, Kenya rates as a moderately decentralised nation in Sub-Saharan Africa. A Kenya Public Expenditure Review report in 2014 determined how this level of fiscal decentralisation related to the country's achievement of its macroeconomic stability goals, particularly to the public debt sustainability. Statistics from Kenya, typically agree with the conclusion that failure to achieve the aims intended for fiscal decentralisation are the result of limitations and restrictions on the decentralised entity concerning the transfer of funds from the central government; concerning revenue collection and concerning appropriate planning and legislation. For example, according to the Kenya Public Expenditure Review of 2014, in the fiscal year 2013/2014, total expenditure by the decentralised government entities in Kenya, was only 63 percent of

what had been approved by the central government for that year. This was attributed to lack of proper planning for the expenditure (IBRD, 2014).

The cumulative effect of this failure to achieve the aims intended for fiscal decentralisation may be the increase in the fiscal burden on the government and a consequent need for the raising of public borrowing. In implementing a major economic policy process like fiscal decentralisation, serious consideration ought to be given to the effects of such a move including its effect on the size of government and the resultant rollover effects on other macroeconomic variables such as the sustainability of public debt. Table 2.2 confirms an overall increase in the public debt at an increasing rate for Kenya. This is attributable to attempts at managing the fiscal deficits which may very well have themselves been occasioned by the failure to achieve the fiscal decentralisation aims.

Table 2.2: Kenya, Public Debt Growth Rate (2003-2017)

Period	Public Debt Growth Rate
2003-2007	5.9 percent
2008-2012	15.1 percent
2013-2017	21.3 percent

Source: World Bank Report, 2018

It is advanced that fiscal decentralisation, leads to technical efficiency and consequent economic growth. The question however needs to be asked about where this leaves the populace of these countries with regard to the influence on its standards of living. The decentralisation process may result in the burdening of the citizens of these countries with a greater weight of public debt to bear. However, having a greater burden of public debt is a lighter affair compared to having an impossible (unsustainable) debt burden. In evaluating this position, Anwar Shah (2010) concluded that generally, fiscal decentralisation has a positive but insignificant impact on growth of the public debt

because it enhances transparency and accountability in public management and also because it enhances GDP growth (Shah, 2010). Effectively this result meant that fiscal decentralisation improved the public debt sustainability status. The report by the Kenya Public Expenditure Review (2014) concluded that the increase in the public debt was due mainly to a quick buildup of administrative and recurrent costs coupled with revenue collection shortfalls that necessitated transfers of funds from the central government to the decentralised governments units (IBRD, 2014). The result of making these fiscal transfers was a deterioration of the degree of sustainability of public debt in the country moving it away from its most efficient position. This could be supported by the observation that Kenya's total public debt-to-GDP ratio rose to 66.00 in 2021, up from 39.80 in 2013 (Cytonn, 2020). Nakatani (2022) points to taking a cautious approach on undertaking fiscal decentralisation – and the need to clearly distinguish between the various forms of fiscal decentralisation. This is because according to him, the effect of revenue decentralisaton is in contrast to that of expenditure decentralisation the negative effects of expenditure decentralisation exceed the positive effects of revenue decentralisation. He however concludes that overall fiscal decentralisation leads to a more sustainable public debt (Nakatani, 2022).

2.5 Summary of the Reviewed Literature

The interest-growth rate differential is a commonly used variable in literature in evaluating public debt sustainability. Studies such as that done by Calderón and Fuentes, (2013) on public debt have established that higher interest rates adversely influence debt dynamics since it implies that more is spent in paying interest to service government debt (David & Francesca, 2012). On the other hand, Calderón and Fuentes (2013) also determined that higher nominal increases in GDP growth rates tend to lower the public debt-to-GDP ratio (Calderón & Fuentes, 2013). This research did not

consider interest rates and growth rates as separate variables. Instead, it took the excess of the interest rate paid for public debt over the growth rate of the Kenyan economy as a single variable (the interest-growth rate differential). Many developed countries such as those in the OECD, have experienced a low and sometimes a positive interest-growth rate differential. This has been considered by many a researcher including Gamber and Seliski (2019), to be favourable to their debt sustainability status as it supposedly presents a zero financial cost on public debt (Gamber & Seliski, 2019). Some studies however have pointed to the negative effect of this trend on the sustainability of public debt citing the prevalence of implicit costs. Costs such as the reduction in government expenditure which are caused by ensuring the creation of a surplus in the primary balance limit the government's ability to stimulate aggregate demand and the subsequent lack of economic growth (European Commission, 2021). In this manner, literature shows the indirect effects of the primary balance to the sustainability of public debt.

Literature on the subject of public debt sustainability as seen in the work of Mendoza and Ostry (2008) concludes that a positive relationship exists between public debt and a surplus in the primary balance (Mendoza & Ostry, 2008). It analyses how various countries, aiming to manage their public debts and keep them sustainable, have manipulated this relationship with varying degrees of success. The relationship between fiscal decentralisation and economic growth has been found by researchers to be mixed. Some scholars like Niko Hobdari (2016), have found a positive relationship between fiscal decentralisation and economic growth. This they say has been through the improvement of allocative technical efficiency by allowing public service expenditure decisions to be made by authorities in the decentralised entity who given their proximity are supposedly 'more knowledgeable' about the needs of the people than the more

removed central government authorities. They have concluded that through the effect of fiscal decentralisation, such allocative technical efficiency is achieved by raising the level of accountability of the decision makers and so forcing a reduction in the size of government expenditure (Niko Hobdari, 2016). However, other scholars for example Guo, Pei, and Xie (2022) have challenged the significance of the economic technical efficiency of fiscal decentralisation on service delivery by the decentralised government entities and the acceleration of sustainable economic growth (Guo *et al*, 2022). Possibly this may be explained by the public choice and the principal agency theories (Jensen & Meckling, 1976).

In the less developed countries like the Sub-Saharan Africa region and Kenya for in particular, public debt is in most cases negatively linked to economic growth (Achwoga, 2016). There are disagreements however causing ambiguity and inconclusiveness due to differing results. Consequently, there is no universally accepted position from these studies on whether or not fiscal decentralisation creates a leaner more accountable government that is capable of providing public services more efficiently; and consequently one that would better manage its macro economy - particularly with regard to maintaining the sustainability of public debt to as optimal a position as possible.

Studies for both the developed world (European Commission, 2013) as well as for the developing world (Achwoga, 2016), show that fiscal decentralisation is oriented more towards expenditure decentralisation than revenue collection decentralisation. Given this consensus, for Europe and other developed economies, those countries with a greater leaning towards income decentralisation have resulted in better public debt sustainability. On the other hand, according to Achwoga (2016), for those countries that

have an expenditure decentralisation orientation, including developing nations like Kenya, increased fiscal decentralisation has necessitated an increase in the transfers of funds from the central government to the decentralised government entities and the consequent deterioration in the position of sustainability of public debt (Achwoga, 2016).

2.6 Research Gaps

Breuss and Eller (2004) pointed out the need for a wider more generalised perspective to formalise the primary impact of fiscal decentralisation on macroeconomic stability (Breuss & Eller, 2004). One macroeconomic stability measure is the ability of government to maintain a sustainable level of public debt. The sustainability of public debt is related to the size of government because as per the leviathan theory, the leaner the government, the lower the government expenditure. By extension, the leaner the government, the lower the need to incur public debt or the better equipped the government ought to be to sustain its public debt (Whajah *et al*, 2019). This implies that the size of government is itself a proxy measure of macroeconomic stability in the use of the government's resources. Empirically, there have been various studies on the subject matter of the effect of fiscal decentralisation on government size and resource allocation. These studies have come up with a mixed outcome of results on this relationship. Some such as that by (Makreshanska-Mladenovska & Petrevsk, 2019) agree with the Leviathan hypothesis while likes Oates do not (Forbes & Zampelli, 1989). It would therefore appear that different relationships exist between these variables in different regions and in different circumstances. A number of items were targeted by the study in an attempt to introduce new information on this subject of the relationship between fiscal decentralisation and sustainable public debt.

The first gap that this study attempted to cover was to detach itself from this mainstream line of interrogation. Instead of making an enquiry along the traditional lines of the relationship between fiscal decentralisation and the sustainability of public debt, the study sought to determine the causal relationship between fiscal decentralisation and the technical efficiency of sustainable public debt in Kenya. It viewed this approach as a more specific enquiry into the effect of fiscal decentralisation which would not only give the nature and extent of causality, but would also serve to indicate the country's debt carrying capacity more accurately.

Secondly, on describing the variables to be used to measure fiscal decentralisation, this study attempted to determine the effect of both 'arms' of fiscal decentralisation on the sustainable public debt level – both revenue as well as expenditure decentralisation. Despite the fact that a significant number of studies on fiscal decentralisation in SubSaharan Africa have been done, few studies have been comprehensive and comparative enough in Cabral's (2011) view. Cabral believes that even though much of the analysis has been grounded on a set of the very specific commonly used variables the focus has fallen short of interrogating the effects of this autonomy of employing all the variables to an equal measure (Cabral, 2011). Such commonly used variables include the level of participation by the decentralised government entities in terms of their empowerment by the central government to collect their taxes in their jurisdictions for their own revenue generation and their empowerment to execute their own expenditure - these are variables which measure the effects of the fiscal autonomy of sub-national entities.

Past studies have focused on the effect of expenditure decentralisation rather more than focusing on both expenditure decentralisation as well as the decentralisation of

revenuecollection. They have thus been rather one sided with regard to the full definition of fiscal decentralisation. Consequently, the studies on the effects of fiscal decentralisation done for these countries in Sub-Saharan Africa including Kenya have had limitations in terms of the nature variables that were used to define fiscal decentralisation. As a matter of fact, in some past studies, decentralisation of expenditure has been defined in a limited sense as the empowerment of the decentralised government entities to plan and execute the expenditure of funds transferred to them (given to them after collection by) the central government (Cabral, 2011). This study therefore went further to define fiscal decentralisation of expenditure in terms of expenditure by the decentralised entities of that revenue they had collected by themselves from their jurisdictions. It thus included a more balanced consideration of the variables with a more meaningful definition to describe the degree of fiscal decentralisation.

2.7 Conceptualisation of the Study Variables

This study used the following variables: the interest-growth rate differential, the county primary balance, the decentralisation of revenue collection to, the decentralisation of expenditure and the decentralisation through fiscal transfers from the central government to the county governments. The choice of these variables was made based on the fact that they are the ones that are most commonly used by academics in their research in the area of the effects of devolution. For example, Silvia Golen (2010) made an analysis of a sample of a variety of studies on devolution, which analysis showed the extensive recurrent use of these variables (Golem, 2010). Another reason for making the choice to use these variables stems from the fact that these variables are also used as by policy makers to assess the effects of the delegation of revenue collection and

expenditure functions of the central government to the decentralised government entities.

As an additional ground for the selection of the variables in this study, it is determinable that the same variables are also the ones that were used in the formal frameworks developed by the World Bank and the International Monetary Fund. This was done in 2002 to carry out debt sustainability analyses for the purpose of detecting, preventing, and resolving debt crises by assessing current debt situations, identifying possible weak points and seeking out possible corrective policy directions for different countries classified into categories based on their income levels. One of these categories as set out in the framework is the low-income country framework to which Kenya belongs. The variables used in this study coincide with those set out in the (World Bank's) low-income country framework (IMF, 2019). This makes the study relevant for in its conclusions for a low income country whose economic circumstances are similar to Kenya's.

Being of a panel data design with data being collected from the counties, this study determined the sustainable level of public debt and consequently its technical efficiency using the percentage of county public debt to the gross county product. The conceptual framework of this study was draw from the function of causal dependence between variables and was grounded on the Evsey Domar model. In this model, the percentage of county public debt-to-GCP was assumed to be able to decrease over time or, at the worst, to remain constant if the sustainability of public debt is to be ensured. The assumed change in the percentage of county public debt-to-GCP would occur only if the interest rate charged for the debt did not exceed the GCP growth rate.

To capture these assumptions, the variables that were used in the study therefore included the difference between the rate of interest and the GCP growth rate (the interest-growth differential) and the difference between the government's revenue and its expenditure (the primary balance). Also used were variables that denoted the extent of delegation of the fiscal duties of income collection and income expenditure to the county governments. The latter included the following. One, the ratio of county revenue to the central government revenue (this was referred to as revenue decentralisation). Two, the ratio of the county own-income expenditure to the central government expenditure (this was referred to as expenditure decentralisation). Three, the fiscal transfers from the central government to the counties as a percentage of the central government development budget (this was referred to as fiscal transfers decentralisation). These variables indicated the variation in the degree of fiscal decentralisation in the country between 2013 and 2021. The dependent variable was the technical efficiency of county public debt-to-GCP. The breakdown of relationships in these variables is shown in figure 2.4:
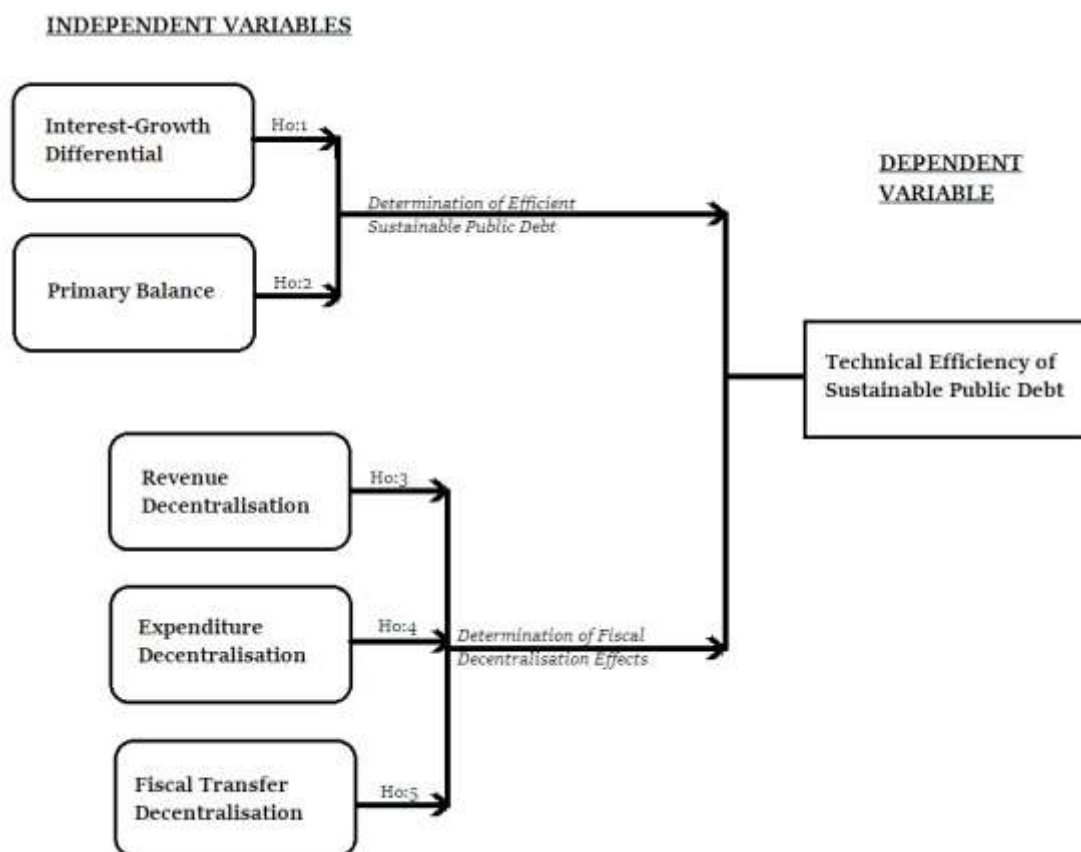
Figure 2.4: The Conceptual Framework

Source: Author, 2022

As illustrated in figure 2.4, the difference between the rate of interest and the GCP growth rate (the interest-growth differential) and the difference between the government's revenue and its expenditure, were used to find and compare the prevailing level of sustainable public debt to the optimal level of sustainable public debt in each year. This gave the level of technical efficiency of sustainable public debt. The revenue decentralisation, the expenditure decentralisation the fiscal transfers decentralisation were regressed on the level of technical efficiency of the sustainable public debt.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter lays out the research philosophy and the research design that were adopted

for the study. It presents the sampling and data collection procedures as well as the data

sources. It outlines the model specification and the data analysis technique that was

used. The chapter also outlines how the study interacted with major ethical issues.

3.2 Research Philosophy

This study predicated upon the positivist research philosophy. Positivism as a research

philosophy views phenomena as realistic, external and independent. Philosophy in

general concerns the views about the working of phenomena in the natural world

(Žukauskas *et al,* 2018); and so this exposition of the research philosophy used in this

study is a clarification of the assumptions in the research that concern beliefs about the

nature of truth and the development of knowledge in this study. The kind of research

philosophy ascribed to greatly influences the manner in which any research is carried

out, as well as its final product; it also guides the way in which data on the variables

concerned are gathered, analysed and interpreted (Jansen, 2022). This points to the

importance to clearly lay down the kind of research philosophy that the study ascribed

to. Following this therefore, the assumptions made in this research with regard to what

truth is, and how knowledge is developed, which consequently governed the manner in

which the data about relevant phenomena were gathered, the analysis of the phenomena,

as well as the manner of the reporting of the findings were clarified. These assumptions

encompassed the ontological assumptions regarding the acknowledgement of reality of

the existence of knowledge in its empirical state. They also included the epistemological

assumptions on generally expected ideal condition of what knowledge ought to be and

the researcher's own axiological assumptions or values which influenced the research process.

The ontological assumptions about the nature of reality shape the point of view of the research objects and process of studying them (Jansen, 2022). For example, in this study, the research objects such as the institutions of the government of Kenya at both central and county levels were assumed to be proactive in the introduction of change through fiscal decentralisation for the purpose of maximising the overall gain for all the citizens of the nation. Different types of knowledge (including numerical data, facts and interpretations) were taken to legitimately fall within the epistemological assumptions given that economics is a central part of life and a discipline that interacts with many other disciplines. Consequently, research on problems related to the subject of economics is based on a wide variety of epistemological ideologies. These are the expected ideal situations which individuals, institutions and governments strive to achieve. However, despite the existence of the range of ideologies, there are two major epistemological research paradigms can be identified for use as a basis for the process of effective researching. These are the positivism and interpretivism paradigms (Žukauskas *et al*, 2018). Positivism assumes a oneness or a universalism of reality that is well ordered in character. Knowledge under positivism is taken to be observable and measurable such that it can be analysed using scientific methods to arrive at facts and law-like generalisations. Effectively then, such knowledge is assumed to be capable of having causality and predictability in the relationships between its entities. The positivist researcher is detached, neutral and does not give his value judgement in the research process and in the findings. Being free and independent of what he researches enables him to maintain an objective stance throughout his work. Based on this, positivist research methods are typically deductive, quantitative and highly structured.

This means that these research methods follow the pattern of making generalisations or assumptions about phenomena before acquiring, observing and analysing data to draw specific conclusions (Park *et al*, 2020). These conclusions are supposed to be repeatedly attainable should similar researches be carried out under the same conditions and so can be described as being law-like.

On the other hand, an interpretivist research is socially constructed and its results may have multiple meanings based on the experiences and perceptions of the researcher. The theories and concepts are subject to interpretations and are bound by the researcher's values. It is therefore subjective, making the interpretevist researcher to be part of the research. He or she usually uses qualitative analysis and inductive methods of analysis (Saunders *et al*, 2019). In these forms of analyses, the researcher first states his specific beliefs or theories about a phenomenon and then goes ahead to make a generalised position about it after making empirical observation of existing phenomena (Burney & Saleem, 2008). Together with inductive theorisation, qualitative research techniques are usually the techniques of choice engaged under interpretivism. This is because from their vantage point, qualitative researchers view reality as constructed and not given. They consequently contend that there cannot be one distinct reality, but that reality is multiplicity of truths depending on the results and the nature of manipulation by the researcher (Jansen, 2022).

Since technology, sustainable public debt and fiscal decentralisation are phenomena that are both clearly affected by human manipulation for example through the making of government policies, interpretivism or constructivism would have appeared to be the more suitable approach with regard to how knowledge in this study should have been uncovered. This would have been in agreement with the interpretivists' contention that

to understand reality, one must intervene in the same reality. This would have led to the subjective interpretation of the reality of the relationship between fiscal decentralisation and the technical efficiency of sustainable public debt. In that case, the study would not have observed the variables in their natural setting. Instead, it would have observed them as being affected by the various policies and other forms of manipulation. It is in this regard then, that inductive theorisation methods would have been deemed appropriate for use as a means of generating a generalised theory based on specific instances of empirical observation (Burney & Saleem, 2008).

However, in this study the basis of perception deemed more suitable and adopted for use of was positivism. As par this paradigm, discoverable knowledge exists as a single reality. Given laws only interact with this knowledge in a consistent, predictable manner. Given this point of view, the acknowledged reality is that quantified data is useful for maintaining objectivity. It follows that knowledge can be gathered objectively under the positivism paradigm (Jansen, 2022). Quantification and objectivity was an important requirement for this study. The study intended to determine a quantifiable level of technology and an optimum level of an achievable macroeconomic indicator (sustainable public debt) in the face of measurable fiscal decentralisation levels. It strove to objectively determine the extent to which Kenya's decentralisation process has related with the technical efficiency of sustainable level of debt. The analysis of the optimal sustainable debt level that is achieved at different levels of fiscal decentralisation was an attempt at estimating a measurable level of technical efficiency in managing public debt. Positivist quantitative research believes in the singularity and tangibility of reality, as opposed to interpretivism qualitative research that views reality as a construction, which must inevitably give room to multiplicity. The study was an attempt to find the best result/output (technical

efficiency) while reducing the inputs to their minimal. The optimality of sustainable public debt was measured with regard to the interest rates charged on the debt, economic growth as well as the government primary balance, all of which measures are also quantifiable.

An additional acknowledged reality under positivism is that outcomes of relationships between variables are not only singular, but that they are repeatable. This was in line with the aim of this study, which was to draw a conclusion on the level of technical efficiency that can maintain sustainable public debt its most optimal level when manipulating government policies on fiscal decentralisation. The employment of the positivism paradigm points to the use of deductive reasoning for example in determining which of fiscal decentralisation factors is most suitable to decentralise, between revenue expenditure and revenue collection if one is to maximise the technical efficiency of public debt sustainability, and by what proportions the decentralisation should be made if at all. This in acknowledgement of the fact that the outcomes of the decentralisation policies may improve or deteriorate by changing such policy inputs.

3.3 Research Design

The plan laid out to study the research problem was a causal research design, applied to examine the probabilistic causal relationship between a select set of measurable variables (Eom *et al*, 2007). Specifically, the causal design was chosen in an endeavor to reveal the direction and magnitude of correlations between the technical efficiency of attaining the optimum level of sustainable public debt and the fiscal decentralisation variables. The research used a panel data analysis to provide repeated cross-sectional measurements of the fiscal decentralisation variables over the period 2013 to 2021 in multiple observed counties. The variables measured were those that describe the level

of fiscal decentralisation as shown under the specific objectives of the study. Besides the data on the fiscal decentralisation variables, data were also collected on the county public debt, the central government real interest rates paid on the public debt, the real gross county product growth rate as well as on the county government primary budget balance. County public debt data were the central government public debt apportioned to the counties on the basis of the percentage of the GCP to GDP. This was done to facilitate the employment of the panel data analysis in the research. It enabled the interpretation of the findings of the analysis as findings for the central government as an aggregation on the basis of the findings for the counties. In other words, the objective was to determine the technical efficiency of sustainable public debt for the whole country, and essentially, this was equivalent to determining the effect on the technical efficiency of the aggregate or the sum of the sustainable public debt of all the counties.

The time-varying coefficients of the fiscal decentralisation factors were determined in a quantitative study meant to explore actionable novel information on the topics of public debt management and fiscal decentralisation. Factual data expressed in numbers and graphs, were collected with the aim of determining the level of technical efficiency and the hypothesisation made on the effect of fiscal decentralisation on the technical efficiency of sustainable public debt in the country. Contemporary debt sustainability analysis tools that are in common use are based on the assumptions of the solvency and the liquidity of the indebted entity. They also rely on the assumption of the importance of avoiding explosive debt trajectories. These assumptions are long-term concepts which have to be weighed against the reliability of the debt sustainability analysis results that are produced. For purposes of conformity and standardisation, this study followed these same assumptions. Naturally, the accuracy of forecasts diminishes with increases in the length of the forecasting horizon. As such, literature on public debt

analysis stresses that the tools used for analysis of the sustainability of public debt can only better inform judgment the shorter the projection periods are. Debrun, Ostry., Willems and Wyplosz (2018) recommend that five to ten year periods are the most suitable for achieving both the accuracy and the realism of assessing the effects of fiscal policy on public debt management (Debrun *et al*, 2018). This fact informed the limitation of the number of years to be studied to the eight years ranging from 2013 to 2021.The choice of the period scrutinised also took cognisance of the fact that fiscal decentralisation although formally instituted in Kenya in 2010 (Sihanya, 2011), did not in fact come into full implementation until 2013 (Cannon & Ali, 2018). Data on the relevant variables were collected from the decentralised government entities of the republic of Kenya (the counties) at yearly time intervals over the period 2013 to 2021.Data was collected for each year up to the year 2021, to take into account the need to have the most up to date information.

In summary, to accomplish the study's aim of investigating the effect of fiscal decentralisation on the technical efficiency of sustainable public debt in Kenya, a regression analysis on the panel data from each of the forty-seven counties in the country was done. This included data on gross county product (GCP), revenue decentralisation, expenditure decentralisation and fiscal transfer decentralisation which data was collected directly for the counties. Data on the public debt was collated for the central government and disaggregated to the counties on a GCP to GDP ratio. Thus, the results that were found for the county government on the disaggregated scale were interpreted to be true for the central government on the aggregate scale.

3.4 Target Population

The unit of analysis in the study was the county governments of Kenya or the forty-seven administrative regions. Data on fiscal decentralisation was collected from these decentralised entities of the country what had formerly been the 46 districts in the provincial administration with the addition of Nairobi County. The label 'districts' had been in use under the previous administrative setup also known as the Provincial Administration. At one point in the year 2009, just before the formal adoption of decentralisation as the official system of governance, there had been two hundred and fifty-six districts in Kenya, two hundred and ten of which had been established between 2003 and 2009. In 2009, the High Court of Kenya outlawed two hundred and ten of these two hundred and fifty-six districts to bring the number down to forty-six. Upon the promulgation of the new constitution in 2010, the remaining forty-six districts were promoted to become counties. Nairobi which had not been a district before was added to make forty-seven counties in the country. Taking a census of the population, the sample frame was the list of the forty-seven counties as given figure 3.1 and appendix 2.
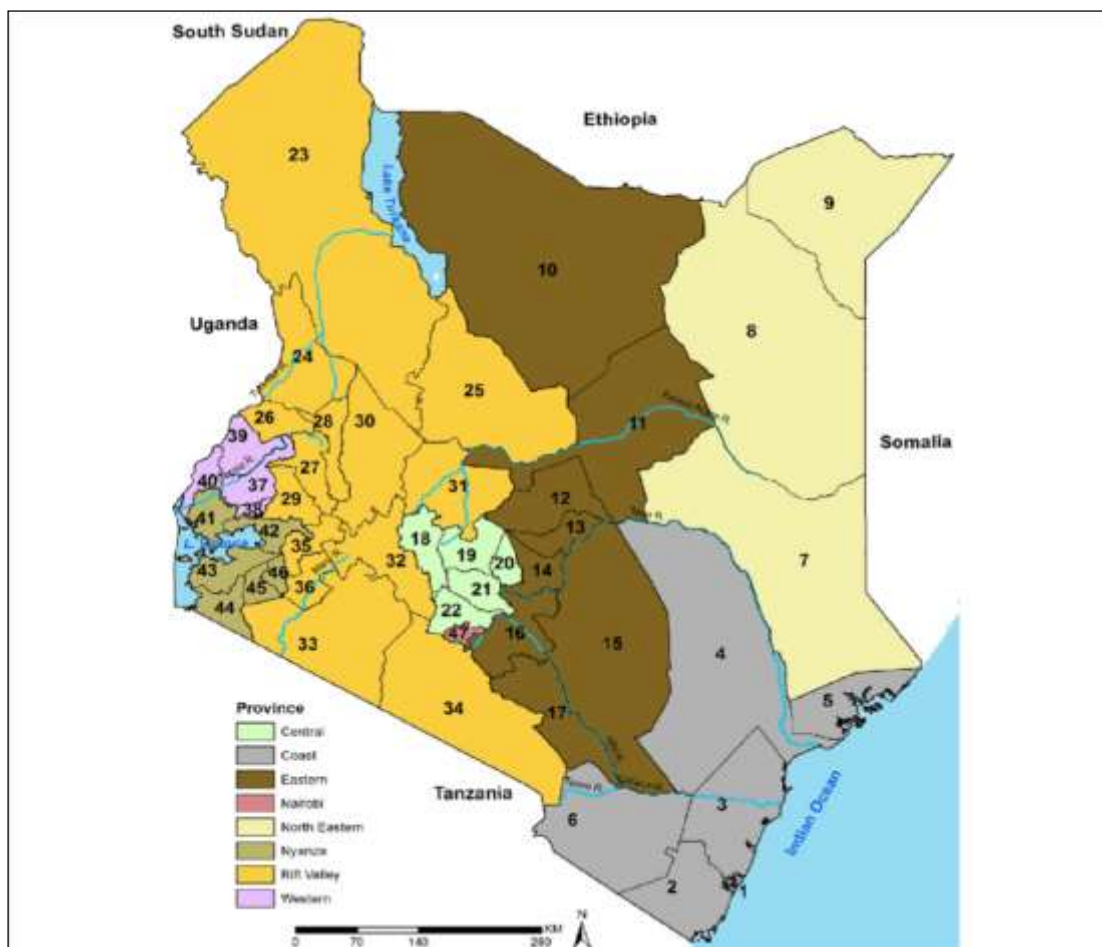
KEY: County numbers are as indicated in Appendix 2

Figure 3.1: Kenya Counties (Established in2010)

Source: Macharia *et al* (2019)

It is worth noting that after the promulgation of a new constitution in 2010 at which

fiscal decentralisation was officially established in Kenya, the boundaries of these forty-

seven counties were generally retained as they had existed under the provincial

administration as the distinct administrative regions known as "districts" before the

promulgation. The new counties even retained the names by which they had formerly

been known as districts. The importance of the retention of this regional demarcation

for this study before and after 2013 is that it reduced the possibility of bias in the

research. The reduction of the possibility of bias stems from two pointers. Firstly, the

fact that the regions retained their geographical demarcations before and after 2013 was

an assurance that the choice of 2013 as the starting point for data collection was not because of a particular convenience in the research. It meant that no convenience was being sought after that would create a bias in the findings based on the existence particular regional boundaries in 2013 (different from those in existence before 2013).

A second factor that makes the choice of 2013 arbitrary and lacking in bias is the fact that fiscal decentralisation was practiced in the country even before that year (albeit on an unofficial scale - primarily in the form of fiscal transfers from the central government to the districts). In effect, there was a 'continuity' before and after the year 2013 in the two forms of the regional demarcations and in fiscal decentralization. It is due to this fact that the possibility of bias can be said to have been reduced with regard to choosing 2013 as the beginning year of the research. It means any other year before or after 2013could have been chosen as the beginning point of the period of data collection. This said, the choice of 2013 is also of noteworthy significance since it marks the year in which the implementation of fiscal decentralisation was actualised and put into practice in the country (Cannon & Ali, 2018). This made the choice that year both reasonable and significant as the entry point for data collection for such a study which is centered on fiscal decentralisation in the country.

Given the small size of the population, the study conducted a census inquiry of all the items (counties) in the population in the hope that the adoption of this technique would maximise the accuracy of the results and minimise the possibility of bias (Kothari, 2004). Taking a census instead of a sample was also found to be suitable on the grounds of there being high a degree of variability in the attributes that define the level of fiscal decentralisation across the counties. An example of this was the variation in the amounts of OSR collected by the counties. As illustrated in figure 3.2, in the fiscal year

2020/ 2021 for example, the revenue collected in Nairobi county differed greatly compared to that collected in a number of other counties such as Bomet, Bungoma, Busia and Elgeyo Marakwet in the same fiscal year.
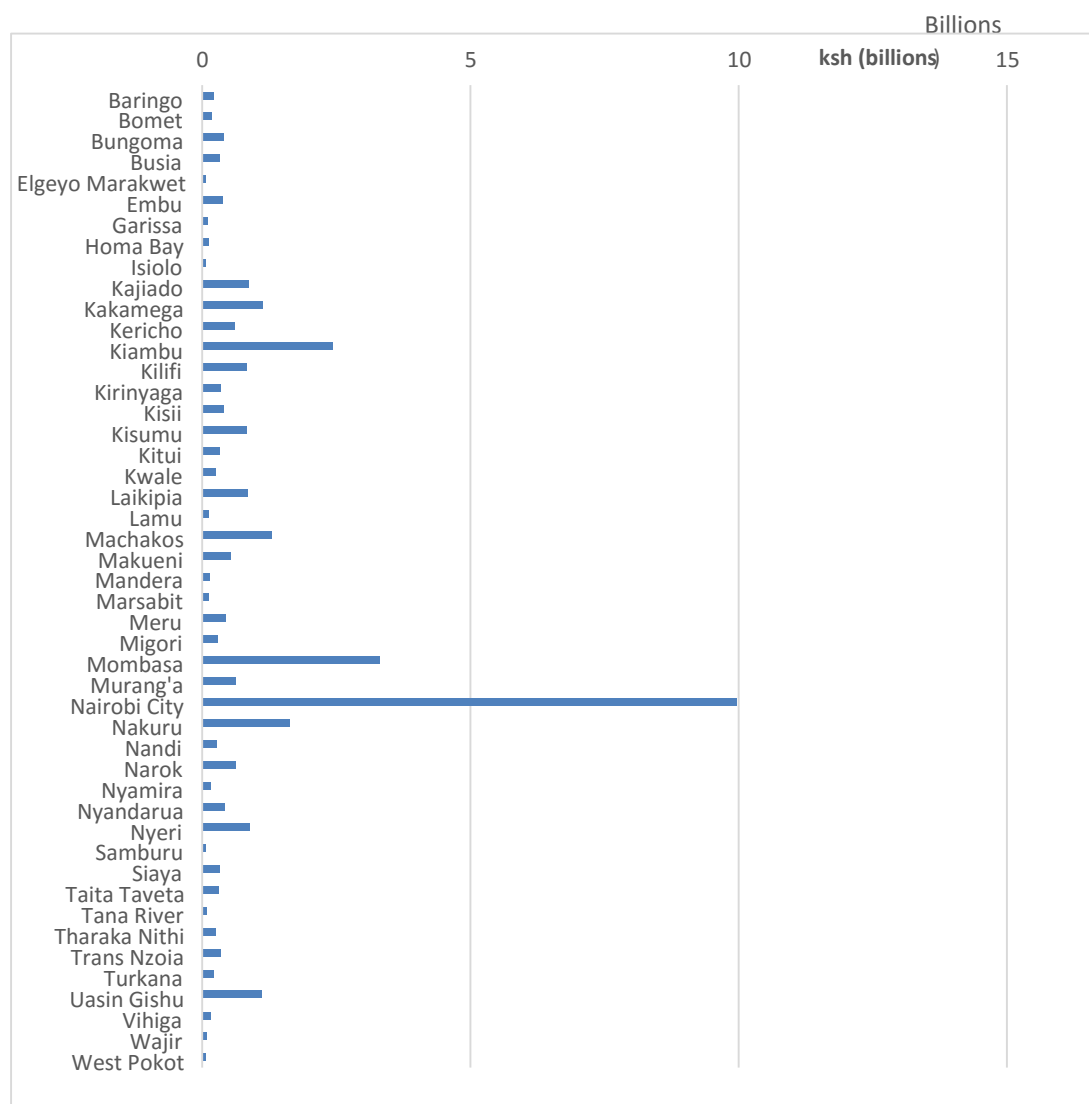
Figure 3.2: County Own Source Revenue (1st July 2020 to 30th June 2021)
Source: KIPPRA, 2022

3.5 Data Collection

Governments and their agencies collect large amounts of data on economic insights for a variety of reasons using a variety of methods. These formed the main sources of data used in this study. The data that was collected included information on population

levels, interest rates charged on public debt, county gross products, county revenues and county expenditures for each of the forty seven counties, the central government development budgets and the fiscal transfers counties received by the counties from the central government for the period 2013 to 2021. The specific government data sources included: the Kenya National Bureau of Statistics, the Central Bank of Kenya Annual Reports, the Kenya government statistical bulletins and the Commission of Revenue Collection. Governments are not the only sources of secondary data. Non-governmental bodies also specialise in collecting data that can aid their operational efforts in different ways. This study made use of such non-governmental entity data sources for information on the central government budgets and the fiscal transfers from the central government to each of the forty-seven counties. These included the Government Financial Statistics Yearbook of the World Bank. Other prime sources which were used included published books, referred journals and online portals. The study made use of data from referred journals published by research associations as well as colleges and universities, which are also reliable sources of secondary data.

The study used document-based research and records-based research as its main data collection tools. Being efficient and inexpensive tools, internet browser tools were used to search websites databases and records. Given that secondary data collection is a process that involves gathering of second-hand data by individuals or organisations other than the original user, the intended use for the data by the secondary data collector may differ significantly from the use required for the same data by the original collector leading to the unreliability of the data. Due to this, proper care was taken during the data collection procedures to ensure that only relevant evidence was captured and to allow for an analysis that led to the formulation of convincing and credible conclusions on the hypotheses under testing in the study. For instance, in many cases the same

information was looked up in several sources. The fact that these statistics were found in multiple places provided a valuable opportunity to cross check and verify the accuracy of the data during its collection before its analysis. It facilitated the counter comparison across different sources to ensure that the information gathered was complete, relevant and up to date. The data collected were compared across various sources in which they were available.

3.6 Data Analysis

In microeconomic theory a production process is said to be technically efficient in the input oriented sense when, with the given technology and the quantities of inputs available, it would be impossible to reduce the (cost of) inputs any further in order to produce a given (the same) amount of output. To evaluate the attainment of a technically efficient operational position, a frontier technique is usually used to compare the relative efficiencies of operating units executing various processes in an entity. These techniques can be deterministic or stochastic. A careful consideration of the advantages associated with each type of technique as shown in figure 3.3, helped in choosing between the available alternative techniques; the main criterion being with regard to whether or not the technique chosen would account for the degree of technical efficiency, which concept was what this study aimed to test.
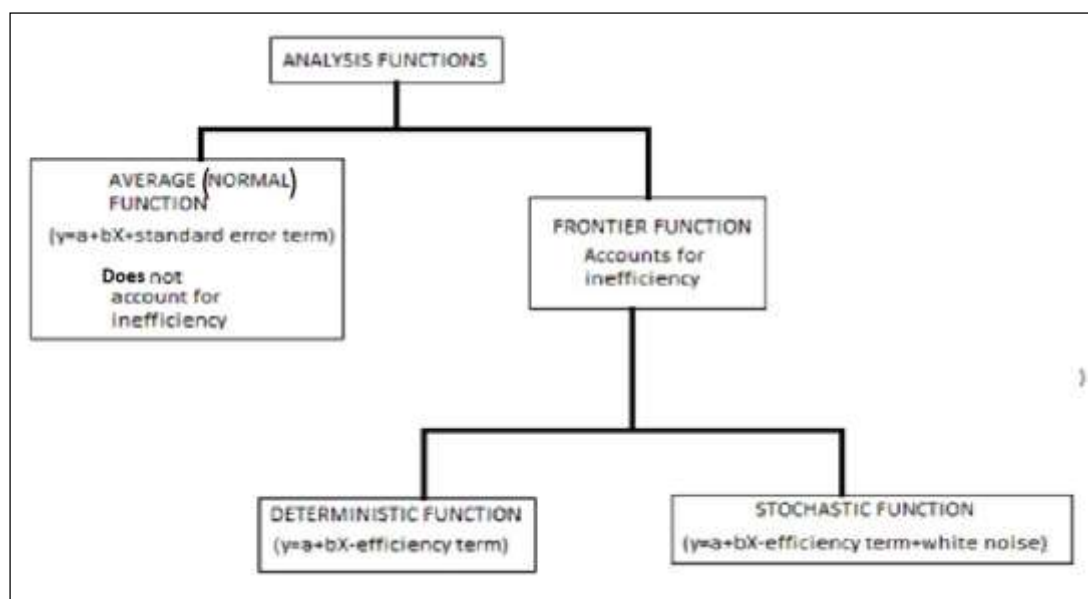
Figure 3.3: Technical efficiency Frontier Analysis

Source: Author, 2013

For this study, the stochastic frontier analysis (SFA), an analysis technique that has a stochastic or random effect component was applied (y = a + bX – inefficiency term + white noise term). The SFA is a method that is commonly used in research to measure the achieved efficiency levels relative to/compared to an empirical technical efficiency frontier (Read, 1998).

The use of stochastic frontier analysis technique necessitated the selection of a model of appropriate functional form as in equation 3.1 (Laura, 1998):

$$y_{it} = f(x_{it}, t\beta).\exp(\varepsilon_{it})...\text{Equation 0.1}$$

   Source: Laura Elizabeth Read, 1998

where at time t (t = 1; 2; . . . ; T), y_{it} represented the dependent variables (i = 1; 2; . . . ;N) x_{it} was the corresponding matrix of independent variables; β was the vector of parameters to be estimated; and ε_{it} represented the error term composed of two independent elements v_{it} and u_{it} given by equation 3.2:

$$\varepsilon_{it} = v_{it} \pm u_{it} \text{ ...Equation 0.2}$$

This composite error included in it a term that would explain the mean and the variance of the technical efficiency of the optimisation of sustainable public debt – that is the degree of variation from the most technically efficient sustainable public debt level. The SFA technique has been a popular tool for production technical efficiency analysis since its introduction in literature in the late 1970s (Lovell, 1995).

3.6.1 Specification of the SFA Model

Using the panel data, it was possible to tell whether inefficiencies detected persisted at a constant unit or varied over time. It could also be ascertained as to whether factors individually associated with each county were correlated with or were independent of the inefficiencies (Kumbhakar *et al*, 2015).

Following Battese and Coelli (1988) and other researchers, the error term (ε_{it})in the econometric model of equation 3.1:

$$y_{it} = f(x_{it}, t\beta).\exp(\varepsilon_{it})\dots \text{ equation 3.1}$$

was decomposed into two components as $\varepsilon_t = v_t + u_t$. V_t represented the usual random shocks which capture classical white noise (Battese & Coelli, 1992). Indeed, the term "stochastic" in the name stochastic frontier analysis refers to the random component as distinct from the technical inefficiency component of the error term (Lawson *et al*, 2004). The other component of the error term, u_t, was associated with the level of technical inefficiency and measured the extent to which the debt sustainability levels deviated from their optimum level as the factors of fiscal decentralisation changed over the study period. It indicated the extent to which the most technically efficient level of sustainable public debt was either achieved or underachieved. It captured the systematic influences that were unexplained by the independent variables. These influences were

attributable to the effect of technical efficiency or lack thereof in the attainment of the most technically efficient level of sustainable public debt. It was assumed that μ_t, was an identical normally distributed random variable with a mean of zero and a standard deviation σ_μ^2 or $\mu \sim N^+(0, \sigma_\mu^2)$. It was also assumed that it was distributed independently of the v_t (Battese & Coelli, 1992). It was further assumed to be a vector of non-negative random variables, That is, a half-normal distribution arising from the truncation at a zero mean with variance σ^2 (Kibaara & Kavoi, 2012). Its value was therefore greater than or equal to zero at all times (Tijiani, 2006). This one sided component indicated the technical inefficiency level (not efficiency levels) by showing how far from the stochastic frontier an observed data of sustainable public debt fell. For any year (with its associated level of fiscal decentralisation) that the public debt sustainability level would fall on the frontier, the component indicating the level of technical inefficiency of debt sustainability would be equal to zero. The interpretation of this would be that in such a year the debt sustainability level would be deemed to be fully efficient with regard to achieving its optimal level (a zero level of technical inefficiency). The component would be greater than zero for any year (with its associated level of fiscal decentralisation) that the actual level of debt sustainability would lie above the frontier (Kibaara & Kavoi, 2012). A negative relationship between the technical inefficiency component and actual level of optimal public debt sustainability therefore would denote a decreasing tendency in the technical inefficiency. This would denote a movement towards the optimal position of public debt sustainability on the other hand, a positive relationship between the technical inefficiency component and actual level of optimal public debt sustainability would denote an increasing tendency in the technical inefficiency or a movement away from the optimal position of public debt sustainability (Kibaara W. B., 2005). In this sense, the Stochastic Frontier Analysis technique

assumed that the frontier could not be breached, in other words, the frontier represented the most technically efficient level of public debt sustainability applicable to Kenya in relation to the explanatory variables chosen.

The distance of the score for any year (with its attendant level of fiscal decentralisation) from this frontier represented the extent to which, in that particular year, the country's public debt sustainability mechanism operated below its most technically efficient. In other words, this represented an operation in the feasible locality but within its means, to achieving the optimal sustainable public debt. Those years whose score was close to the frontier were years in which the country was more efficient in its use of policies to attain the optimal level of public debt sustainability as opposed to those years whose score was further away from the frontier. In effect the component indicating the level of technical inefficiency of debt sustainability was interpreted as indicating the extent to which the technical efficiency of sustainable public debt was attained.

Based on the selected functional form with the error term given by $_{it}$ in equation 3.1:

$$y_{it} = f(x_{it}, t\beta) . \exp(\varepsilon_{it}) \ldots \text{Equation 3.1,}$$

the general form for the model that accounted for both technical inefficiency and noise in its composite error function was derived after Matawie and Assaf (2010), as in equation 3.3:

$$lny_i = \alpha + \beta_i lnx_i + (v_i + u_i) \ldots \text{Equation 0.3}$$

Where: y_i = technical efficiency of sustainable public debt

$\propto$ = constant value

β = coefficients of the independent variables to be determined

x_i = fiscal decentralisation measurement variables

V_t = stochastic shocks

$u_{t,}$ = the technical inefficiency of sustainable public debt

With a deliberate summation (not the difference) of the two error term components to capture the economic theory that the sustainable level of public debt was being minimised rather than maximised. If the case sought after had been a maximisation case, the appropriate treatment would have been to show the extent to which the random component μ_i 'pulled the observed statistic away' from the optimum level by having μ_i given y_i i.e. (μ_i / y_i) being subtracted from v_i given y_i i.e. (v_i / y_i) or simply $v_i - u_i$ at any given y_i i.e. $(v_i - u_i)/yi$.

The half-normally distributed technical inefficiency error term μ formed part of equation 3.4:

$$lny_i = \alpha_0 + \beta_1 ln(1 + \lambda)d_i - \beta_2 lnp_i + (v_i - \mu_i) \ldots \text{Equation } 0.4$$

where all the similar terms retain their descriptions as in equation 3.3 and:

$(1 + \lambda)d_i$ = the interest-growth differential

p_i = the primary balance

The log-transformed μ_i was defined by equation 3.5

$$ln\mu_i = \delta_0 + \sum_{i=1}^{n} \beta_i ln\delta_i Z_i \ldots \text{Equation } 0.5$$

$ln\mu_I$ in equation 3.5 was used to assess the technical inefficiency, so that:

δ_0 denoted a common constant term, and $\sum_{i=1}^{n} ln\delta_i Z_i$ was the vector measuring

δ_i = the coefficients to be determined.

In equation 3.5 the factors of fiscal decentralisation in each of the consecutive years between 2013 and 2021 were measured in terms of the share of the county government fiscal variables. The choice of these variables was made in conformity to the choices

made for the measurement of fiscal decentralisation in devolution literature (Breuss &

Eller, 2004) and (Hallwood & MacDonald, 2008)

3.6.2 Definitions and Measurements of Variables

The public debt sustainability function was specified as the stochastic function in

equation 3.4

$lny_i = \propto_0 + \beta_1 ln(1 + \lambda)d_i - \beta_2 lnp_i + (v_i - \mu_i)$ …Equation 3.4

It was derived from the fiscal reaction public debt sustainability model initially

developed by Evsey Domar in 1944. The model was adopted to formulate the

econometric function from equation 1.1:

$D_t = (1+r) D_{t-1} - P_t$ …. Equation 1.1

To relate these variables to debt sustainability over time (Escolano, 2010), they are

expressed as ratios of GDP by dividing through by the nominal GDP in period t.

Letting GDP in period t be Y_t:

$$\frac{D_t}{Y_t} = (1 + r)\frac{D_{t-1}}{Y_t} - \frac{P_t}{Y_t}$$

If real economic growth rate between year t–1 and year t is denoted as g, then Y_t is

defined as follows:

$$Y_t = Y_{t-1} + gY_{t-1} = (1 + g)Y_{t-1}$$

so that

$$\frac{D_t}{Y_t} = \frac{(1 + r)D_{t-1}}{(1 + g)Y_{t-1}} - \frac{P_t}{Y_t}.$$

If the lower case alphabet is used to represent the terms as ratios to GDP, public debt in year t can then be defined as:

$$d_t = \frac{1+r}{1+g} d_{t-1} - p_t$$

Introducing the following (i and γ) after Bilan (2010):

i = nominal interest charged and paid in period t on the outstanding public debt at the end of period t-1

γ = nominal GDP growth rate between periods t–1 and t,

a ratio $\emptyset$ can be defined such that: $\emptyset = \frac{i-\gamma}{1+\gamma}$

and adding 1 or $\frac{1+\gamma}{1+\gamma}$ to the ratio $\emptyset$:

$1 + \emptyset = \frac{1+\gamma}{1+\gamma} + \frac{1-\gamma}{1+\gamma} = \frac{1+i}{1+\gamma}$. (Bilan, 2010)

Similarly, defining r as the real interest rate expense in period t, π as change in the GDP deflator between period t–1 and period t (Escolano, 2010),

then $r = \left\{\frac{1+i}{1+\pi}\right\} - 1$

this may be rearranged into the following:

$1 + i = (1+r)(1+\pi)$

Since g = real GDP growth rate from year t–1 to year t

This means that $g = \left\{\frac{1+\gamma}{1+\pi}\right\} - 1$ such that $1+\gamma = (1+g)(1+\pi)$

Then $1 + \emptyset = \frac{(1+r)(1+\pi)}{(1+g)(1+\pi)} = \frac{1+r}{1+g}$

and $\emptyset = \frac{r-g}{1+g}$ this is the interest-growth rate differential in real terms.

Assuming that $\frac{1+r}{1+g}$ approximately equals the amount by which the excess of the real

interest rate over growth rate has risen between periods *t* and *t*-1(or $\frac{1+r}{1+g} = 1 + r - g$);

the public debt model converts to a public debt sustainability model given in equation

3.6:

$$d_t = (1 + r - g)d_{t-1} - p_t$$

and $\quad d_t - d_{t-1} = (r - g)d_{t-1} - p_t$ (Escolano, 2010) ...Equation 0.6

Studies investigating public debt sustainability using this function incorporate extra

explanatory variables into it. Allowing these extra explanatory variables to be denoted

by Z, the general function was then expressed as equation 3.7 after the incorporating

the additional variables and the error term …Equation 0.7

  (Curtaşu, 2011):

$d_t = (1 + \lambda)d_{t-1} - p_t + Z_t + \varepsilon$ ...Equation 0.7

The variables Z represented the component measuring the variability of fiscal

decentralisation.

Showing the two-component error term ε, as $(v_i + \mu_i)$ and then specifying the log-

linearised half-normally distributed technical inefficiency error term μ_i as in equation

3.8 :

$ln\mu_i = \delta_0 + \sum_{i=1}^{n} \beta_i ln\delta_i Z_i$ ...Equation 0.8

the model was fitted as equation 3.9:

$lny_{it} = \propto_i + \beta_1 ln(1 + \lambda)d_{i\,t-1} - \beta_2 lnp_{it} + \delta_0 + \sum_{i=1}^{n} \delta_i lnZ_{it} + v_{it}$ ...Equation 0.9

Substituting the log-transformed specific variables of Z_i to be used in this study, the model was finally specified as in equation 3.10:

$$lny_{it} = \alpha + \beta_1 ln(1 + \lambda)d_{t-1} - \beta_2 lnp_{it} + \beta_3 lnSrev_{it} + \beta_4 lnSexp_{it} +$$

$$\beta_4 lnItran_{it} + v_{it} \text{ ...Equation 0.10}$$

In this function:

α = the intercept term

β_i = the coefficients to be estimated

λ in equation 3.10 represented the excess of real interest rate (r) charged for the debt over real GCP growth rates (g) in the period immediately before period t or $(r - g)d_{t-1}$. It was measured in Kenyan shillings. The real interest rates were the nominal interest rates adjusted for the effects of inflation in order to reflect the real cost of funds; and the real GCP growth rate was defined as the rate of change of the gross county product from one year to another after adjusting for inflation

p represented the primary balance given by percentage county primary balance of the central government primary balance as in equation 3.11:

$$\frac{\text{excess of the county government income over its expenditure}}{\text{excess of the central government income over its expenditure}} \ 100 \text{ ...Equation 0.11}$$

Since both governments' expenditures exceeded their incomes throughout the years of study, p was instead described as the excess of ratios of the government's expenditures over their revenues. Consequently, p was measured in Kenyan shillings.

The Z variables defined the extent to which the central government's fiscal functions had been devolved to the county governments. They described the factors of fiscal decentralisation in the area of study as described below.

rev represented the ratio of the county revenue to the central government revenue measured in Kenyan shillings.

exp represented the ratio of the county own-income expenditure to the central government expenditure measured in Kenyan shillings.

trn represented fiscal transfers to counties as a percentage of the central government development budget measured in Kenyan shillings.

The suitability of this model derives from the fact that it is a fiscal reaction model that shows how a government reacts to its debt burden through the making of policies. In other words, it was suitable for determining how fiscal decentralisation policies relate to the technical efficiency of sustainable public debt. It was based on the avoidance of an unabated rise in the level of public debt by comparing two major factors that determine the rate of growth in public debt over time: namely, the interest-growth rate differential and the primary deficit (Curtaşu, 2011).

In equation 3.10, the dependent variable y_i measured the technical efficiency of sustainable public debt. It was formally estimated using the county sustainable public debt value. The county sustainable public debt value of was computed by equation 3.12

…Equation 0.12

$$Sustainable\ County\ Public\ Debt = \frac{County\ Public\ Debt}{Gross\ County\ Product} \, x \, 100 \quad …\text{Equation 0.12}$$

Where: County public debt = the total central government public debt apportioned pro-rata to the counties on the basis of the county populations in August 2019 as in equation 3.13:

$$\frac{County\ Population}{National\ Population} \, x \, Central\ Government\ Public\ Debt …\text{Equation 0.13}$$

Gross County Product = each county's average contribution to Gross Domestic Product in the central government

The technical efficiency of sustainable public debt (the dependent variable y_i), was then arrived at by taking the observed county sustainable public debt percentage of the optimal county sustainable public debt as in equation 3.14:

$$y_i = \frac{Observed\ Sustainable\ County\ Public\ Debt}{Optimal\ Sustainable\ County\ Public\ Debt}\ x\ 100 \text{ ...Equation 0.14}$$

Both county government public debt and Gross County Product and consequently y_i, were measured in Kenyan shillings.

3.6.3 The Operationalisation of the Stochastic Frontier Analysis (SFA) Technique

The application of the Stochastic Frontier Analysis technique to the data analysis process was done in two stages as follows.

Stage 1:

The first stage involved establishing the technically efficient sustainable public debt frontier – that is, the most efficient value of the ratio of actual to observed sustainable public debt. In this stage, the observed level of sustainable public debt and the optimal (most technically efficient) level of sustainable public debt in the county for each year between 2013 and 2021 were found and compared to find the frontier of the technically.

The technical inefficiency was given in equation 3.3 and its derivation by μ_i in equation 3.8:

$$ln y_i = \alpha + \beta_i ln x_i + (v_i + u_i) \text{ … Equation 3.3}$$

$$ln \mu_i = \delta_0 + \sum_{i=1}^{n} \beta_i ln \delta_i Z_i \text{ … Equation 3.8}$$

The interest-growth differential and the primary deficit were regressed on the county public debt percentage of the county GCP for the estimation of the sustainable county

public debt before the ratios of the observed to the optimal county sustainable public debt were established. The question to be answered at this stage was what the most technically efficient sustainable public debt position was given the prevailing interestgrowth rate differential and the primary deficit.

Stage 2:

The second stage involved an interrogation of the relationship between the varying degrees of fiscal decentralisation and technical efficiency of attaining the already estimated optimal sustainable public debt level. For this second stage the independent variables were employed to indicate the interaction between the varying degrees of fiscal decentralisation and the technical efficiency. The fiscal decentralisation variables defined the varying levels of decentralisation of income and expenditure activities over the years 2013 to 2021. The question to be answered at this stage was to what degree the country measured up to the predetermined most technically efficient sustainable public debt given the variation in fiscal decentralisation levels over the years. The outcome would be the estimated fiscal decentralisation variable coefficients over the period and the establishment the relationship between the variations in the degrees of fiscal decentralisation levels and the technical efficiency.

3.7 Pre-estimation Data Statistical Property Tests

Necessary assumptions made to provide unbiased, efficient linear estimators when using the ordinary least squares econometric tool including the normality in the distribution of the error term were followed in this study. The assumption was made about the absence of heteroscedasticity, autocorrelation and multicollinearity. Based on the central limit theorem the need for the test for normality in the distribution of the error term would have been precluded given that the sample size of forty-seven counties

was greater than the thirty that is usually acceptable for the adoption of the theorem. Never the less, the distribution of the error term was tested to assess the normality of its actual distribution. The normal linear regression analysis accuracy tests were run for autocorrelation and heteroscedaticity as well as for multicollinearity that could plague the estimated parameters and interfere with the accuracy of the results of the study.

3.7.1 The Hausman Endogeneity Test

The problem of endogeneity may occur when applying an inter-temporal or dynamic data model whose function is of the form adopted for this study as given by equation 3.7.

$$d_t = (1 + \lambda)d_{t-1} - p_t + Z_{t-1} + \varepsilon \ldots \text{Equation 3.7}$$

This is the correlation between one or more independent variables and the error term in a regression equation. This problem can be the case where the independent variable is predicted by the dependent variable - also referred to as "simultaneity bias" (Lynch & Brown, 2011).

In a panel data study such as this which analyses a causal processes but in which some variables in the model used, depend for their value in a given period (t) on the values of another variable in the causal system in the immediately preceding period (t–1) such a situation is likely to occur. This is the case of endogeneity over time as observed in equation 1.1:

$$D_t = (1+r) D_{t-1} - P_t \ldots. \text{Equation 1.1}$$

The value of sustainable public debt in period t given as D_t, is partly predicted by the value of the interest charged on the public debt in period t-1, which is included in the term $(1 + r)D_{t-1}$. The size of the sustainable public debt in period t-1 influences the

size of the public debt in period t through the amount of interest rate charged in period t-1. As a result, the value of sustainable public debt in the model may be endogenous over time even if it is exogenous in each of the observed time periods.

Another reason for a possible occurrence of correlation between an independent variable and the error term is the case of the omission of some important variables when the model is being specified (also referred to as "omitted variable bias"). In such a case, the outcome of the regression may be biased due to the inclusion of these variables in the error term when they should have actually been specified among the independent variables instead. They actually influence the dependent variable directly or through their effect on the independent variables giving rise to the need to control for these 'omitted' variables.

Each observed entity in the study (a county - in the case of this study) has its own individual characteristics that may or may not influence the independent variables. In this study, examples of such characteristics include the population size and the 'political sway' of a particular county over the central government both of which could influence the amount of fiscal transfers received from the central government; it could also be the economic policies of a particular county that influence the amount of revenue collected by the county. These variables may be regarded as variables that were omitted during the specification of the model. It is therefore important to choose between two types of models each of which is influenced differently by endogeneity. If the unobserved individual characteristics accompanying each entity were correlated with the explanatory variables, then the model that is most suitable for use to determine the relationship between the dependent and the independent variables would be the fixed effects model. This is because the fixed effects models can be used as a means of

controlling bias that may arise from the individual characteristics of observed entities – that is, if there exist any such variables which have been omitted when they should not have been.

The estimated coefficients of the fixed-effects model cannot be influenced by omitting the time-invariant characteristics since the fixed-effects model accounts for all the time invariant variations between the individual entities (Williams, 2018). Certain conditions are necessary for such control to be successful. First, there must be correlation between the omitted variables and the independent variables in the model so that the independent variables serve as their own controls. The second, essential premise of the fixed-effects model is that the individual entity's time-invariant features are distinct from those of other entities and should not be correlated with those other entities. Since each entity's characteristics are unique to it or differ from those of other entities, the error term for the entities should not be correlated. Should the error terms be correlated, the fixed-effects approach is inappropriate and the conclusions may not be reliable. Third, the omitted variables must be time-invariant in their values. This means that their values must remain constant in each of the periods of the study. Fourth, the omitted variables must be time-invariant in their effects or that they should have the same effect in each of the time periods of the study.

Overall, if these conditions were to be met it would imply that in spite of the fact that the omitted variables influenced the independent variables of the model, their effects remained constant over time so that their effects would be "fixed "or did not change over time. In such a case, any changes in the dependent variable would be the result of influences other than these unobserved individual characteristics of the entity which are omitted in the model specification. This then supports the suitability of the use of the

fixed effects model. It is expected when employing the fixed-effects model that an individual entity's characteristics may influence or bias the predictor or outcome variables, and this need to be accounted for. The correlation between the entity's error term and the predictor factors is predicated on this reasoning. One can therefore accurately evaluate the overall impact of the predictors on the outcome variable using the fixed-effects model, which takes these time-invariant qualities out of the equation.

The fixed-effects model is not perfect as an analytical tool. Some of its limitations include its inability to examine the effects of the time-invariant features on the dependent variables. Technically speaking, the individual entity's time-invariant traits are a perfect match for the entity dummies. All said though, the fixed-effects models are made to investigate the reasons behind changes inside an entity. Such changes which take place inside the entity cannot have been caused by a time-invariant characteristic because it is constant for each individual (Torres-Reyna, 2007).The fixed-effects model removes the effect of the unobserved individual characteristics across entities to enable the assessment of the net effect of the independent variables on the dependent variable. This means that the fixed-effects model controls for all time-invariant differences between the individual entities, and gives estimated coefficients that are not biased as a result of the omission of the time-invariant characteristics. Therefore, in using the fixed effects models, there would then be no need for the estimation of the effects of time invariant variables because the model provides for the control for such variables. It would also be seen to have used all the data available so that the omitted variables are absorbed by the intercept. (Williams, 2018).

This is in contrast to the random-effects model where the effect of the unobserved individual characteristics of the entities embodies elements that are uncorrelated with

the independent variables in the model (Torres-Reyna, 2007). If the individual characteristics across entities do not have any influence on the dependent variable, then the variation in the individual characteristics across entities must be assumed to be random and uncorrelated with the independent variables included in the model. This would be the same as arguing that there are no omitted variables or that if there are omitted variables, they bear no influence on the independent variables used in the model. In such a case the random-effects model would be the more suitable model to apply. In such circumstances, a random-effects model would produce unbiased estimates of the coefficients with the smallest standard errors (Williams, 2018). Unlike the fixed effects model, the random effects model assumes that change between entities is random and unrelated to the independent or predictive variables included in the model. The random effects model provides the benefit of allowing time-invariant variables to be used.

A generalised random effects model to show the inclusion of errors within and across the entities is such as the one given as in equation 3.15:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it} \text{ ...Equation 0.1}$$

u_{it} = error term for within-entity errors

ε_{it} = error term for between-entity errors.

Time-invariant variables can serve as explanatory variables in a model with random effects since they are predicated on the assumption that the entity's error term is uncorrelated with the predictors. Thus the random-effects model allows for the generalisation of the inferences beyond the sample used in the model. In the randomeffects model, one must identify the specific traits of each individual that may or may not have an impact on the predictor variables. This raises the issue of omitted

variable bias in the model resulting from the inability to determine the effects of some variables (Torres-Reyna, 2007).

Endogeneity may cause inconsistency and bias in the estimators. Therefore, the Hausman endogeneity test was applied to determine the more suitable model to use between the fixed effects model and the random effects model. This was done with the aim of avoiding both inconsistency and biasness in the results. The test was applied to the null hypothesis that the preferred model was the random effects model – or that the unobserved individual characteristics (given as ε_i in table 3.1 and in equation 3.8) were not correlated with the regressors (given as x_{it} in table 3.1 and in equation 3.8). The alternative hypothesis was that the preferred model was the fixed effects model – in other words the unobserved individual characteristics were correlated with the regressors.

Table 3.1: The Augmented Regression Test for Endogeneity

		Suitable Model
Null Hypothesis	H_o: $Cov(\varepsilon_i, x_{it}) = 0$	Random-effects model
Alternative Hypothesis	H_a: $Cov(\varepsilon_i, x_{it}) \neq 0$	Fixed-effects model

Source: Torres-Reyna (2007)

The basis of the Hausman test is the determination of whether the unobserved individual characteristics include features that are linked with the regressors in the model, regardless of whether or not these effects are stochastic. The null hypothesis was to be rejected if the Hausman statistic, which asymptotically follows a chi-square distribution, would be statistically significant (if the p-value was to be found to be less than 0.05). In which case the fixed-effects model would be the suitable model for use.

3.7.2 Autocorrelation Test

Autocorrelation refers to the existence of a relationship between the residuals (ε), or the possibility that $E(\varepsilon_i) = E(\varepsilon_j)E(\varepsilon_i) = E(\varepsilon_j)$ for $i \neq ji \neq j$. Where $E(\varepsilon_i)$ is the expectation of the error term.

To detect whether the residuals from the linear regression model of the study were independent, the Durbin-Watson test statistic (DW statistic) was carried out. Most regression models that use panel data exhibit positive autocorrelation (Gujarati & Porter, 2009). Consequently, assuming the existence of both a normal distribution of the error term and stationarity Durbin-Watson test was done.

The test statistic used was as expressed in equation 3.16 the ratio of the sum of squared differences in the successive residuals to the residual sum of squares:

$$DW = \frac{\sum_{t=2}^{n}(e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2} \ldots \text{Equation 0.2}$$

Where: $e_t = yi - \hat{y}_i = $ residuals from the ordinary least squares regression.

And y_i and $\hat{y}_i$ are, respectively, the observed and predicted values of the dependent variable for individual i observations.

According to Field (2009) the hypotheses usually considered in the Durbin-Watson test are: that

Null hypothesis H_o: $\rho = 0$ (there is no autocorrelation: DW test statistic value of 2) and Alternative hypothesis Ha: $\rho \neq 0$.

The interpretation of the results of the Durbin-Watson test rests on the fact that it reports a test statistic whose values range between 0 and 4. Where a DW = 2 ($\rho = 0$) is interpreted as the total absence of autocorrelation. Values of a DW test statistic less than

2 indicate positive autocorrelation. Such that a DW value of 0 or $\rho = +1$ is interpreted as a position of perfect positive autocorrelation. On the other hand, values of a DW test statistic greater than 2 indicate negative autocorrelation. Such that a DW value of 4 or $\rho = -1$ being a position of perfect negative autocorrelation. The test statistic DW statistic value becomes smaller as the serial correlations increase.

In summary, the results would be interpreted as follows:

A value of DW = 2 would signify the absence of autocorrelation,

DW values from 0 to< 2 would signify positive autocorrelation and

DW values in the range >2 to 4 would signify negative autocorrelation (Field, 2009).

The hypotheses for the Durbin Watson test were stated alternatively as follows:

Null Hypothesis   ($H_{o:}$) no first order autocorrelation exists
Alternative Hypothesis   ($H_{a:}$) first order correlation exists

This allowed for an alternative way of interpreting the results of the Durbin-Watson test for autocorrelation. Upper and lower critical values denoted respectively by d_U and d_L were to be tabulated for different values of the number of explanatory variables and the number of observations (denoted as n in the test statistic shown in equation 3.14). If the outcome were to be DW $< d_L$ the decision would be to reject H_o: $\rho = 0$

If the outcome were to be DW $> d_U$ the decision would be not to reject H_o: $\rho = 0$

If the outcome were to be $d_L< $ DW $ < d_U$ the decision would be that the test was inconclusive

3.7.3 Heteroskedasticity Test

An important tenet in the stochastic estimation methods such as the maximum likelihood and OLS is the assumption that the errors in the stochastic function are

distributed the same but unknown variance. This is the assumption that the variance of the conditional distribution of the error term (ε_i) given the independent variables (X_i) is assumed to be constant for all observations in the data as:

$$Var(\varepsilon_i/X_i = x) = \sigma_i^2 \forall \ i = 1,\dots,n$$

The Breusch Pagan test was used to test for heteroskedasticity for the possible violation of this assumption. Given the small population size of forty-seven counties in Kenya and assuming the independence and normality in the distribution of the error term, the Fstatistic was used to assess the dependence of the regression errors variance on the values of the independent variables using equation 3.17:

$$F = \frac{R^2/P}{(1-R^2)/N-1-P} \ \dots\text{Equation 0.3}$$

The squared residuals R^2 were generated and regressed against the same independent variables from equation 3.10:

$$lny_{it} = \alpha + \beta_1 ln(1+\lambda)d_{t-1} - \beta_2 lnp_{it} + \beta_3 lnSrev_{it} + \beta_4 lnSexp_{it} +$$

$$\beta_4 lnItran_{it} + \ v_{it} \ \dots\text{Equation 3.10}$$

This was to find out whether or not the independent variables predicted the variability of the error term – equation 3.18:

$$\varepsilon_t^2 = \phi + \lambda_{1t}d_{t-1} + \lambda_t p_t + Z_{t-1} \ \dots\text{Equation 0.4}$$

Where the meanings of ε, λ, d, p and Z from the regression equation 3.10 are retained as before and the hypotheses given as:

- Null Hypothesis (H_0): Homoscedasticity is present (there is no difference in the distribution of the residual variance) in which case λ, p and Z in equation 3.16 would be jointly significant.

- Alternative Hypothesis (H$_1$): Heteroscedasticity is not present (the residuals are not distributed with equal variance). In which case λ, p and Z in equation 3.16 would not be jointly significant. Put differently and deriving from equation 3.16:

Null Hypothesis	(H$_o$:)$\lambda_1 = \lambda_2 = 0$
Alternative Hypothesis	(H$_a$:)$\lambda_1 \neq \lambda_2 \neq 0$

H$_o$ was to be rejected if F was greater than $F_{CRITICAL}$ at the degrees of freedom for the first input and N-p-1 for the second input or Fp,N-p-1.

3.7.4 Multicollinearity Test

Multicollinearity is a case in a regression model when two or more independent variables may be highly correlated with one another, such that it becomes difficult to determine the effect of each individual independent variable on the dependent variable. Multicollinearity may show itself through high correlations between pairs of predictors, the changing of signs of coefficients when the number of variables is changed and as inflated standard errors in the results of the regression (Kothari, 2004).

To detect the possible presence of multicollinearity the variance inflation factors (VIF) in equation 3.17 were calculated for the independent variables. A variance inflation factor for the estimated regression coefficient b_j is the factor by which the variance of b_j is "enlarged" by the presence of correlation among the independent variables in the model. Therefore, the variance inflation factor for the jth independent variable is shown in equation 3.19:

$$VIF_j = \frac{1}{1-R_j^2} \dots \text{Equation 0.5}$$

Where R^2 = the explained percentage of the variance of the observed from the estimated value of the individual independent variable (Frost, 2022).

In drawing a conclusion, the rile of thump is that VIFs exceeding 5 but less than 10 may indicate the presence of multicollinearity without needing any corrective action, while VIFs exceeding 10 are a definite case of serious multicollinearity which must be corrected. Consequently, conclusion was to be made that the data exhibited the presence of multicollinearity in case the value of the VIF rose above the value of ten.

In addition, a pairwise correlation test between the variables was done to find out whether there existed any marginal correlation between the model variables.

3.7.5 Non-stationarity Test

Since this study used panel data, the mean and variance of the error term could vary across the period of time under study. This would mean that the model exhibited nonstationerity or data whose means, variances or covariances change over time. This can result in inconsistent and unreliable results (Gujarati & Porter, 2009). In this regard, the Levin–Lin–Chu test was used to verify the panel data stationarity properties of the variables. The null hypothesis was that the series would be said to contain a unit root, and the alternative hypothesis was that the series possessed stationarity. The Levin–Lin– Chu test assumes a common autoregressive parameter for all panels. Consequently, it does not allow for the possibility of a situation where some counties had data containing unit roots while other counties' data did not. The significance level is expected to be above 5% when the Levin-Lin-Chu test detects a unit root. Then it would be concluded that autocorrelation existed.

3.8 Hypothesis Testing

The study hypotheses about the individual partial regression coefficients were done. A 95% level of confidence being chosen to establish the statistical significance of the estimators chosen. '*P*' values for the t-test statistics that indicated the significance of the independent variables in the regression model were then interpreted to show how the fiscal decentralisation variables related to the technical efficiency of sustainable debt. The economic interpretation was then also given. This meant that, variables found to have a *p* value of less than 0.05 in the regression equation were considered significant. In effect, where *p* values were above 0.05, the null hypothesis was not rejected and where it was below 0.05, the null hypothesis was rejected (Gujarati & Porter, 2009). A rejection of the null hypothesis on any particular fiscal decentralisation variable would indicate a bearing of a statistical relationship between the particular variable and the technical efficiency of sustainable public debt.

3.9 Ethical Considerations

The term ethics refers to the set of rules that are both written and unwritten, which govern how one is expected to behave and why those around him expect him to behave in that manner (Fouka & Mantzorou, 2021). Ethics govern how research is disseminated and is important in research in ensuring that certain important principals are adhered to in data collection, data analysis and presentation of results. These principles include: honesty and integrity, objectivity, openness, respect for intellectual property, confidentiality, responsible publication, legality and the protection of human participants (Resnick, 2021).This study endeavoured to maximise competency and due care in order to produce worthwhile outcomes with the aim of contributing positively to knowledge and promoting welfare. It took care to ensure that it would not be the genesis of any unwarranted negative impacts on all or any who in one way or the other

came to interact with it whether in its formulation or consumption (Fleming & Zegwaard, 2018).

The data used in this study was mostly of secondary nature and a number of ethical issues were taken into consideration in its collection, analysis and discussions. Firstly, the research aimed for the highest level of objectivity in its analysis and discussions. It was purposed to be void of any form of bias that could potentially be introduced through the manipulation of data or the research processes including design, data analysis and interpretation (Resnick, 2021). No data was advertently excluded from the research to change results or omit findings (Akaranga & Makau, 2016). Secondly, care was taken to show respect for all intellectual property and to avoid plagiarism by acknowledging the works of other authors whenever such work was made use of. By quoting or citing all the original material appropriately, this research respected all copyright and other forms of intellectual property (Resnick, 2021).The research was therefore made as devoid as possible, of information borrowed directly without acknowledging the sources; regardless of whether it was in the form of "self-plagiarism" or "redundant publication" (Akaranga & Makau, 2016). All effort was also made to ensure that situations where the researcher had interests in the research process that were not fully apparent and which would have influenced his judgment, methodology and outcome were avoided (Jenn, 2006). This was so that the author's personal relationships and views such as biasness in favour or in disfavour of the contemporary arguments for and against government borrowing, would never be an influencing factor that could have otherwise adversely affected the study during the data collection, data analysis and the entire outcome of the study (Fleming & Zegwaard, 2018).

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Overview

In this chapter, the research findings are presented and discussed. The outcome of the checks on possible violations of the econometric assumptions made on the properties of the data is given. The basic characteristics of the data used in this study are presented using descriptive statistics, followed by a presentation of the results of the estimation of the stochastic frontier model. The results are summarised in tables, charts and graphs.

The chapter reports the hypotheses testing results highlighting each of the variables' findings and relationships from the analysed data. Explanation of the nature of the results is suggested at the same time as comparison is made to findings on the same matter in past literature.

The study investigated the effect of fiscal decentralisation on the technical efficiency of sustainable public debt in Kenya. Discussions and interpretations were done with reference to Kenya as an economy on the basis of the findings of data observed on the variables. Some of the data observed was collected directly from the counties (namely: the GCP and its growth rates, county revenue, county expenditure and fiscal transfers) while some others were disaggregated proportionally to the counties from macroeconomic central government figures (these were: the public debt, the interest rates and the primary balance). Some of the data analysed was collected directly for the county while some were disaggregated from the macroeconomic national data to the counties. Due to this disaggregation and in line with the study objectives, the discussions and interpretations are made for Kenya as an economy based on the analysis of the county data.

4.2 Descriptive Statistics - Summary

Descriptive statistical analysis was used to explain the nature of the data observed in the study. As per the data collected, Kenya's gross public debt increased steadily over the period 2013 to 2021starting at the debt being 39.8 percent of GDP in 2013/14 to 69.00 percent of GDP by June 2021.Over the years in that period the sustainability of the country's public debt steadily deteriorated. Data analysis summarised in table 4.1 shows that the ratio of public debt-to-GDP averaged 57 percent in this period.

Table 4.1: Means of the Variables

Variable		Obs	Mean	Type	Min	Max
(Public Debt/GDP %)	dbt	376	56.9375	Arithmetic	39.8	69.00
(Interest-Growth Differential)	dfr	376	-1.315797	Arithmetic	0.25	-6.85
(Primary Budeget % of GDP)	dfc	376	7.825	Arithmetic	6.2	9.3
Revenue Ratio	rev	376	7.272594	Arithmetic	0.0069	10.4357
Expenditure Ratio	exp	376	54.01227	Arithmetic	48.2100	60.3634
Fiscal Transfer % of Dev't Budget	trn	376	30.61483	Arithmetic	27.15	33.62

Source: Data Analysis Results, 2022

The difference between the growth rate of the GCP and on the interest rate charged on the public debt, referred to as interest-growth rate differential, was used to assess the optimum level of sustainable public debt. Results indicated that between 2013 and 2021 the interest charged on public debt exceeded the county economic growth rate by an all county average of between 6.85 (observed in 2019/2020) and 0.07 (observed in 2015/2016). The exception was in the year 2013/2014 when average economic growth rate was above the interest rates by a county average of 0.25. Over the whole study period, this variable had a mean of negative 1.316.

The second variable used to assess the optimal level of sustainable public debt in this period was the county primary balance. This had a mean of 7.83 percent over the study

period for all the counties. The average was highest in the year 2014/2015 at 9.3 and lowest at 6.2 in the year 2013/2014. The rise in the national public debt as a percentage of GDP from 39.8 percent to 69 percent shown in figure 4.1 was a reflection of the primary balance deficits that occurred in the government's budgeting process throughout these years.
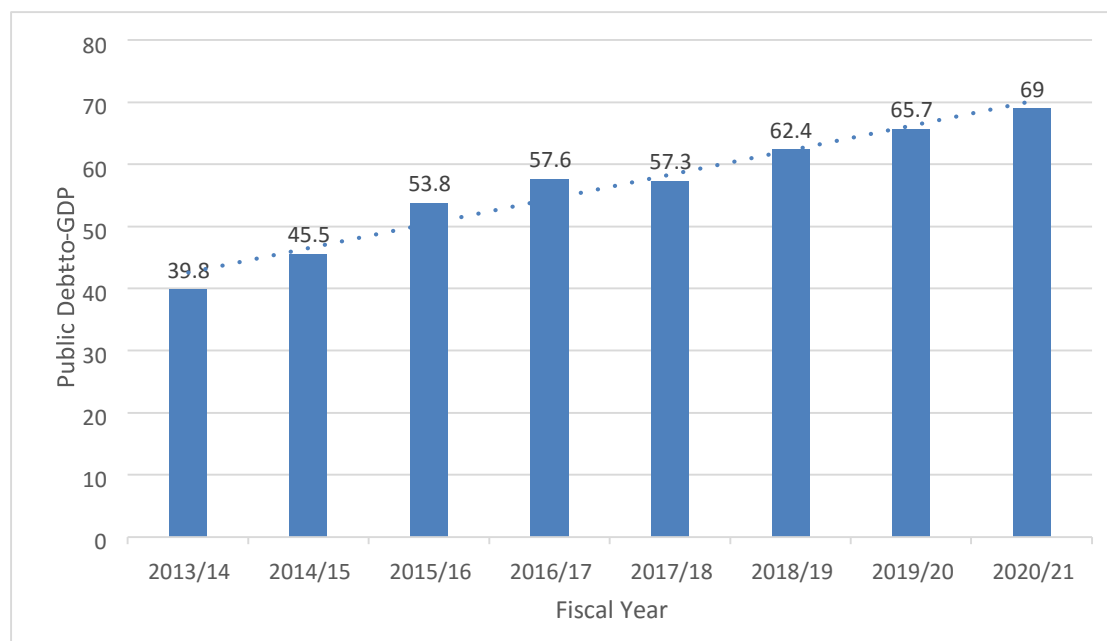
Figure 4.1: The Debt-to-GDP Ratio (2013-2021)
Source: Collected Data, 2022

These deficits necessitated increases in borrowing and the worsening the debt-to-GDP ratio. Despite its worsening trend, Kenya's public debt was assessed to be sustainable as at June 2021 (Fedelino *et al*, 2021). A possible reason for this is that the country made the right financial policy calls in this time. This would imply that the central point of focus in effectively maintaining the sustainability of public debt should not be the arresting of the rising level of public debt per se but rather the taking of suitable fiscal policy measures to offset the debt shocks such as the dip in exports occasioned by the effects of covid-19. This focus could be sharpened by a more specific measure in the efficiency of the sustainability of public debt. The positive debt sustainability rating

may also imply that Kenya's fiscal policies towards making public debt sustainable are working effectively. As per economic theory since output or GCP is used to service the public debt, it is expected to have a positive effect on the government's liquidity in terms of its diligence in the repayment of loans. Interest charged on the loans on the other hand is expected to have a negative effect on the same. As a result, any excess of the factor that positively influences optimal debt sustainability over the negatively influencing factor should lead to a net positive effect and vice versa for factors wwith a negative influence.

Three variables were used to evaluate the technical efficiency of sustainable public debt. Their analysis revealed the following results. The county revenue collection as a percentage of the central government revenue reported an all-county mean of 7.27 percent of which the lowest, 0.0069 percent, was recorded in 2019/2020 and the highest (10.4357 percent) recorded in the year 2014/2015. The ratio of the county own-income expenditure to the central government expenditure for all the counties, averaged 54.01 percent, ranging from 48.210 (2013/2014) to 60.364 (2015/2016). On its part, the central government funds transferred to the counties shown as a percentage of the central government development budget stood at an average of 31 percent annually over the study period. The lowest average of these transfers to the counties (27.15 percent) was made in year 2020/2021and the highest (33.62 percent) in the year 2017/2018.

4.2.1 Ratio of County Revenue to Central Government Revenue

The assessment of the technical efficiency of the sustainable public debt requires the adoption of an approach that is tailored to a specific country's environment. This follows from the fact that the intervening factors that influence the potential of achieving the most technically efficient sustainable public debt for each country are

country-specific. The degree of decentralisation of revenue collection is one such factor whose features differs from country to country depending on the political, economic and financial environment of each country. Decentralisation of revenue collection becomes a countryspecific characteristic stemming from the peculiarity of the provisions of the nation's laws regarding the conditions of collection of revenue as laid out for the sub-national government. Kenya's constitution promulgated in 2010 specifies such conditions under which the county governments may generate their own funds (Institute of Economic Affairs, 2010). These conditions differentiate the Kenyan revenue decentralisation from that of other countries. It was found that from 2013 to 2021, the amount of revenue collected by the counties as a percentage of the total revenue collected by the central government took on a falling trend with an all-time, all-county average of 54.0 percent. Across the counties, the annual average ranged between 17.9 percent (in Lamu) to 91.6 percent (in Nairobi) over the entire period. The assessment made of revenue decentralisation in Kenya for the forty-seven counties gave the annual averages over the study period shown on table 4.2:

Table 4.2: Revenue Decentralisation Trend

Year	Index of Annual Average of County Revenue to Central Government Revenue
2013/14 (Base Year)	100
2014/15	116.3854
2015/16	108.3003
2016/17	88.45512
2017/18	82.03206
2018/19	90.34937
2019/20	0.077232
2020/21	63.26875

Source: Data Analysis Results, 2022

It is noteworthy that most county governments were not able to meet their annual revenue targets due to the presence of limitations in the county revenue collection

systems such as the lack of qualified staff and the lack of infrastructure for effective administration (Kosaye, 2018).

4.2.2 Ratio of the County Own-Income Expenditure to the Central Government Expenditure

In its Fourth Schedule, the constitution of Kenya divides the public expenditure functions and powers between the central government and the county governments. The county governments are allocated functions in various sectors including the energy sector, the health sector and water provision. The functions that have been devolved to the county governments to varying degrees capture the expenditure aspect of fiscal decentralisation in the country (Kinuthia & Lakin, 2014). The devolution of expenditure was measured in this study using the ratio of the county own-income expenditure to the central government expenditure. It was used as an inefficiency factor – to determine the manner in which this aspect of fiscal decentralisation related to and influenced the technical efficiency of sustainable public debt. Over the study period, it was observed that the allcounty average value of expenditure decentralisation took on a rising trajectory from an index of 100 in 2013/2014 to 103.4 in 2020/2021as illustrated in table 4.3:

Table 4.3: Expenditure Decentralisation Trend

Year	Index of All-County Annual Average of Ratio Own-Income Expenditure to the Central Government Expenditure
2013/14 (Base Year)	100
2014/15	123.7235
2015/16	125.2104
2016/17	114.3133
2017/18	105.0469
2018/19	114.9047
2019/20	109.6928
2020/21	103.3913

Source: Data Analysis Results, 2022

4.2.3 Fiscal Transfers from the Central Government

Fiscal imbalances in the Kenyan economy arise from differences in the levels of revenue in the counties. They occur horizontally (between the counties) due to the differences in the abilities of various counties' own-source revenue collection. They also occur vertically between the central and the county governments (Goer & Seiferling, 2014). The persistence of fiscal imbalances leaves open the possibility of the counties making progress in economic development at unequal rates. Due to the need for balanced regional growth across the country, the central government makes transfers to local governments to offset both horizontal and vertical fiscal imbalances. These transfers measured the level of fiscal decentralisation as a percentage of the corresponding central government development budget in each year and analysed its relationship with and effect on the technical efficiency of sustainable public debt. Over the study period, the annual average value of the fiscal transfers received by the county governments from the central government as a percentage of the central government development budget exhibited a generally falling trend from an index of 100 percent in 2013/2014 to an index of 84.8 percent in 2020/2021 as table 4.4 shows.

Table 4.4: Fiscal Transfers Trend

Year	Index of All-County Fiscal central to County government Transfers
2013/14 (Base Year)	100
2014/15	95.94723
2015/16	96.59088
2016/17	96.50138
2017/18	104.977
2018/19	99.68408
2019/20	86.33461
2020/21	84.76839

Source: Data Analysis Results, 2022

4.3 Post-estimation Robustness Test Results

The model estimated the effects and statistical influence of each of the independent variables on the technical efficiency of sustainable public debt using the maximum Likelihood method (Coelli, 2007). Data for this study was successfully collected for each of the 47 counties for the period under study. This represented a census taken of the whole population that amounted to 376 observation points. The results of the various diagnostic tests conducted on the model of study are summarised as follows.

4.3.1 Autocorrelation Test

Autocorrelation is likely to occur with the analysis of time-series data such as was done in this study. The Durbin-Watson test statistic (DW statistic) was carried out to detect the presence of correlation of the same variables between successive periods regression in the regression model. According to Field (2009), the Durban Watson statistic (DW) gives a value between 0 and 4

where a value of: $DW = 2$ indicates that there is no autocorrelation,

$DW < 2$ indicates a positive autocorrelation,

$DW > 2$ indicates a negative autocorrelation.

Durbin-Watson test statistic values that are less than one or greater than three should be a definite cause for concern about the presence of autocorrelation. On the other hand, values in the range of 1.5 to 2.5 at 5 percent alpha level are considered to be relatively normal (Field, 2009). Following the analysis, the reported test statistic value of 2.1877 at the 5 percent alpha level of significance shown in table 4.5 was found to lie between these two limits: $(1.5 < 2.1877 < 2.5)$.

Table 4.5: The Durbin-Watson Test

```
. tsset trend
        time variable:  trend, 1 to 376
                delta:  1 unit

. estat dwatson

Durbin-Watson d-statistic(  6,    376) =  2.187732
```

Source: Data Analysis Results, 2022

Consequently, it was concluded that there was no definite cause for concern about autocorrelation in the data.

4.3.2 Heteroskedasticity Test

To test whether or not the error variance was constant across all the observations, the Breusch Pagan was used. This test is employed on the assumption that the error terms are normality distributed. The normality test is used to determine whether or not a data set follows a normal distribution (symmetrical and bell-shaped curve) with a mean of 0 and a standard deviation of 1 (Saunders *et al*, 2007). The normal distribution assumption was made as a prerequisite to making the Breusch Pagan test in order to ensure that the results interpretation and inference made from them would be valid and reliable (Razali and Wah, 2011). To test the normality of the distribution, the distribution of these terms were plotted to assess their actual distribution with the resultant normal distribution shown in figure 4.2.
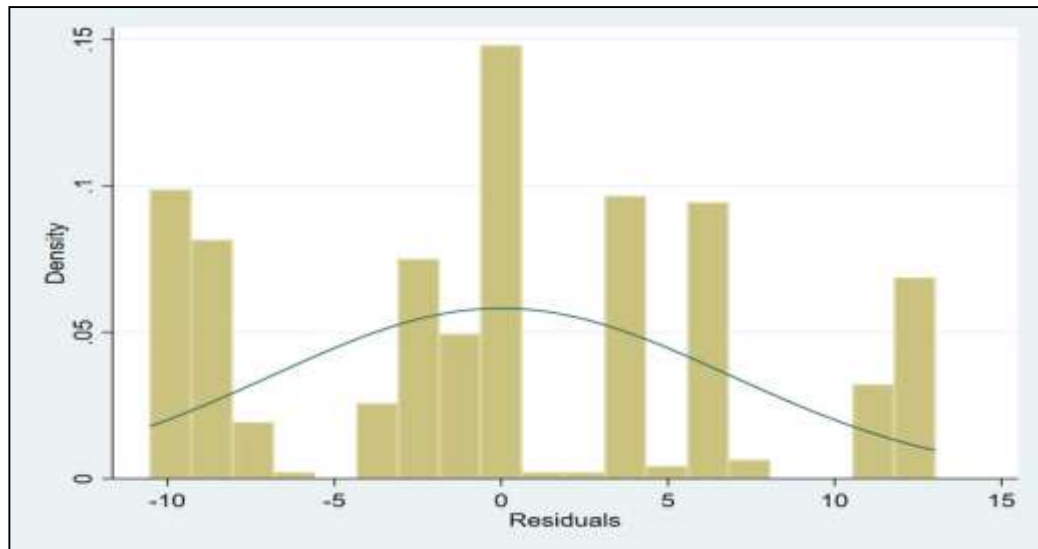
Figure 4.2: Normality of the Error Term Distribution

Source: Data Analysis Results, 2022

On the strength of this finding, the F-statistic (the Breusch Pagan test) was to test the joint significance of the predictors on the squared residuals or observation error variances. The null Hypothesis that there was no difference in the distribution of the residual variance was to be rejected if F was greater than $F_{CRITICAL}$ at the degrees of freedom for the first input and N-p-1 for the second input or Fp,N-p-1. The test returned the result shown on table 4.6:

Table 4.6: The Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

H_o: *Constant variance*
Variables: dfr   dfc   rev   exp   trn
$F(5 , 370) = 17.52$
$Prob > F   = 0.0000$

Source: Stata Programme Test Results, 2022

Given the significant value of the F-statistic, the null hypothesis was not rejected and it was concluded that there existed heteroskedasticity. Consequently, to avoid possible biased estimations and to cope with regression outliers (Christophe *et al*, 2010) robust standard estimators were used instead.

4.3.3 Multicollinearity Test

The results of the multicollinearity test using the variance inflation factors (VIF) calculated for the independent variables show a VIF below 10 for each of the individual independent variables and a mean of 5.59. Additionally, the paired correlation test also returned a low inter-variable correlation result as shown on table 4.13. The conclusion was therefore reached that there was no serial correlation among the predictor variables and that the model was therefore useful in showing the influence made by each of the independent variables on the technical efficiency of sustainable public debt. The results are given in table 4.7.

Table 4.7: Variance Inflation Factors

Variable	VIF	1/VIF
Expenditure Ratio	1.99	0.071487
Fiscal Transfers	6.79	0.147345
Revenue Ratio	4.72	0.211879
Interest-Growth Differential	1.24	0.8.9711
Primary Balance	1.22	0.818025
Mean VIF	5.59	

Source: Data Analysis Results, 2022

The implication of these was that the effect of each of the variables of fiscal decentralisation on the technical efficiency of optimising sustainable public debt could be individually determined.

4.3.4 Non-stationarity Test

The Levin–Lin–Chu tested for possible non-stationarity panel data properties. The null hypothesis that the series contained a unit root, and the alternative hypothesis was that the series possessed stationarity. When test detects a unit root, the significance level is expected to be above five percent. The results summarised in table 4.8 give the adjusted t statistic and p-values for the variables in the study tested at 5 percent level of

significance. As per the results, none of the variables showed a statistically significant time-based trend or seasonal trend.

Table 4.8: Levin-Lin-Chu Unit Root test

	Unadjusted t Statistic	Adjusted t Statistic	p-value
Public Debt	-13.1355	-12.8366	0.0000
BOP Deficit	-11.9129	4.2064	0.0010
Interest-growth Rate differential	-5.2449	17.3289	0.0314
Revenue Ratio	-1.8450	6.1737	0.0026
Expenditure Ratio	-18.2202	-10.3814	0.0000
Fiscal Transfers	-13.7940	-5.1308	0.0000

Source: Data Analysis Results, 2022

The null hypothesis that the series contained a unit root was therefore rejected and the alternative that the series data exhibited stationarity was accepted. This meant that the data collected had a stable and predictable behavior such that conclusions made could be reliably taken as representative of future generalisations.

4.4 Model Estimation Results Summary

Table 4.9 gives a summary of the results of the analysis of the estimated study models. These incorporate the correction for violated Ordinary Least Squares assumptions. The summary presents two models the first of which is the frontier model that gives the annual most efficient technically inefficient sustainable public debt level. This were determined with the regression of the interest-growth rate differential (*drf*) and the county primary budget balance expressed as a percentage of GCP (*dfc*).

The second model is the fiscal decentralisation effects model whose variables were:

rev = county revenue collection as a percentage of central government revenue collection (revenue decentralisation)

exp = county expenditure as a percentage of central government expenditure (expenditure decentralisation)

trn = county fiscal transfers as a percentage of central government development budget

The technical efficiency of public debt was represented as *dbt*

Table 4.9: The Ordinary Least Squares Output

					(Std. Err. adjusted for 47 clusters in id)	
dbt	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Frontier						
dfr	-1.925927	.0379282	-50.78	0.000	-2.000265	-1.851589
dfc	2.677012	.3050887	8.77	0.000	2.079049	3.274975
yearr	.0110772	.0025154	4.40	0.000	.006147	.0160074
cons	50.03958	3.462518	14.45	0.000	43.2309	56.84826
Mu						
rev	.0142708	.0184321	0.77	0.439	-.0218555	.050397
exp	.1219097	.0144893	8.41	0.000	.0935112	.1503082
trn	-17.22448	.0420944	-10.60	0.000	-21.08038	11.20612
_cons	6.177773	.0460386	0.42	0.129	4.2309	6.84826
Usigma						
_cons	4.452977	.0834695	53.35	0.000	4.289379	4.616574
Vsigma						
_cons	-25.49173	.6870913	-37.10	0.000	-26.8384	-24.14505
sigma_u	9.267265	.3867669	23.96	0.000	8.539391	10.05718
sigma_v	2.91e-06	1.00e-06	2.91	0.004	1.49e-06	5.71e-06
lambda	3179874	.3867675	8.2e+06	0.000	3179874	3179875

Source: Data Analysis Results, 2022

4.5 Assessment of Measurement Model

One of the assumptions of the Ordinary Least Squares regression method is the absence of endogeneity or the absence of any correlation between the independent variables and the error term. Endogeneity occurs when variables that have been included in the model possess values that are determined by other variables in the same model. Its presence causes the ordinary least squares estimators to fail as predictors of factor relationships.

4.5.1 Model Selection - The Hausman Endogeneity Test

The decision was reached to use the fixed effects model, based on the results of the

Hausman Endogeneity Test given in table 4.10:

Table 4.10: The Hausman Test Result

```
. hausman fe re

                  ——— Coefficients ———
                  (b)           (B)            (b-B)       sqrt(diag(V_b-V_B))
                  fe            re            Difference         S.E.

        dfc     -.2229397     -.2430264       .0200867          .0464426
        rev      .1072372      .0467661       .0604711          .0120541
        exp     -.0343376     -.0222836      -.012054           .0161677

                        b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:   Ho:  difference in coefficients not systematic

                chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                        =        28.44
                Prob>chi2 =      0.0000
```

Source: Data Analysis Results, 2022

To detect endogeneity in the independent variables of the regression model the

Hausman test had been used as a model misspecification test to help choose between

the fixed effects and the random effects models. If the test had detected endogeneity,

then the random effects model would be have been used otherwise the fixed effects

model would be preferred. The null hypothesis was that the preferred model was the

random effects model (if there was no correlation between the independent variables

and the error terms in the model). The alternate hypothesis was that the preferred model

was the fixed effects model (if there was correlation between the independent variables

and the error terms in the model). The null hypothesis was to be rejected if the Hausman

statistic, was found to be statistically significant ($p < 0.05$).

The results show a p-value that is less than 0.05, showing a Hausman statistic that was statistically significant at 5 percent (p = 0.000). Additionally, using the decision table 4.11,

Table 4.11: The Augmented Regression Test for Endogeneity

	If H_o: is true	If H_a: is true	Suitable Model
Null Hypothesis H_o: $Cov(\varepsilon_i, x_{it}) = 0$	Consistent and Efficient Estimators	Inconsistent Estimators	Random-effects model
Alternative Hypothesis H_a: $Cov(\varepsilon_i, x_{it}) \neq 0$	Estimators Consistent but may be Inefficient	Consistent Estimators	Fixed-effects model

Source: Torres Reyna (2007)

The set of coefficients that were estimated by the fixed-effects estimator (*fe*) and the corresponding set of coefficients under the random-effects estimator (*re*) were not statistically different. Consequently, the null hypothesis was rejected and it was held that model was mis-specified and that the observed differences must have been due to the violation of the non-correlation assumption. Following this rejection of the null hypothesis the fixed effects model was adopted as the more appropriate model for the study on the basis that the model that did not exhibit endogeneity would give the most unbiased results. Given the choice to use the fixed effects model, it must be noted that the assumption made is that the coefficients of each of the predictor variables show an identical across-county effect, on the technical efficiency of sustainable public debt. That is, the effect in terms of whether the relationship is positive or negative as well as in terms of the coefficient absolute value. In other words, the coefficient only reports the average effect of the relevant fiscal decentralisation factor for all the counties and not the effect per county.

4.5.2 Model Strength

In equation 3.3: $y_i = \alpha + x'_i\beta + v_i - \mu_i$ … equation 3.3

μ refers to the technical inefficiency of sustainable public debt. The value μ takes is of imperative significance since if μ happens not to be significantly different from zero then the entire equation would reduce to a normal regression specification with normal errors and would no longer be a stochastic frontier specification (Matawie & Assaf, 2010). The relevance of the stochastic frontier specification was therefore checked by invoking the value of μ. This was done by splitting the total variance of the error term (σ^2) into the technical inefficiency component error variance (σ_μ^2) and the random component error variance (σ_v^2) in equation 4.1:

$$\sigma^2 = \sigma_\mu^2 + \sigma_v^2 \text{ …Equation 0.1}$$

From this the gamma statistic (γ) was computed to determine the proportion of the variation in sustainable public debt accounted for by technical inefficiency. Gamma, (γ) in equation 4.2 was used to measure the proportion the variance parameter accounted for by the technical inefficiency as in equation 4.2:

$\gamma = \frac{\sigma_\mu^2}{\sigma^2}$ …Equation 0.2

Using this relationship and the analysis results shown in the output extract table 4.12, the gamma statistic was computed to be:

$$\text{Gamma, } (\gamma) = \frac{\sigma_\mu^2}{(\sigma_\mu^2 + \sigma_v^2)} = \frac{9.267265}{9.267265 + 0.00000291} = 0.99999969$$

Table 4.12: The Model Strength

					(Std. Err. adjusted for 47 clusters in id)	
Vsigma						
_cons	-25.49173	.6870913	-37.10	0.000	-26.8384	-24.14505
sigma_u	9.267265	.3867669	23.96	0.000	8.539391	10.05718
sigma_v	2.91e-06	1.00e-06	2.91	0.004	1.49e-06	5.71e-06
lambda	3179874	.3867675	8.2e+06	0.000	3179874	3179875

Source: Data Analysis Results, 2022

This large (and significantly different from zero) value of the γ was an indication that the one sided error term μ_i dominated the symmetric error v_i, such that the variation in actual sustainable public debt was explained mostly by variations in the levels of fiscal decentralisation (to the extent of 99.9 percent), rather than by random variability. It indicated a good fit and correctness of the specified distribution assumption.

4.5.3 Correlation of Variables

According to Oscar (2007), cross-sectional dependence is a commonly occurring problem in panel data data analysis particularly for large data. Such cross-sectional dependence can lead to bias in the test results, also referred to as contemporaneous correlation (Torres-Reyna, 2007). In this study correlation tests were performed to determine whether the residuals were correlated across entities and the potential level of correlation between the study variables. The null hypothesis used in the independence test was that residuals across entities were not correlated. The results of this test given as the correlations of the variable coefficients in the study are presented in table 4.13.

Table 4.13: Variable Correlations

	dbt	dfr	dfc	rev	exp	trn
dbt	1.0000					
dfr	-0.5625	1.0000				
dfc	0.1537	-0.1317	1.0000			
rev	-0.1170	0.1556	0.0090	1.0000		
exp	-0.0330	0.0138	0.0851	0.8082	1.0000	
trn	-0.1057	0.1154	-0.0844	0.5583	0.8617	1.0000

dbt = technical efficiency of sustainable Public debt
dfr = the interest-growth rate differential
dfc = the primary budget balance
rev = the ratio of the county to the central government revenue
exp = the ratio of the county to the central government expenditure
trn = fiscal transfers to counties as a percentage of the central government budget
Source: Data Analysis Results, 2022

The results revealed that the relationships between the variables in the study were weak. For instance, the interest-growth differential (*dfr*) had a correlations value of -0.1317 with the primary budget balance (*dfc*), 0.1556 with revenue decentralisation (*rev*), 0.0138 with the expenditure decentralisation (*exp*) and 0.1154 with the fiscal transfers decentralisation (*trn*). This example shows that interest-growth differential did not influence the primary budget balance, the ratio of the county to the central government revenue, the ratio of the county to the central government expenditure or fiscal transfers to counties as a percentage of the central government budget. The same is true for the relationships between the other variables. The exceptions were just two: the positive correlations between the expenditure ratio (0.81) and the revenue ratio and between the expenditure ratio and the fiscal transfers (0.86) which were both close to a correlation of positive 1. This is an indication that overall, the variables did not influence each other and as such the results show what effect each of the individual independent variables have on the dependent variable. There was no need for further action as the correlations were less than positive 0.5 and greater than negative 0.5.

4.6 Inferential Statistics: Estimated Variable Relationships

4.6.1 The Technically Efficient Sustainable Public Debt Frontier Model

The two variables analysed with the objective of determining the frontier of the technically efficient sustainable public debt in Kenya between 2013 and 2021were represented in equation 3.4 by λ (for the excess of real interest rate charged on county public debt over real GCP growth rate) and by p (for the county primary budget balance):

$$ln y_i = \propto_0 + \beta_1 ln(1 + \lambda)d_i - \beta_2 ln p_i + (v_i - \mu_i)\ldots\text{equation n 3.4}$$

The resultant estimated model for these variables is shown in the extract from table 4.9 as table 4.14 in which the two variables are shown as *dfr* and *dfc* respectively:

Table 4.14: Optimum Sustainable Public Debt Variables

			(Std. Err. adjusted for 47 clusters in id)				
dbt	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]		
Frontier							
dfr	-1.925927	.0379282	-50.78	0.000	-2.000265	-1.851589
dfc	2.677012	.3050887	8.77	0.000	2.079049	3.274975
yearr	.0110772	.0025154	4.40	0.000	.006147	.0160074
cons	50.03958	3.462518	14.45	0.000	43.2309	56.84826

dbt = technical efficiency of sustainable Public debt
drf = the interest-growth rate differential
dfc = the county primary budget balance expressed as a percentage of GCP

Source: Data Analysis Results, 2022

Equation 4.3 was the estimated frontier:

$$y_t = 50.03958 - 1.925927(1 + \lambda)d_t - 2.677012p_t \ldots\text{Equation 0.1}$$

It indicates that both the interest-growth rate differential and the primary balance had a negative influence on of the technically efficient sustainable public debt frontier. A one percent increase in the interest-growth rate differential caused a 1.925927 percent

reduction in the technically efficient sustainable public debt frontier. The finding in this study conforms to economic theory as increases in interest rates are expected to make it more difficult to service public debt with the result of negatively influencing the sustainability of public debt. Similarly, increases in the GDP (GCP) growth rate ought in theory to make funds more available for the servicing of public debt and thereby enhancing the achievement of sustainable public debt. Given that over the study period, the annual interest rates exceeded the corresponding growth rates there was a negative net annual interest-growth differential with an average of -1.315797 across all the counties. This must have been the reason for the inverse relationship between the differential and the technically efficient sustainable public debt frontier. The net effect of a negative differential or an excess of interest rate over the growth rate is theoretically expected be negatively correlate with the optimisation of sustainable public debt.

Similar results have been recorded with regard to the negative relationship between the interest-growth rate differential and sustainable public debt before. Gamber and Seliski in 2019 reported a favourable effect of an excess of the growth rate over the interest rate in the public debt sustainability status of the OECD due to its creating zero financial cost on public debt (Gamber & Seliski, 2019). Even so, another report warned that this favourable position may only be gained at the expense of costly efforts to economic growth, as efforts are made to maintain surpluses in the government budget so as to inhibit borrowing (European Commission, 2021).

A rise in interest rates accompanied by movement in the growth rate in the opposite direction affects the sustainability of public debt adversely. As a result, there arises the overall negative relationship between the interest–growth rate differential and the sustainability of public debt. More specifically, Ryan and Maana (2014) found that that

within three years a 1 percent increase in economic growth in Kenya reduced the public debt-to-GCP ratio by up to 2.5 percent. They also determined that the rising domestic debt levels in the country, which attracts higher interest rates poses a risk to the ability to keep public debt sustainable by making the economy vulnerable to external and domestic shocks. In the same study, Ryan and Maana also found a strong positive and statistically significant relationship between the interest rate on domestic debt to Kenya's public debtto-GDP ratio. This result together with their finding of a positive but statistically insignificant relationship between interest rate on foreign debt and the public debt-toGDP ratio, led them to the conclusion that that the interest cost on public debt in Kenya was mainly driven by domestic debt. They observed a negative but statistically significant correlation between real GDP growth and public debt-to-GDP ratio and so concluded that a positive growth of the economy would be supportive of public debt sustainability (Ryan & Maana, 2014). If the findings of this study based on the county public debt-to-GCP ratio are taken as an aggregate for all the counties, they relate to these earlier studies.

In this research, it was found that, a one percent increase in the primary balance caused a 2.677012 percent decline the technically efficient sustainable debt frontier. Increases in the fiscal deficit were found to decrease the optimal level of sustainable public debt. This was also expected and in conformity with economic theory – increased fiscal deficits are expected to affect the sustainability of public debt negatively (Aybarç, 2019). As contended, fiscal deficits increase the need for public debt thereby reducing the debt sustainability status. In this study, the government expenditure exceeded the income by an average of 7.825 between 2013 and 2021 across all the counties. This is what Mendoza and Ostry found in 2008; a positive correlation between the Debt-to-GDP ratios for both developed as well as developing countries, although the

relationship weakened with increasing levels of debt for both sets of countries (Mendoza & Ostry, 2008).

The observation made in this study with regard to this variable for the Kenyan counties and therefore for Kenya as an economy, was that the country's primary balances over the study period were sufficiently above the World Bank minimum recommended level of 50 percent required so as to maintain public debts at sustainable levels. This observation meant that Kenya was an exception as far as the findings of the research conclusions of Ncube and Brixiová (2016) for the larger sub-saharan Africa region were concerned. Ncube and Brixiová had concluded that the primary balances in Sub-Saharan African economies (of which Kenya is a part) exceed those required to keep public debt at sustainable levels in many of these countries (Ncube & Brixiová, 2016). The finding of this study agrees with that of William Ng'ang'a *et al* (2016) who determined that a surplus primary balance is positively related to public debt. Ng'ang'a *et al* reached the conclusion that fiscal consolidation measures (which aid surpluses in the primary balance) positively affect economic growth and macroeconomic stability (Ng'ang'a *et al*, 2016). A common basis for these findings one can argue is that a positive or surplus primary balance removes the necessity for government borrowing. The less a government borrows, the more sustainable the public debt is likely to be.

The excess of real interest rate charged on county public debt over real GCP growth rate and the county primary budget balance were used in the first step in the analysis. This was the determination of the frontier of the technically efficient optimum sustainable public debt on an annual basis from 2013 to 2021. The second step was the determination of the level of technical efficiency attained in each year. This was done by comparing the observed or actual annual level of sustainable public debt to the

corresponding annual frontier of the technically efficient optimum sustainable public debt (as determined in step one). By use of computer software, the two steps were computed simultaneously.

4.6.2 The Fiscal Decentralisation and Technical Inefficiency Model

In this study, technical inefficiency was measured annually, as the extent of deviation of the observed level of sustainable public debt from the frontier of the technically efficient sustainable public debt (Lawson *et al.*, 2004). Its value was given by the observed sustainable public debt divided by the optimum sustainable public debt – equation 4.4:

$$TE = \frac{\text{Observed county sustainable public debt}}{\text{Optimal county sustainable public debt}} \, X \, 100 \, ...\text{Equation 0.2}$$

Given the regression equation 4.5:

$$\ln d_t = \beta_0 + \sum_{i=1}^{2} \beta_i \ln X_i + \sum_{i=1}^{3} \partial_i \ln[v_i + \mu_i]$$

$$d_t = e^{\beta_0 + \sum_{i=1}^{2} \beta_i \ln X_i} . e^{v_i} . e^{\mu_i} \, ...\text{Equation 0.3}$$

Technical efficiency would be: $TE = e^{-\mu}$ (Lawson, *et al.*, 2004; Tijiani, 2006)

It was found that on average, in any year during the study period 2013 to 2021 the technical efficiency of sustainable public debt was 12.48 percent – table 4.15:

Table 4.15: Technical Efficiency

```
. sum te

    Variable |        Obs        Mean    Std. Dev.        Min        Max
-------------+--------------------------------------------------------
          te |        376    .1248016     .327223    1.91e-15    .999985
```

Source: Data Analysis Results, 2022

The implication is that between the years 2013 to 2021it would have been possible for the country to improve the public debt sustainability position by 87.52 percent towards the most efficient position without making changes to both the excess of real interest rate over real GCP growth rate and the government primary budget balance. Figure 4.3 shows the counties average annual technical efficiency frontier for each of the years of study. It shows that the TE took a generally falling trend over the study period and by 2020/2021, there was almost total technical inefficiency. In figure 4.3, the value 0.000 indicated the maximum technical efficiency while 1.000 would indicated perfect inefficiency.
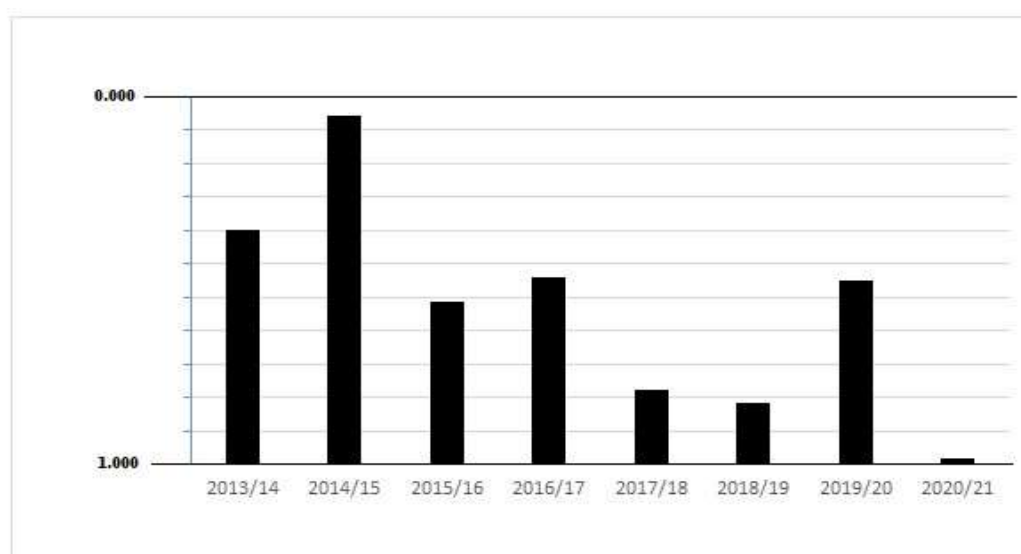
Figure 4.3: Technical efficiency Trend

Source: Data Analysis Results, 2022

The variables of measuring fiscal decentralisation (*rev, exp and trn*) exhibited differing correlations shown in the summary of the estimated regression model in table 4.9. An extract of the table which relates to the inefficiency model only is given in table 4.16:

Table 4.16: Technical Inefficiency Variables

dbt	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf. Interval]	
Mu						
rev	.0142708	.0184321	0.77	0.439	-.0218555	.050397
exp	.1219097	.0144893	8.41	0.000	.0935112	.1503082
trn	-17.22448	.0420944	-10.60	0.000	-21.08038	11.20612
_cons	6.177773	.0460386	0.42	0.129	4.2309	6.84826

(Std. Err. adjusted for 47 clusters in id)

rev = revenue decentralisation
exp = expenditure decentralisation
trn = fiscal transfers decentralisation

Source: Data Analysis Results, 2022

In this technical inefficiency model the dependent variable μ measures the level of technical inefficiency that indicates the shortfall in the attainment of the technical efficiency of sustainable public debt level. The revenue ratio (*rev*), the expenditure ratio (*exp*) and fiscal transfers ratio (*trn*) are the independent variables. The variables of fiscal decentralisation were observed to have taken differing trajectories over the period – expenditure decentralisation rising as revenue decentralisation and fiscal transfers decentralistion fell.

From the extract of the analysis results in table 4.16, one can extract the equation 4.6 as the technical inefficiency model:

$$ln\mu_{i\,t} = \delta_0 + \sum_{i,t=1}^{n} \delta_{i\,t}lnFD_{i\,t-1} + \omega_{i\,t},$$

as:

$$\mu_t = 6.177773 + 0.0142708rev_t + 0.1219097exp_t - 17.22448trn_t \dots\text{Equation 0.4}$$

For this model, those variables with positive coefficients such as revenue decentralisation had the effect of reducing the chances of achieving the optimal sustainable public debt level.

4.7 Revenue Decentralisation

The finding as shown in table 4.16 was that there is a positive correlation between revenue decentralisation and the technical efficiency of sustainable public debt. Analysis of the study data returned a coefficient of 0.0142708 for this technical inefficiency estimator - equation 4.6. The indication was that increases in this variable had the effect of lowering the technical efficiency of attaining the optimal level of sustainable public debt. Specifically, the technical efficiency of a sustainable public debt position was lowered by 0.0143 percent with every one percent increase in the ratio of the county government self-generated revenue to the central government revenue. This behooved a fall back to a search for a relationship between these variables on the basis of economic theory. It leads us to speculate that the inverse relationship between the efficiency levels of attaining optimum public debt sustainability and revenue decentralisation may arise from the low levels of revenue collection by the counties. The poor collection necessitates reliance on central government funding which in turn causes borrowing by the central government and a worsened sustainable public debt situation.

From the data collected in this study, the revenue ratio not only recorded low values overall (dipping to almost zero percent in the covid-19 year 2019/20), it also exhibited a falling trend over the period of study from a 100 % 2013/2014 base year index to 63.3% in 2020/2021. This meant that over these years less and less revenue (as a ratio to the revenue collected by the central government) was collect by the county

governments. The effect of this could have been a mitigation of the observed/actual negative effect of the revenue decentralisation on the likelihood of attaining the frontier of the technically efficient sustainable public debt over this period. This trend was compared to that of the technical efficiency ratio over the same period. The same year 2013/14 also used as the base year for the index of the TE ratio - figure 4.4.
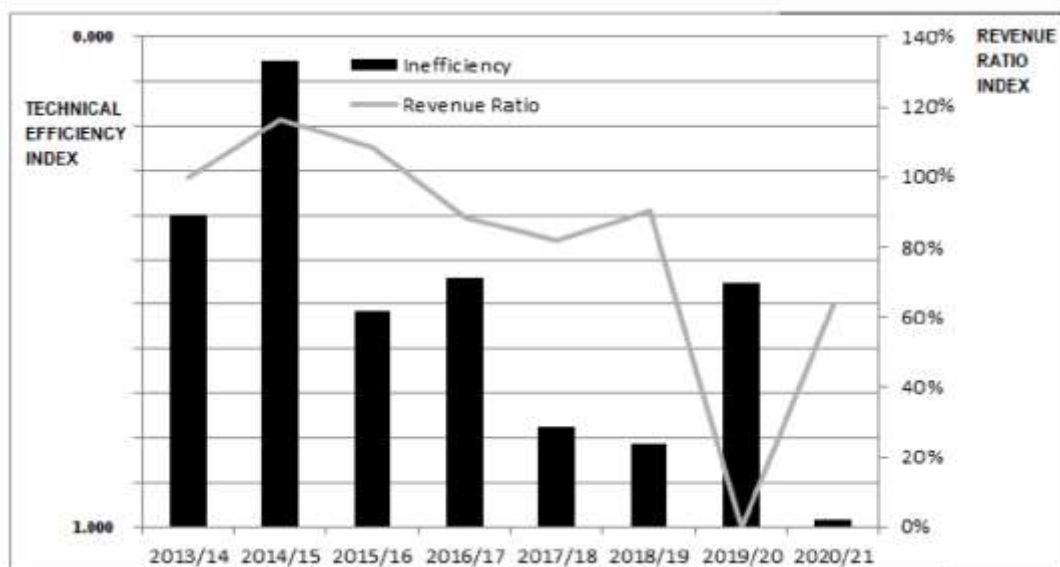
Figure 4.4: Revenue Decentralisation and Technical Inefficiency of Sustainable Public Debt

Source: Data Analysis Results, 2022

It shows an overall downward trend for both variables; although perhaps the TE may have fallen at a higher rate save for the fact that the revenue decentralisation ratio was also falling over the period.

Other studies have been carried out which seek to establish the relationship between decentralisation of revenue collection and the size of government. The relevance of government size to the sustainability of public debt stems from the fact that the larger the government size, the more likely the government is to borrow in order to finance its operations. Since the size of government has a bearing on the public debt, it is worth comparing the findings of these studies to those of this study. In studying revenue collection decentralisation and the size of government, the studies also measure the

variables in same manner as in this study – namely as a ratio of the sub-national governments' own-source revenues to total government expenditures.

According to Golem (2010), these studies do not all agree on the nature of the relationship between the decentralisation of revenue collection and the size of government. The results some of these studies reach are that the greater the extent to which revenue collection is decentralised, the larger the size of government (and consequently the more unattainable the sustainable public debt). As reviewed by Golen (2010), one study with such a result was made by Ehdaie's in 1994 whose findings gave a negative relationship with the revenue decentralisation variable which was statistically significant. It also revealed that the size of government varied according to the form or nature of decentralisation – whether revenue decentralisation or expenditure decentralisation. Such findings agree with that of this study; that increases in revenue decentralisation had the effect of lowering the technical efficiency of attaining the optimal level sustainable public debt. By contrast, Si Guo, Yun Pei and Zoe Xie (2022), found that decentralisation of revenue collection results in lower total government debt, whereas expenditure decentralisation leads to higher total government debt (Guo *et al*, 2022).

Another research reviewed by Golen (2010) is that by Jin and Zou that was done in 2002. This research drew a differing conclusion that revenue decentralisation reduces the central government's size by smaller degree than it increases sub-national government size which leads to net smaller aggregate governments size. In terms of this research, this would consequently mean a better position of the sustainability of public debt, and would therefore be opposed to the findings of this research. Related to the findings of Jin and Zou (2002) with regard to the significance of the type or nature of

fiscal decentralisation is a study on these variables by Stegarescu in 2005 which focused on the degree of revenue decentralisation vis-à-vis expenditure decentralisation. It indicated that a smaller government size (a better technical efficiency of attaining the technically sustainable public debt frontier) is achievable with a greater degree of revenue decentralisation over expenditure decentralisation (Golem, 2010).

4.8 Expenditure Decentralisation

Based on the results in this research, the coefficient for the ratio of the county ownincome expenditure to the central government expenditure was positive at 0.1219097 as given in equation 4.6. This meant that any increases in this variable had a negative effect on the technical efficiency of sustainable public debt. A one-percentage increase in the expenditure decentralisation ratio lowered the technical efficiency of attaining the optimum sustainable public debt position by 0.1219 percent. According to Golen (2010), an earlier research by Brennan and Buchanan agrees with and gives a reason for this state of affairs. In an ideally fully decentralised country, sub-national governments have discretion to govern their own budgets without interventions from the central government.

The argument commonly made in devolution literature is that technical efficiency in resource allocation can be improved with the empowerment of decentralised government units over the provision of public goods and services from the fact that the sub-national governments being closer to their local residents are better placed to respond more effectively to their needs and preferences. The decentralisation is also supposed to make those in charge of finances in the decentralised governments more accountable to the local residents on the ground and push them to compete with neighbouring local governments for efficient resource allocation. This improvement in

technical efficiency should reduce the size of decentralised governments and so too improve the sustainability of their public debt. This contrary to the observation made in this study. One may invoke the principal agency and the public choice theories to explain this contradiction. These theories show why government interference in encouraging resource allocation through expenditure decentralisation without the price mechanism indicators in the free market system may fail.

A smaller government size would translate to a more technically efficient capacity to optimise sustainable public debt. A subsequent study by Shadbegian in 1999 was in agreement with Marlow's conclusion in 1988 showing that higher sub-national government own-revenue expenditure relative to total central government expenditures decreased expenditure by the federal (central) government thus decreasing the overall government size (Golem, 2010). This is also in line with Thushyanthan Baskaran (2009) covering the European countries which found that fiscal decentralisation with a greater leaning towards expenditure decentralisation than revenue-collection decentralisation in the region had a positive relationship between it and the public debt-to-GDP ratio (Baskaran, 2011). However, Si Guo, Yun Pei and Zoe Xie (2022), found that decentralisation of revenue collection results in lower total government debt, whereas expenditure decentralisation leads to higher total government debt (Guo *et al*, 2022). Figure 4.5 compares the technical efficiency and the expenditure decentralisation indices with 2013/14 fiscal year as the base year for calculating the indices.
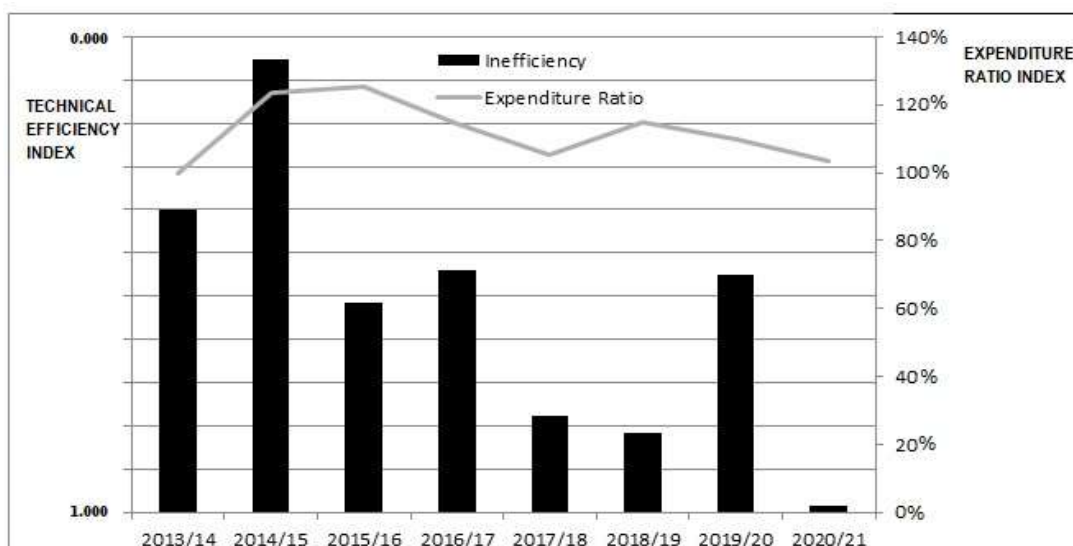
Figure 4.5: Expenditure Decentralisation and Technical Inefficiency of Sustainable Debt

Source: Data Analysis Results, 2022

It was observed that ratio of the county own-income expenditure to the central government expenditure took an upward trajectory of variable over the period under study from an index of 100 in 2013/2014 to 103.4 in 2020/2021. This must have had the actual effect of raising the rate of technical inefficiency over the study period.

4.9 Fiscal Transfers

For this model, the independent variables that have negative coefficients had the effect of improving the technical efficiency. This was the case for fiscal transfers made to the county governments. The analysis of the fiscal transfers from the central government to the counties as a percentage of the central government development budget (*trn*) returned a negative coefficient of -17.2244 in the estimated regression function indicating that increases in this variable improved the technical efficiency by 17.224 percent with every single percentage increase in the fiscal transfers. However, over the study period, fiscal transfers received by the county governments from the central government as a percentage of the central government development budget exhibited a generally falling trend as is shown by figure 4.6:
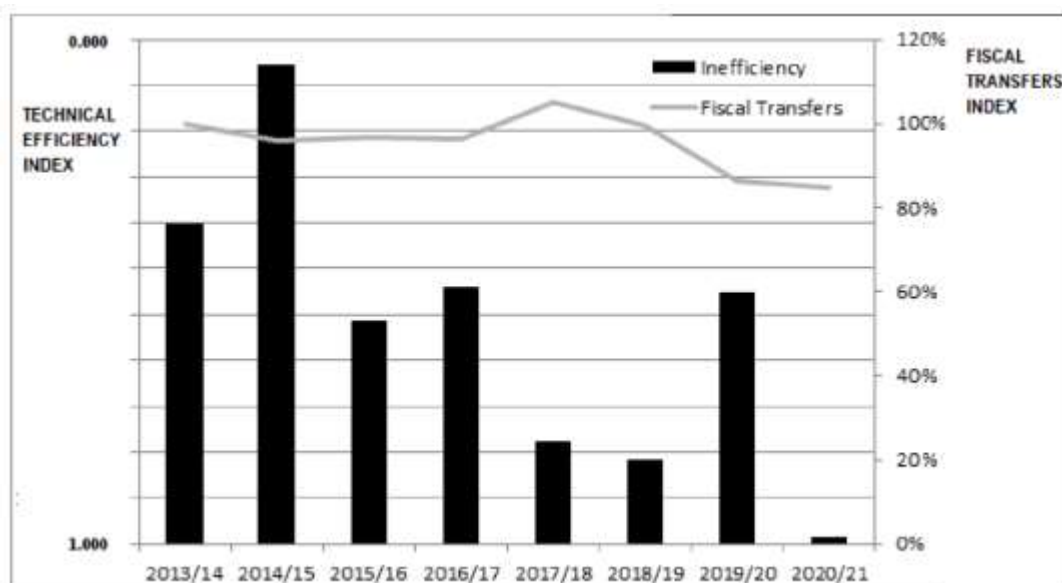
Figure 4.6: Fiscal Transfers and Technical Inefficiency of Sustainable Debt
Source: Data Analysis Results, 2022

This is to say that less and less amounts of fiscal transfers (relative to the central government development budget) were made to the county governments, making the country ever less technically efficient to achieve the optimal sustainable public debt.

It is possible, consistent with this empirical evidence, that fiscal transfers reduce vertical fiscal imbalances, allowing local economies to grow faster over time and raise their capacities of contributing to GDP growth. This could be holding back the negative effect of the observed interest-growth rate differential and so having the net effect of enhancing the central government's technical efficiency of sustainable debt level. A study by Grossman done on the role of intergovernmental fiscal transfers in 1989 was examined by Golem in 2010 had similar results. According to Grossman the indication is that these transfers have the effect of weakening the fiscal discipline of sub-national governments. This is because with the anticipation of the availability of the fiscal transfers, the subnational governments come to rely more and more on the transfers and less on limiting their expenditure to efficiently manage their resources. It follows that that these subnational governments end up overspending and creating the need to borrow. In this manner these entities reduce the capacity of these entities to sustain the

public debt. Also in agreement with both the results of this study and the findings of Grossman (1989), are the findings of Shadbegian in 1999. These are that fiscal transfers from the central government to the sub-national governments enhance the sustainability of public debt by creating competition for the fiscal transfers among the sub-national governments, which competition improves their efficiency. Increased efficiency is indicative of the technical inefficiency of attaining the optimum level of sustainable public debt (Golem, 2010).

These finding are fundamentally similar to the outcome reached in this study.However, in contrast to the conclusion of these studies, in the European region, the budget balance worsened where decentralisation was carried out in the form of fiscal central government transfers (European Commission, 2013).

One may offer that the reason for the relation observed in this study with regard to the relationship between the sustainability of public debt and fiscal transfers may arise more from the fact that the transfers are meant as a cure to the effects of the lopsided manner in which fiscal decentralisation is instituted. In most cases such as Kenya's, there has been more expenditure decentralisation with little if any revenue collection decentralisation. The effect has been to high degree of vertical fiscal imbalance where more revenue is held by the central government compared to that in the hands of the sub-central government. Governments with a high vertical fiscal imbalance arising from excessive expenditure decentralisation over revenue decentralisation have tried to solve the vertical fiscal imbalance through making fiscal transfers to the county governments (Golem, 2010). Less imbalance then translates to increased efficiency as observed in literature, fiscal decisions are brought to closer to more accountable and responsive levels. This may be the reason why in this study, fiscal transfers enhance the technical

efficiency of sustaining public debt. However, this must be on condition that the negative side effect of reductions in the fiscal discipline of the decentralised government units does not offset the positive efficiency gains; so that instead of competing to make their expenses lean these decentralised government will instead sit back and wait for (sometimes even fight over) expected central government hand-outs. In some cases, the central government may over-transfer funds to the sub-national government in advance, anticipating that the subnational governments are bound to overspend. The ultimate effect of too much of these negative effects would be that a small size of government becomes unachievable and consequently, the technical efficiency of sustainable public debt would become less attainable.

4.10 Results of the Hypothesis Tests

In its hypothesis testing, the study adopted a 5 percent level of significance to draw conclusions about the statistical significance of the effects of the selected variables of fiscal decentralisation on the technical efficiency of sustainable public debt. The results of the hypotheses tests are given in table 4.17:

Table 4.17: Summary of Hypothesis Tests

Hypothesis	Test Statistic	Decision
Ho1: Interest-growth rate differential has no significant effect on the technical efficiency of sustainable public	β = -1.925927 p = 0.000	Null Hypothesis Rejected
Ho2: Primary budget balance has no significant effect on the technical efficiency of sustainable public	β = -2.677012 p = 0.000	Null Hypothesis Rejected
Ho3: Decentralisation of revenue collection has no significant effect on the technical efficiency of sustainable public	β= 0.0142708 p = 0.439	Null Hypothesis NOT Rejected
Ho4: Decentralisation of expenditure has no significant effect on the technical efficiency of sustainable public	β = 0.1219097 p = 0.000	Null Hypothesis Rejected
Ho5: Fiscal transfers have no significant effect on the technical efficiency of sustainable public	β = -17.22448 p = 0.000	Null Hypothesis Rejected

Source: Data Analysis Results (2020).

Of the three independent variables used to describe fiscal decentralisation, only revenue decentralisation was found not to have a statistically significant correlation with the technical efficiency of sustainable public debt in Kenya. The rest were statistically significant at the 5 percent α level of significance. The hypotheses test results are summarised as follows:

Hypothesis H_{o1} postulated that the interest-growth rate differential had no statistically significant effect on the technical efficiency of sustainable public debt in Kenya. The regression results as summarised in table 4.17 indicate that the interest-growth rate differential is a statistically significant predictor of this efficiency (β = - 1.925927, p < 0.01). Based on this outcome, the null hypothesis was rejected. Results similar to these have been recorded before with regard to the statistical significance of the relationship between the elements that make up the interest-growth rate differential namely, interest

rate and growth rate. Such was Achwoga's conclusion (2016) who concluded that economic growth rate in Kenya was positively and significantly related to external debt (Achwoga, 2016).

Hypothesis H_{o2} stated that the primary budget balance had no statistically significant influence on the technical efficiency of sustainable public debt in Kenya. By primary balance was meant the difference between county government income and expenditure as a percentage of the corresponding central government measure. In this study, with regard to the hypothesis test, the central government primary budget balance was found to be significantly correlated with the technical efficiency of sustainable public debt in Kenya (β = -2.677012, p < 0.01) as given in table 4.17. The null hypothesis was consequently rejected.

Hypothesis H_{o3} presupposed that there was no statistically significant relationship between the decentralisation of revenue collection and the technical efficiency of sustainable public debt in Kenya. The relationship was found not to be significant (p = 0.439> 0.05 and z = 0.77). Thus the null hypothesis was retained due to the lack of statistical evidence that the observed relationship was not due to chance. The relationship was more likely due more to chance than to conformity to some statistical basis. This result was not expected and its implication is that increasing the autonomy of revenue collection in the counties countries causes public debt to become less sustainable.

Hypothesis H_{o4} presumed that the decentralisation of expenditure had no statistically significant influence on the technical efficiency of sustainable public debt in Kenya. Data analysis (table 4.9), returned a result that there was a statistically significant correlation between this variable and the technical efficiency of sustainable public debt

in Kenya (p = 0.000 < 0.01 and z= 8.41), the null hypothesis, was thus rejected and the determination made, that it was justifiable to expect a repetition of the same result across many studies.

Hypothesis Ho_5 tested the relationship between fiscal transfers and the technical efficiency of sustainable public debt in Kenya. The test as to whether or not this relationship was due to random chance led to the rejection of the null hypothesis that there was no statistically significant relationship between fiscal transfers decentralisation and the technical efficiency of sustainable public debt in Kenya (p = 0.000< 0.01 and z = -10.60).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter summarises the research findings and presents the conclusions from the study. It also shows how the study may offer contributions to the already existing store of knowledge and gives its implications for policy. Finally, suggestions for further research stemming from this study are offered.

5.2 Summary of the Study

To achieve its aim of assessing the effect of fiscal decentralisation on the technical efficiency of sustainable public debt in Kenya, the study set up five specific objectives that went on to inform the stated null hypotheses. In the hypotheses, public debt referred to the outstanding value of all borrowing by the government. Borrowing has become something of a norm rather than being an occasional exception in today's fiscal governance process. Borrowing is made necessary by the government's desire to improve living standards. It may also be undertaken as a measure of government control of the economy. For example, borrowing may be made from the resources within the country in order to mop up an excess supply of money in the economy with the aim of reducing inflation or even reducing an international trade deficit. Alternatively, borrowing may be done to fill up government fiscal deficits where budgeted government expenditure has exceeded budgeted government income.

An observation of the primary budget balance shows that most countries have deficits in their primary balances as their expenditures exceed their incomes. Governments cover these deficits through public borrowing. Borrowing represents an important source of government revenue next to taxation. Debt is variously classified in literature.

It can be short-term debt, medium-term debt or long-term debt; it can be internal or external; It is also classified as voluntary debt or obligatory debt (Aybarç, 2019). The meaning of public debt in this study incorporated these classifications and was given as the total accumulated or payable amount of money by the government of a Kenya at the end of the relevant fiscal year.

In literature, the measurement of public debt is made in both absolute as well as in relative terms. In this research, it was expressed in relative terms as a percentage of the borrowing nation's repayment ability as shown by its Gross Domestic Product (GDP). The measurement public debt was made in these relative terms to gauge its sustainability

(Dabrowski, 2016). It made a comparison of the debt burden to the country's economic potential and specifically its potential ability to pay off the debt. This relative measure offered a suitable platform for the reviewing of the quality and reliability of the government's fiscal policy. To facilitate the panel data research design employed in this study, the central government public debt was split up among the counties pro-rata to the GCP to GDP ratio.

Literature on Public debt sustainability analysis commonly makes the assumptions of the solvency and the liquidity of the indebted entity in defining the sustainability of the debt. The other assumption made in this literature is the assumption of the need for avoiding explosive debt trajectories. This study followed these same assumptions to enforce the reliability of its debt sustainability analysis results as is done by the other studies in this area.

Fiscal decentralisation was instituted in Kenya through the promulgation of The Constitution of Kenya in 2010 with the main intention of improving the governance and

empowerment of Kenyans. The constitutional devolution dispensation included the political, administrative and fiscal elements of decentralisation, the sub-national governments being designated as the forty-seven counties. Of the three components of devolution, fiscal decentralisation may be considered the most significant form with the political decentralisation and administrative decentralisation only playing a supportive role (Cabral, 2011). Fiscal decentralisation is commonly measured in literature using variables such as expenditure decentralisation, revenue decentralisation and decentralisation in the form of intergovernmental fiscal transfers. These same variables were employed in this study in the analysis of fiscal decentralisation. The study investigated the influence of fiscal decentralisation on the technical efficiency of sustainable public debt in Kenya. This was possible because there exists a link between public debt and fiscal decentralisation.

Because most governments have deficits in their primary balances, the examination of whether or not technical efficiency of sustainable public debt is achieved with the institution of fiscal decentralisation is effectively concerned with examining the excess negative value of the government's own-source revenue over its expenditure. These deficits in the primary balances are the main cause of public debt. In the end, an analysis of the management of the government financial outlay or the primary balance becomes synonymous with an analysis of the management of the primary deficit or public debts.

A linkage can be made between the technical efficiency created on service provision through fiscal decentralisation and the technical efficiency achieved on the optimisation of sustainable public debt through the proper management of the primary balance. This is because fiscal decentralisation is said to create efficiency in bettering service provision by lowering the government expenditure that is necessary to provide a given

level of the public services. By lowering expenditure, it may be assumed that the saving made in this manner reduces the need for borrowing thereby stabilizing the sustainability of public debt. In other words, the level of technical efficiency achieved through fiscal decentralisation can be construed as a saving on government outlay, which restricts the growth of government spending thereby restricting the need for the government to borrow. According to Engineer (1990), the technical efficiency created goes to reduce the deficits experienced in the primary deficit. A reduction in the government outlay reduces the primary balance deficit and in turn enhances the technical efficiency in the field of public finances (Engineer, 1990). This can be assumed to raise the possibility of attaining an optimal position of sustainable public debt. It means that if fiscal decentralisation leads to gains in the technical efficiency of public service provision by increasing savings or surpluses in the government budget it also leads to the attainments in the technical efficiency of sustaining public debt.

In most cases what exist in reality are deficits instead of surpluses in national budgets. Government borrowing and public debt always cover these budgetary deficits. Given this situation the technical efficiency gains from fiscal decentralisation on the public service provision can just as accurately be measured by the sustainability of public debt. This is to say that the failure to minimise the excess of government expenditure (the cost inputs of public service provision) over government income will always lead to the lowering of technical inefficiency (in other words it leads to a failure to achieve the optimal level of sustainable public debt). In the same vein, if measures are not taken to reduce interest rates charged on loans (the cost inputs) at the same time as encouraging the GDP growth rates to rise, it will inevitably lead to technical inefficiency in terms of the inability to achieve optimal levels of sustainable public debt.

This research was made based on a positivism philosophy. Philosophy concerns the views about the working of phenomena in the world and the kind of philosophical beliefs of the researcher guides the way in which data is gathered, analysed and interpreted. As par this paradigm, the study intended to determine a quantifiable level of technology and an optimum level of an achievable macroeconomic indicator (optimum sustainable public debt) in the face of measurable fiscal decentralisation levels. The employment of the positivism paradigm implied the use of deductive analysis in determining the nature of the effect of revenue, expenditure and fiscal transfers decentralisation on the technical efficiency of public debt sustainability. A number of ethical issues were taken into consideration in the collection and analysis of data in this study. These included ensuring that the research aimed for the highest level of objectivity and avoiding of any form of bias. Respect for all intellectual property and the avoidance of plagiarism was made paramount.

The study used a causal research design to examine the probabilistic causal relationship, the direction and magnitude of correlations between the fiscal decentralisation variables and the technical efficiency of attaining the optimum level of sustainable public debt. It used a panel data analysis to provide repeated cross-sectional measurements of the fiscal decentralisation variables over the period 2013 to 2021. Given that the tools used in the analysis of the sustainability of public debt are most effective and efficient in informing judgment over short periods of projection such as five to ten year periods the study period for this research spanned the eight years from 2013 to 2021. Given the small size of the sample frame the study conducted a census inquiry of all the forty-seven counties. Data was collected from several government databases and non-governmental data bases using document-based research and records-based research data collection tools. The data collected analysed using the stochastic frontier analysis

technique to evaluate the attainment of the operational technically efficient position of sustainable public debt. The basic characteristics of the data used in this study were presented using descriptive statistics summarised in tables, charts and graphs

5.3 Summary of Research Objectives and Findings

This study set out to determine the effect of fiscal decentralisation on Kenya's technical efficiency of sustainable public debt. The sustainability of public debt was measured as a percentage of the GCP while the level of fiscal decentralisation was assessed on the basis of revenue decentralisation, expenditure decentralisation and the decentralisation of fiscal transfers using data collected for the period 2013 to 2021.The analysis was performed at two levels. Firstly, the most technically efficient sustainable public debt was estimated annually over the study period. The technical efficiency attainment was measured by ratio of the observed sustainable public debt to its expected optimal level. The first two objectives were covered in this stage. The first objective was to determine the relationship between the interest-growth rate differential and the technical efficiency of sustainable public debt in Kenya. The second study objective aimed to evaluate the relationship between the primary budget balance and the technical efficiency of sustainable public debt in Kenya.

The second part involved establishing, on an annual basis, the extent to which the counties fell short of attaining the most technically efficient sustainable public debt in relation to the variations in the level of fiscal decentralisation over the years 2013 to 2021. In other words; the second stage concerned the determination of the effect of annual variations in fiscal decentralisation on the optimum level of public debt. This second part employed the third to the fifth objectives of the study. Detailed theoretical and empirical reviews were made of the variables on which both public debt and

sustainability are based. The effect of fiscal decentralisation on the ability to attain the optimal level of sustainable public debt was done by conducting an analysis of the past trends of Kenyan counties' public debt and its sustainability.

An investigation was then made as to the extent to which the country fell short of attaining the most technically efficient sustainable public debt in relation to the variations in the level of fiscal decentralisation over the years 2013 to 2021. These related to the last three objectives of the study and revealed the following. The third objective was to assess the effect of the revenue-decentralisation on the technical efficiency of sustainable public debt in Kenya. The fourth objective concerned was to find the relationship between the expenditure-decentralisation and the technical efficiency of sustainable public debt in Kenya. The fifth objective wanted to evaluate the effect of fiscal transfersdecentralisation on the technical efficiency of sustainable public debt in Kenya.

5.3.1 Interest-Growth Rate Differential and Budget Primary Balance

Even though Kenya's public debt was deemed as sustainable in this period 2013 to 2021, the outcome from the descriptive statistics of this study revealed that the country's public debt sustainability position worsened by about 30 percent and averaged 56.94 percent over the period 2013 to 2021. With regard to the interest-growth rate differential, it was found that apart from the year 2013/2014 (when the growth rate was higher than the interest rates by 0.25 percent), the interest charged on public debt always exceeded the economic growth rate throughout the period of study. The average excess of the interest rate over the growth rate in the years studied was 1.32 percent. It was determined that this factor significantly influenced the optimal sustainable public debt albeit negatively ($p = 0.000 < 0.01$). Similarly, the county primary balance ranged from

6.2 percent and 9.3 percent with a mean of 7.83percent. It had a positive and statistically significantly correlation with optimal sustainable public debt ($p = 0.000 < 0.01$).

Both the interest-growth rate differential and the primary budget balance were found to be significant influencers of the optimal sustainable public debt at five percent level of significance. For both variables, the relationship with the technical efficiency of sustainable public debt was not due to chance happenings but to certain statistical bases such that the same conclusion could be reached if there were to be any similar consequent enquiries.

5.3.2 Revenue Decentralisation

The third specific objective of the study was to assess how revenue decentralisation in Kenya relates to the technical efficiency of sustainable public debt. Revenue decentralisation was measured as the extent to which the county governments were allowed autonomy by way of empowering them to collect funds within their jurisdictions for their own expenditure. The aim was to establish the influence if any, of fiscal decentralisation in the form of revenue collection, on the technical efficiency of sustainable public debt. The findings revealed that the county revenue as a percentage of the central government revenue took on a falling trend over the study period. It ranged from 10.4357 percent to 0.0069 percent with a mean of 7.27percent. The results indicated that the relationship between the variables was positive (0.142708) but not significant at 5 percent level of significance ($p = 0.439 > 0.05$). The dependent variable of the function tested was a measure of the level of inefficiency so that a positive coefficient in an independent variable indicated an inverse relationship between the independent variable and the technical efficiency. The positive relationship between these variables therefore implied that as the ratio of county revenue to the central

government revenue increased, the technical efficiency of attaining the optimal sustainable public debt deteriorated. The result therefore meant that the level of technical efficiency worsened by 0.142708 percent with every percentage increase in the ratio of the county government self-generated revenue to the central government revenue.

5.3.3 Expenditure Decentralisation

The fourth specific objective of the study was to determine the effect of the county Government expenditure as a percentage of the central government expenditure on the technical efficiency of sustainable public debt in Kenya. It was observed that changes in the variable ranged from 60.364 percent to 48.210 percent with an average of 54.01 percent. There was an upward trajectory of the ratio of the expenditure by the county government of self-generated income to expenditure by the central government observed over the period under study. The multiple regression analysis revealed that the ratio of the county own-income expenditure to the central government expenditure coefficient of 0.1219097 percent fell far away enough from the null hypothesis value for the conclusion to be reached that it is unusual enough for the null hypothesis to be rejected. It had a statistically significant correlation with technical efficiency of sustainable public debt in Kenya at an alpha value of 5 percent ($p = 0.000 < 0.05$). Just as in the case of revenue decentralisation, the coefficient for the expenditure decentralisation was found to be positive – and just as in the aforegoing case, the positive coefficient in the independent variable indicated an inverse relationship between expenditure decentralisation and the technical efficiency of sustainable public debt.

5.3.4 Decentralisation through Fiscal Transfers

The fifth specific objective investigated the effect of decentralisation through fiscal transfers on the technical efficiency of sustainable public debt in Kenya. On this objective, the study found that the amount of funding from national government to the county government had a generally falling trend between 2013 and 2021. The highest percentage was 33.62 percent and the lowest, 27.15 percent. The central government funds transferred to the counties as a percentage of the central government development budget had an annual average of 31 percent. Fiscal transfers received by the county governments from the central government were negatively correlated with the technical efficiency of sustainable public debt. The negative relationship implied that increases in the fiscal transfers would raise the level of technical efficiency in Kenya. The actual increase being determined as 17.22448 percent for every unit percentage increase in fiscal transfers received by the county governments from the central government. Fiscal transfers to the county governments was found to be significantly correlated with optimal sustainable public debt in Kenya (p = 0.000< 0.01).

5.4 Study Conclusions

One of the earliest studies on the subject of the effects of decentralisation on the size of government by Wallace Oates in 1985 failed to find a strong, systematic relationship between the size of government and the level of decentralisation for forty-three countries (Wallace, 1985). In studying the effect of fiscal decentralisation on Kenya's technical efficiency of sustainable public debt this study's results would influence the effect of decentralisation on the size of the Kenyan government. This is because the size of government has a direct relationship with the level of public debt and the efficiency gained through the policymaking.

The relationship between the excess of interest rate over real GDP growth rate and the sustainable public debt, and the relationship between the sustainable public debt and the county primary budget balance were both found to significantly influence the optimality of sustainable public debt at five percent level of significance. As per economic theory, GDP or output is expected to have a positive effect on the liquidity of the government in terms of repayment of loans. Interest charge on the loans on the other hand is expected to have a negative effect on the same. As a result, any excess of the positively influencing factor over the factor that negatively affects optimal debt sustainability should lead to a net positive effect. The findings of the study were in line with this theory, as it was determined that every percentage increase in the growth-interest rate differential decreased the technical efficiency of sustainable debt by 1.925927 percent. Similarly, every percentage increase in the fiscal deficit decreased the efficiency by 2.677012 percent. This was also in agreement with expectations based on economic theory because deficits worsen the status of the sustainability of public debt.

Regarding the three variables whose relationship with the technical efficiency of public debt was investigated, fiscal transfers raised the said efficiency, while revenue and expenditure decentralisation lowered it. A percentage increase in the fiscal transfers received by the county governments from the central government raised the level of efficiency in Kenya by 17.22448 percent. For the actual years under study this variable was actually falling from an index of 100 percent in 2013/2014 to an index of 84.8 percent in 2020/2021. This lead to the conclusion that between 2013 and 2021this variable actually caused a decrease in the efficiency of attaining optimal sustainable public debt in Kenya. Increases in the other two inefficiency variables were found to have a negative effect on the technical efficiency of sustainable public debt. Efficiency worsened by 0.142708 percent with every percentage increase in revenue

decentralisation. The fact that this variable exhibited a falling trend over the study period with the annual average ranging from 91.6 percent to 17.9 percent led to the conclusion that the actual effect of this variable on efficiency between 2013 and 2021was to improve the technical efficiency of sustainable public debt over this period. On the other hand, there was a 0.1219097 percent deterioration in the technical efficiency of sustainable public debt with every percentage increase of expenditure decentralisation. It was observed that there was an upward trajectory of this variable over the period under study from an index of 100 in 2013/2014 to 103.4 in 2020/2021which accelerated the deterioration in the inefficiency. From the results of the study, a number of conclusions were made:

Firstly, the country is inefficient with regard to its technical efficiency of sustainable public debt. The technical efficiency level found was 12.5 percent and the implication of this was that there was an opportunity to improve technical efficiency of sustainable public debt by 87.52 percent.

Secondly, over the years covered by the study, the level of technical inefficiency was observed to rise as the overall degree of fiscal decentralisation increased. This meant that that with increases in the general degree of fiscal decentralisation, the technical efficiency of sustainable public debt worsened. The conclusion was therefore reached that there exists an inverse relationship between fiscal decentralisation and the technical efficiency of sustainable public debt. From an input oriented point of view of technical efficiency, it was therefore concluded that, it was not possible to obtain a given output (attain optimal levels of sustainable public debt) by minimising inputs (manipulating fiscal policy through the factors of fiscal decentralisation) in Kenya.

Thirdly, and specific to the fiscal decentralisation variables the study found that: (a) There is a statistically significant relationship between the interest-growth rate differential (β = 1.925927, p = 0.000) and the technical efficiency of sustainable public debt in Kenya and between the government budget primary balance and the technical efficiency of sustainable public debt in Kenya (β = -2.677012, p = 0.000), both of which reduce the technical efficiency of sustainable public debt:

a) There was insufficient statistical evidence to determine the whether or not revenue decentralisation had any influence on the technical efficiency of sustainable public debt in Kenya. However, increased fiscal decentralisation of revenue collection to the county authorities (p = 0.439) could lead to a decrease in the technical efficiency of sustainable public debt in Kenya (β = 0.0142708).

b) The increases in the fiscal decentralisation of expenditure to the county governments led to a decrease in the technical efficiency of sustainable public debt in Kenya (β = 0.1219097, p = 0.000).

c) Fiscal decentralisation through transfer of funds from the central government to the county governments led to an increase in the technical efficiency of the sustainable public debt in Kenya (β = -17.22448, p = 0.000).

5.5 Recommendations

5.5.1 Theoretical Implications

Studies on the relationship between public debt sustainability and economic growth rates invariably report a negative relationship between the two. For example, a study by Calderon and Fuentes (2013), of the Latin America and the Caribbean nations, revealed a strong negative relationship between growth rate and public debt. It concluded that high levels of public debt caused low levels of economic growth even though the

adverse economic growth rate effect may be mitigated by having strong institutions, high quality domestic policies and outward-oriented policies (Calderón & Fuentes, 2013). A similar study in the Euro area supported the view that public debt always has a negative influence on the long-run economic growth rate of the Euro area member states (GómezPuig and Sosvilla-Rivero, 2017). Ugo Panizza and Andrea Presbitero (2013) further affirmed the negatively correlation (Panizza & Presbitero, 2013). Studies on the SubSaharan Africa region show the same negative relationship between public debt and economic growth rate giving the reason for it as the 'crowding out' of investors in SubSaharan Africa due to the increase in the external debt overhang and making the said investors to lose the incentive to invest (Lyoha, 1999).

These literary works connect devolution and the management of public funds. Their overall conclusion is that devolution, and in particular, fiscal decentralisation enhances better public funds management and better provision of public services. This implies that fiscal decentralisation is a form of government intervention in an economic system which exhibits inefficiency. A study by Mendoza and Ostry (2007) of the manner in which governments react to fiscal to movements in the level of their public debt revealed that overall there is a positive and significant relationship between primary balances and public debt for most countries. In India for example, it was found that out of the twenty states, ten experienced a positive reaction of debt sustainability to the institution of primary surpluses (Curtaşu, 2011).For this reason, individual countries have in the past manipulated their primary balances to make their debt positions solvent (Mendoza & Ostry, 2008). The limitation of this interventionist measure is explained by theories such as the public choice theory and the principle agency theory. These theories advance the principles embedded in their workings, which cause government intervention not to achieve its intended objectives. The findings of this research lend

support to these theories. It is reported that from the early 2010's in Sub-Saharan Africa, the primary balances exceeded those required to keep public debt at a sustainable level in many of the countries of the region (Ncube & Brixiová, 2016). For Kenya, William Ng'ang'a, Chevallier and Ndiritu (2016) found that the primary balance is positively related to public debt (Ng'ang'a *et al*, 2016).

Although there is increased autonomy in the county governments with regard to their collection and use of revenue, the level of technical efficiency of sustaining public debt resulting from this decentralisation, at 12 percent, is very low. This low efficiency percentage is an indicator of the ineffectiveness of the interventionist policies in the management of public funds. This contrasts considerably with many findings such as that of a World Bank report in 2013 that found that expenditure decentralisation in the

European Union improved the primary balances of the governments of the bloc (European Commission, 2013). Another study by Thushyanthan Baskaran (2009) found that the higher the level of expenditure decentralisation in that region rose the lower the public debt-to-GDP ratio became (Baskaran, 2011). Si Guo, Yun Pei and Zoe Xie (2022) also concluded that the decentralisation of revenue collection results in lower total government debt, whereas expenditure decentralisation leads to higher total government debt (Guo, Pei, & Xie, 2022).

In a few cases outside Sub-Saharan Africa, studies reveal similar ineffectiveness of decentralisation on public debt sustainability. For example, with regard to decentralisation by way of fiscal transfers, it was established by Si Guo, Yun Pei and Zoe Xie (2022) that in general, increases in the central government transfers to local governments raise the total government debt (Guo, Pei, & Xie, 2022). For the SubSaharan Africa countries, where the aims of fiscal decentralisation range from the

promotion of efficient government spending and generally concern macroeconomic stability (Ruggier *et al*, 2018), ineffectiveness of fiscal decntralisation policies on debt sustainability is prevelant. Although Edgardo (2018) found that in Sub-Saharan Africa, fiscal decentralisation is associated with higher rates of macroeconomic stability (Edgardo *et al*, 2018), Sub-Saharan Africa in general has reported an underachievement as regards the effectiveness of fiscal decentralisation on the attainment of its main aims namely technical efficiency, equity and poverty alleviation (Dickovick & Wunsch, 2014).

Some sub-Saharan countries such as Kenya, which are moderately decentralised give statistics which typically agree with the conclusion that failure to achieve the aims intended for fiscal decentralisation are the result of limitations and restrictions on the decentralised entity concerning the transfer of funds from the central government, concerning revenue collection and concerning appropriate planning and legislation (IBRD, 2014).

5.5.2 Policy Implications

Similar to previous studies, this research analysed the nature of the sustainability of public debt in Kenya by investigating its relationship to the factors that most commonly influence it. However, besides the fact that it made use of the most current data and so provided updated information on the relationships between public debt sustainability and its explanatory variables namely: interest-growth rate differential as well government primary balance, it differed from past studies in the following ways. It first established the technical efficiency of sustainable public debt in Kenya. This research related public debt sustainability to fiscal decentralisation in the country by establishing the most apt level of sustainable public debt and went on to assess the extent to which

this level was attained over the years as variations in fiscal decentralisation took place. This was seen as the knowledge gap that the research set out to cover.

This information can be helpful for making of fiscal decentralisation policies that are based on updated information. Being derived from updated data, such policies are bound to be more relevant and effective for implementation. Policy makers could find these results useful in improving the implementation of fiscal decentralisation. From the findings on the specific objectives of this study, the following may be useful to the policy makers and other parties interested in fiscal decentralisation and in public debt sustainability. First, since the decentralisation of revenue collection in Kenya does not promote the achievement of optimal sustainable public debt this facet of devolution should not be a central pillar in the devolution process if the sustainability of public debt is a joint goal to be achieved. However, it is worthwhile to note that currently there are serious limitations on the ability of county governments to collect revenue for themselves (Cabral, 2011). A knowledge gap still exists with regard to how an improvement in revenue collection by the county governments would affect the technical efficiency of attainment of an optimum level of sustainable public debt. Given that this study established that that the effect of optimal sustainable public debt on revenue decentralisation was not significant, it may be possible that if revenue collection methods were to be improved, different results may be obtained with regard to the effect of the decentralisation of revenue collection on the technical efficiency of sustainable public debt. Second, the study arrived at the conclusion that the decentralisation of expenditure negatively affects the ability the country to achieve its optimal level of sustainable public debt; this study therefore recommends that this element of devolution cannot be relied upon for efficiently attaining an optimum level

of sustainable public debt when making decisions on the manner of fiscal decentralisation.

Overall therefore decentralisation of expenditure and revenue should be done with reservation if policy is aimed at attaining technical efficiency of sustainable public debt for the country. Although this is true, it must be added that the effect both of the two forms of decentralisation have on the technical efficiency of sustainable public debt is not as large as the effect fiscal transfers has. Therefore, one other recommendation of this study is that in order to improve the technical efficiency of sustainable public debt, fiscal transfers from the central government to the counties should be encouraged as they significantly improve the attainment of technical efficiency of sustainable public debt.

Overall therefore, decentralisation of expenditure and revenue should be done with reservation if policy is aimed at attaining optimum sustainable public debt because these forms of decentralisation reverse the attainability of the optimal public debt position for the country. Although this is true, it must be added that the effect both two forms of decentralisation have on the attainability of optimal sustainable debt is not as large as the effect fiscal transfers has. Therefore, the last recommendation of this study is that in order to improve the sustainability of public debt and move it towards its optimal position, fiscal transfers from the central government to the counties as a percentage of the government's development budget should be encouraged. Fiscal transfers significantly improve the attainment of the optimal level of sustainable public debt.

5.5.3 Knowledge Contribution

From the findings, discussions and conclusion, the study contributes to the existing pool of knowledge in public policy in the area of devolution and in the area of fiscal

decentralisation in particular. The existing literature on this subject makes the following general observations. First, the level of public debt globally has generally risen in the past decade (Belguith & Omrane, 2017). Even so, different countries have been able to sustain their levels of debt depending on their growth profile, the credibility and quality of the relevant institutions that set in place to deal with the developing or implementing public debt policy (Sow & Razafimahefa, 2017). Second, when incurring public debt, the people of less developed countries aim at the reduction or elimination of poverty, inequality and unemployment accompanying the growth in the Gross Domestic Products of their economies (Todaro & Smith, 2012). However, the less developed countries have experienced a continuous fall in standards of living brought about by persistent poverty, inequality and unemployment (Makau *et al*, 2018). Third, Public debt is said to be sustainable when the indebted government is able to meet its debt financial obligations without having to resort to unfeasible or undesirable policies (Debrun*et al*, 2019). In most cases, a country's solvency or ability to pay will depend primarily on its government's level of income. The sustainability of public debt and the ability to hold this sustainability at its optimal level therefore ultimately boils down to the debt–to– income ratio (Alesinay & Passalacquaz, 2015). Fourth, for Sub-Saharan Africa, the best form of debt management begins with the restriction of the level of debt to meet the first condition of remaining solvent (Martner and Tromben, 2004). Fifth, in Kenya, the current debt-carrying capacity is evaluated as medium although her risk of debt vulnerability is considered as being high. (Fedelino *et al*, 2021).

Ultimately, the overall observed effect for Kenya has been that of increasing the public debt at an increasing rate. The result was a deterioration of the degree of sustainability of public debt in the country moving it away from its most efficient position. Kenya's total public debt-to-GDP ratio rose to 66.00 in 2021, up from 39.80 in 2013 (Cytonn,

2020). It is for this reason that Nakatani (2022) suggests a cautious approach to fiscal decentralisation. Particularly when the effects of revenue decentralisation are considered separately from those of expenditure decentralisation. According to Nakitani (2022), the effects of revenue decentralisaton contrast with those of expenditure decentralisation such that the negative effects of expenditure decentralisation exceed the positive effects of revenue decentralisation. Overall Nakitani concludes that fiscal decentralisation leads to a more sustainable public debt (Nakatani, 2022).

Similar to these previous studies, this research analysed the nature of the sustainability of public debt by investigating its relationship with the factors that most commonly influence it as shown in devolution literature. However, besides analysing the most current data and so providing updated information on the relationships between public debt sustainability and its explanatory variables, the study added to the aforegoing observations in literature in the following ways.

Firstly, it established the level of most technically efficient sustainable public debt level in Kenya. This could be considered as a more appropriate criterion of determining a country's debt-carrying capacity than just the debt sustainability level. This due to the fact that the technical efficiency of sustainable public debt lets one judge better the sensitivity of debt management policy on the burden of public debt.

Secondly, it established the degree to which the technical efficiency of the optimal public debt was achieved at varied fiscal decentralisation levels in the country in the same period. The findings were that increases in expenditure decentralisation may have a worsening effect on the technical efficiency of achieving an optimum level of sustainable public debt in Kenya. On the other hand, for revenue decentralisation, there

was no statistical basis for a conclusion to be made as to its effect on the technical efficiency of sustainable public debt in the country. On the other hand, increases in fiscal transfers from the central government to the county governments improved the technical efficiency.

This study in effect established the most apt level of sustainable public debt and went on to assess the extent to which this level was attained over the years in relation to the variations in fiscal decentralisation that took place. It thus established a basis by which the country could gauge its debt carrying ability. This is important for future debt management procedures.

5.5.4 Suggestions for Further Research

Having established that the technical efficiency of the sustainable public debt is enhanced by fiscal transfers from the central government to the county governments this study recommends that future research could deliver further insight if it examined the effect on the technical efficiency of sustainable public debt of the different forms of fiscal transfers used in the country. These include: The Constituency Bursary Fund, The Roads

Maintenance Levy Fund, The Rural Electrification Levy Fund, The Women Enterprise Fund, the National Development Fund for Persons with Disability and the Poverty Eradication Fund among others. This could lead to the understanding of which of the methods of fiscal transfers that are used by the central government best suits the process of reducing vertical financial disparities in a fiscally decentralised system of government while at the same time leaving the public debt sustainable.

Secondly, this study measured the levels of fiscal decentralisation using the sub-national government revenue relative to (as a percentage of) the total central

government revenue; and the sub-national government expenditure relative to (as a percentage of) the central government spending. These measures focused on the total general size of the central government that is directly responsible for the technical efficiency of attaining optimal sustainable public debt. These measures of revenue decentralisation and expenditure decentralisation did not detect the extent to which Kenya's county governments actually possess the discretion over the functions of revenue collection and expenditure. This predisposition was taken in line with current studies on fiscal decentralisation that generally assume that the lower tiers of government (such as the counties in the case of Kenya) are given full autonomy power over the collection of revenue and its expenditure within their geographical areas of jurisdiction. They assume that the lower tier governments in a decentralised economy have the full discretion to decide their own budgets without interventions from the central government. In anlysing the effect of fiscal decentralisation on the technical efficiency of sustaining public debt, future studies could focus on factoring in the need, to determine the extent to which the county governments effectively determine their own revenues and expenditures, as pointed out by Golen in 2010. This would give a common base to both revenue decentralisation and expenditure decentralisation and would also indicate the direct influence that the subnational units have on the decentralisation of revenues and expenditures (Golem, 2010).

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APPENDICES

Appendix 1: Sampled Studies on Fiscal Decentralisation

Study Author	Data sample	Measure of Decentralisation	Measure of Government Size
Oates (1985)	43 countries, 1982 48 contiguous USA states, 1977	Central government revenues/expenditures as a share of total government revenues/expenditures State government revenues/expenditures as a share of state and local government revenues/expenditures The absolute number of local government units in a state	Total government revenues as a share of GDP State and local tax revenues as a share of personal income
Nelson (1986)	49 USA states, the 1976/77 fiscal year	State government tax revenues as a share of total state and local tax revenues The 1975 population of testate divided by the number of counties within the state	State and local government tax revenues per capita/per state personal income
Marlow (1988)	USA, 1946-1985	State and local government expenditures as a share of total government expenditures	Total government expenditures as a share of GNP
Forbes and Zampelli (1989)	157 USA SMSAs (345 counties), 1977	Total number of county governments in a SMSA	County government revenue per capita/per personal income County government own revenue per capita/per personal income
Grossman and West (1994)	Canada, 1958-1987	Provincial and local government own-purpose expenditures as a share of total government expenditures	Total/federal/provincial and local expenditures as a share of GNP
Feld, Kirchgassner and	26 Swiss cantons, 1980-1998	Local government revenues a share of state and local government revenue	Cantonal and local government revenue(income, property, profit and capital

Schaltegger (2003)		Total number of communes in a canton per capita	tax as well as user charges) per capita
Prohl and Schneider (2009)	29 countries, 1978-2003	Sub-national government expenditures/revenues as a share of general government expenditures/revenues The Prohl and Schneider(2009) fiscal federalism index	Total government expenditures/revenues a share of GDP

Source: Silvia Golem, 2010

Appendix 2: Kenya Counties and former Provinces

CountyCode	County	Former District
01	Mombasa	Mombasa District
002	Kwale	Kwale District
003	Kilifi	Kilifi District
004	Tana River	Tana River District
005	Lamu	Lamu District
006	Taita Taveta	Taita-Taveta District
007	Garissa	Garissa District
008	Wajir	Wajir District
009	Mandera	Mandera District
010	Marsabit	Marsabit District
011	Isiolo	Isiolo District
012	Meru	Meru District
013	Tharaka-Nithi	Tharaka-Nithi District
014	Embu	Embu District
015	Kitui	Kitui District
016	Machakos	Machakos District
017	Makueni	Makueni District
018	Nyandarua	Nyandarua District
019	Nyeri	Nyeri District
020	Kirinyaga	Kirinyaga District
021	Murang'a	Murang'a District
022	Kiambu	Kiambu District
023	Turkana	Turkana District
024	West Pokot	West Pokot District
025	Samburu	Samburu District
026	Trans-Nzoia	Trans Nzoia District
027	Uasin Gishu	Uasin Gishu District
028	Elgeyo-Marakwet	Elgeyo-Marakwet District
029	Nandi	Nandi District
030	Baringo	Baringo District
031	Laikipia	Laikipia District
032	Nakuru	Nakuru District
033	Narok	Narok District
034	Kajiado	Kajiado District
035	Kericho	Kericho District
036	Bomet	Bomet District

037	Kakamega	Kakamega District
038	Vihiga	Vihiga District
039	Bungoma	Bungoma District
040	Busia	Busia District
041	Siaya	Siaya District
042	Kisumu	Kisumu District
043	Homa Bay	Homa Bay District
044	Migori	Migori District
045	Kisii	Kisii Central
046	Nyamira	Mutomo District
047	Nairobi County	

KEY: *County numbers are as indicated on the table are shown in brackets*

Coast province: Mombasa [1], Kwale [2], Kilifi [3], Tana River [4], Lamu [5], Taita Taveta [6];
North Eastern province: Garissa [7], Wajir [8], Mandera [9];
Eastern province: Marsabit [10], Isiolo [11], Meru [12], Tharaka Nithi [13], Embu [14], Kitui [15], Machakos [16], Makueni [17];
Central province: Nyandarua [18], Nyeri [19], Kirinyaga [20], Murang'a [21], Kiambu [22];
Rift Valley province: Turkana [23], West Pokot [24], Samburu [25], Trans Nzoia [26], Uasin Gishu [27], Elgeyo Marakwet [28], Nandi [29], Baringo [30], Laikipia [31], Nakuru [32], Narok [33], Kajiado [34], Kericho [35], Bomet [36];
Western province: Kakamega [37], Vihiga [38], Bungoma [39], Busia [40];
Nyanza province: Siaya [41], Kisumu [42], Homa Bay [43], Migori [44], Kisii [45], Nyamira [46];
**Nairobi province**: Nairobi [47]
Source: Kenya Bureau of statistics, 2021

Appendix 3: SSA Comparison of Growth and Public Debt-to-GDP Ratio

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Algeria	1964 -2012	4.26	5.61	4.62	3.15
Angola	2000 - 2012	17.25	9.23	8.92	3.08
Benin	2000 - 2012	4.01	4.07	-	-
Botswana	1998 -2012	4.21	-	-	-
Burkina Faso	2002 - 2012	5.60	6.33	-	-
Burundi	2000 - 2012	-	3.86	-	2.69
Cameroon	2000 - 2012	3.31	2.30	4.08	-
Cape Verde	2002 - 2012	-	-	6.00	4.66
Central African Republic	2000 - 2012	2.38	3.71	2.56	-0.06
Chad	1999 - 2012	0.00	9.29	4.40	-
Comoros Islands	2000 - 2012	-	1.91	2.46	-1.18
Côte d'Ivoire	1970 - 2012	6.10	8.78	0.98	1.15
Democratic Republic of Congo (Brazaville)	2000 - 2012	-	7.05	-	4.23
Djibouti	2003 - 2012	-	4.29	-	-
Egypt	1970 -2012	3.80	6.71	5.66	4.33
Equatorial Guinea	1980 - 2012	12.02	43.68	31.70	7.52
Eritrea	2000 - 2012	-	-	-	2.36
Ethiopia	1992 - 2012	8.14	11.51	0.81	6.68
Gabon	1990 - 2012	3.88	3.88	-0.10	2.86
Gambia	2000 - 2012	-	-	4.17	4.82
Ghana	1952 - 2012	-1.20	3.60	5.18	4.78
Guinea	1990 - 2012	-	3.94	3.01	3.40
Guinea Bissau	2000 - 2012	-	2.45	-	1.91
Kenya	1963 - 2012	6.27	4.33	3.08	1.22
Lesotho	1988 - 2012	8.09	4.75	5.14	2.14
Liberia	2000 - 2012	8.12	6.12	-	1.47
Libya	1990 - 2012	10.15	3.36	-1.48	-0.79
Madagascar	1990 - 2012	-	2.63	4.60	2.00
Malawi	2002 - 2012	-	5.96	-	3.83
Mali	2000- 2012	4.96	3.64	4.29	-
Mauritania	2000 - 2012	-	-	8.87	3.70
Mauritius	1970 - 2012	9.05	4.57	4.42	-
Morocco	1965 - 2012	4.92	4.48	4.05	5.82
Mozambique	1999 - 2012	-	7.29	8.00	7.38
Namibia	1993 - 2012	3.69	-	-	-
Niger	1995 - 2012	5.06	11.24	4.88	2.93
Nigeria	1970 - 2012	5.80	8.38	3.73	2.54
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	5.34	7.47	6.15	-1.33
Rwanda	1995 - 2012	7.97	-	9.96	10.31
São Tomé and Príncipe	2001 - 2012		5.88	4.37	5.71
Senegal	2000 - 2012	3.69	4.40	2.81	-
Seychelles	1990 - 2012	-	-	5.18	1.45
Sierra Leone	2000 - 2012	-	7.69	-	10.90
South Africa	1950 - 2012	2.55	3.41	-	-
Sudan	1992 - 2012	-	-	5.37	10.75
Swaziland	1993 - 2012	2.44	-	-	-
Tanzania	2002 - 2012	7.29	6.93	-	-
Togo	2001- 2012	-	4.63	1.94	-
Tunisia	1990 - 2012	-	4.22	4.56	-
Uganda	1997 - 2012	7.23	4.62	6.88	7.10
Zambia	1990 - 2012	6.61	-	5.34	1.81
Zimbabwe	1965 - 2012	-	3.95	1.31	-7.99
Average		5.72	6.39	5.08	3.44
Median		5.20	4.62	4.42	3.08
Observations	1142	235	337	233	337

Source: Veiga *et al*, 2014

Appendix 4: Kenya's Budget 2012 to 2022
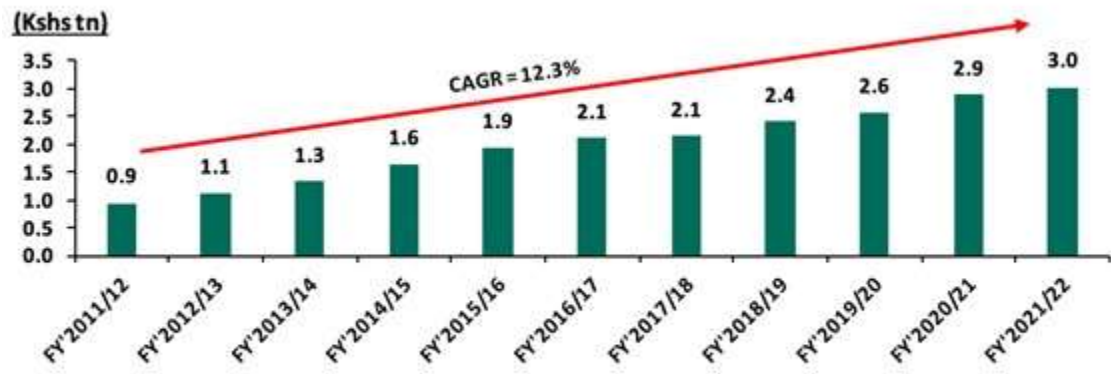
Source: Cyton, 2022

Appendix 5: County Revenue Collection 2013-2021

YEAR	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	(Kshs.)	(Kshs.)	(Kshs.)	(Kshs.)	(Kshs.)	(Kshs.)	(Kshs.)	(Kshs.)
Baringo	201,519,606	249,723,429	279,317,203	288,518,677	301,404,377	359,321,520	301,660	205,203,689
Bomet	200,949,332	206,386,334	166,987,287	236,697,038	181,375,343	205,476,390	201,510	183,008,302
Bungoma	182,702,280	504,623,643	630,988,485	661,588,149	656,750,139	788,333,189	777,460	395,118,238
Busia	328,993,569	315,202,075	334,222,084	256,826,239	176,294,585	292,732,697	225,830	322,558,227
Elgeyo/Marakwet	61,001,213	128,905,771	128,055,734	97,323,973	105,483,195	141,856,503	131,960	69,075,375
Embu	168,486,515	401,105,103	396,525,612	416,272,247	416,111,597	629,429,825	509,650	375,326,291
Garissa	35,892,845	130,717,649	105,943,675	81,958,151	86,687,563	108,297,434	109,920	103,525,792
Homa Bay	134,985,390	157,860,245	183,765,405	144,131,692	106,939,465	101,968,000	274,600	120,412,567
Isiolo	125,064,066	133,699,318	110,108,172	94,996,063	114,557,116	161,767,322	122,080	57,181,282
Kajiado	453,371,648	785,837,768	650,984,978	557,094,069	682,162,558	1,076,698,544	616,800	862,288,151
Kakamega	325,216,300	516,889,024	504,238,292	443,176,020	440,611,031	858,335,582	1,180,810	1,118,235,983
Kericho	371,395,186	413,581,432	434,404,563	489,980,629	414,048,710	473,978,400	473,730	595,976,653
Kiambu	1,246,683,890	2,110,856,557	2,461,351,513	2,032,980,758	1,693,708,234	2,742,223,118	2,466,260	2,425,245,161
Kilifi	459,575,703	545,499,050	519,075,625	620,093,575	523,347,190	792,493,811	788,780	833,845,292
Kirinyaga	200,373,963	311,635,045	390,377,140	320,638,299	343,970,322	432,638,447	374,740	346,521,599
Kisii	250,147,453	296,771,415	306,129,638	271,644,380	256,284,854	342,646,690	333,150	403,001,860
Kisumu	621,861,798	970,903,407	978,889,261	1,004,043,906	874,901,775	842,816,398	804,350	822,299,848
Kitui	255,241,581	320,521,294	416,188,728	315,347,364	335,122,477	440,523,923	408,290	326,450,311
Kwale	208,454,345	253,972,260	248,617,586	221,011,186	276,295,129	315,025,181	254,450	250,090,346
Laikipia	347,118,457	400,484,744	471,147,987	462,723,251	413,328,186	815,790,157	727,960	840,396,632
Lamu	35,566,589	61,672,255	57,324,400	76,960,788	55,286,688	81,837,327	108,910	108,433,650
Machakos	1,175,227,171	1,356,559,888	1,121,680,950	1,259,304,944	1,063,726,784	1,557,229,789	1,376,170	1,296,364,668
Makueni	189,187,741	215,349,954	213,170,805	216,257,976	319,282,234	511,702,072	644,480	527,527,341
Mandera	90,068,630	87,729,461	88,234,634	55,843,625	61,813,295	94,234,580	124,960	143,313,898
Marsabit	46,032,691	99,107,465	111,943,205	128,730,136	83,390,480	124,104,970	126,710	110,368,253

Meru	343,805,963	539,239,910	548,289,334	552,668,157	441,690,937	550,089,828	383,300	435,932,406
Migori	238,630,499	355,111,556	339,368,968	290,815,303	222,251,290	376,224,761	305,690	288,535,155
Mombasa	1,716,054,436	2,492,600,145	2,943,520,686	3,166,240,961	3,159,156,334	3,705,398,047	3,260,010	3,314,532,178
Murang'a	419,989,717	562,227,534	617,526,359	506,685,732	453,706,818	704,030,420	580,300	627,164,598
Nairobi City	10,026,171,804	11,500,049,480	11,710,008,300	10,929,830,353	10,109,419,494	10,248,425,385	8,715,070	9,958,038,681
Nakuru	1,816,532, 538	2,200,279, 602	2,295,462, 842	1,548,294, 999	2,278,646, 064	2,814,628, 525	2,551,210	1,628,821, 37
Nandi	130,536,752	298,042,483	236,898,601	244,730,757	197,886,883	208,345,024	283,190	261,039,027
Narok	1,538,560,899	1,639,205,710	1,752,937,952	1,533,933,960	2,188,436,615	3,122,383,660	2,345,480	618,992,783
Nyamira	94,025,895	104,254,684	106,981,969	93,920,087	96,617,045	165,447,570	185,570	162,863,880
Nyandarua	138,439,331	240,629,472	279,226,186	296,766,563	318,585,599	403,402,541	379,480	408,718,259
Nyeri	432,229,360	680,700,067	709,554,435	643,139,153	760,225,951	819,811,673	664,860	886,892,734
Samburu	201,001,447	195,715,348	166,836,134	187,663,504	257,292,957	243,861,101	215,670	70,378,827
Siaya	99,771,315	143,328,488	127,931,767	172,837,124	139,336,798	189,668,022	179,430	332,883,061
Taita/Taveta	126,861,698	216,603,678	172,765,506	172,017,112	193,595,795	332,712,552	296,040	302,005,400
Tana River	31,556,087	33,033,490	28,405,081	27,417,024	56,625,198	62,648,714	64,470	83,075,805
Tharaka - Nithi	85,372,943	115,729,722	139,130,083	78,569,191	126,606,742	245,317,160	270,150	254,745,602
Trans Nzoia	201,655,713	301,267,105	364,970,035	217,893,803	246,062,902	370,824,751	356,080	340,453,746
Turkana	132,882,771	126,524,507	134,015,965	186,316,769	143,896,898	175,028,751	176,230	209,830,607
Uasin Gishu	563,669,444	800,823,542	719,042,325	663,830,778	819,220,211	918,942,252	779,330	1,105,676,540
Vihiga	123,302,433	115,939,226	138,938,281	96,033,000	143,530,752	177,233,290	148,200	169,109,802
Wajir	61,032,930	107,742,634	81,782,275	75,908,720	67,608,475	60,123,112	60,420	73,955,722
West Pokot	58,887,573	103,899,329	98,305,114	83,218,907	88,411,177	118,824,134	107,180	68,866,910
Total	26,296,089,510	33,848,542,299	35,021,571,159	32,522,875,093	32,491,694,261	40,304,833,142	35,772,580	34,444,282,669

Source: KNBS, 2013 - 2021

Appendix 6: County Expenditure 2013-2021

YEAR	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
Baringo	2,810,730,985	4,161,116,867	4,688,560,000	5,214,390,000	5,202,361,751	5,552,683,315	6,323,674,608	4,595,957,071
Bomet	3,552,909,534	4,413,415,793	5,070,830,000	4,814,540,000	4,947,942,666	6,883,884,430	6,212,596,854	5,642,201,668
Bungoma	4,160,879,324	7,144,801,262	8,274,800,000	7,992,180,000	8,630,658,699	9,570,948,730	10,815,861,232	11,393,630,404
Busia	2,472,864,986	4,996,463,819	5,865,760,000	5,881,400,000	5,808,443,802	6,648,660,955	6,751,248,724	7,474,457,173
Elgeyo/Marakwet	1,713,649,370	3,387,398,251	2,928,520,000	3,964,680,000	3,869,950,000	4,427,596,370	4,343,251,132	4,764,442,587
Embu	2,745,450,987	3,802,946,285	3,957,160,000	5,759,240,000	5,062,390,666	5,913,261,077	5,163,468,567	5,227,192,077
Garissa	2,169,311,140	6,596,270,167	6,546,400,000	7,123,690,000	6,519,327,288	8,990,680,175	8,385,320,325	8,466,199,360
Homa Bay	4,032,521,427	5,279,133,188	5,776,120,000	5,737,180,000	5,145,499,789	5,738,111,128	7,188,263,930	7,456,289,311
Isiolo	2,068,049,447	2,845,475,390	3,246,130,000	3,466,450,000	3,390,332,791	4,279,137,943	5,052,297,266	4,388,740,162
Kajiado	2,826,016,705	4,533,109,097	5,140,370,000	5,061,920,000	5,121,805,274	7,726,842,472	7,229,574,721	8,888,720,921
Kakamega	5,218,632,876	7,487,335,023	9,852,290,000	10,845,120,000	10,544,003,459	12,178,304,743	12,524,601,840	12,610,307,850
Kericho	2,811,151,764	4,280,705,575	4,812,320,000	5,600,720,000	5,176,527,480	6,131,869,521	6,499,890,001	6,140,297,306
Kiambu	6,682,789,998	8,766,062,308	10,427,290,000	10,811,570,000	10,763,617,821	14,260,249,607	14,974,642,946	13,635,818,026
Kilifi	4,013,172,293	7,522,315,167	8,469,370,000	10,184,220,000	9,528,205,830	9,641,716,662	11,324,626,036	11,508,204,654
Kirinyaga	1,801,872,833	3,184,966,073	4,140,550,000	4,246,580,000	4,593,335,506	5,164,155,761	4,769,716,018	5,597,315,743
Kisii	4,768,837,893	6,538,292,744	7,940,450,000	7,985,610,000	8,582,978,655	9,561,759,161	9,444,226,902	9,779,271,222
Kisumu	4,526,461,462	5,757,542,162	6,439,960,000	6,837,850,000	6,427,689,758	8,378,752,507	9,120,604,955	9,253,365,407
Kitui	3,441,897,729	6,901,263,422	7,870,620,000	8,314,600,000	9,126,607,936	9,867,656,342	10,011,080,965	10,510,465,660
Kwale	2,929,287,013	4,476,661,899	5,801,270,000	5,860,630,000	6,588,072,610	7,694,574,291	8,899,511,299	9,745,959,346
Laikipia	2,628,711,608	3,389,807,898	3,994,110,000	4,710,670,000	4,802,676,874	5,710,290,375	5,403,613,790	5,826,533,448
Lamu	729,046,399	1,717,019,590	2,505,460,000	1,993,560,000	2,061,017,595	2,902,228,666	3,052,495,707	3,117,959,113
Machakos	6,069,062,423	7,085,394,848	8,328,650,000	9,148,790,000	7,402,380,000	11,652,592,143	9,461,865,339	10,956,691,593
Makueni	3,139,886,712	4,383,932,845	5,505,730,000	8,922,500,000	7,194,783,364	8,436,546,115	8,603,310,374	9,235,438,497
Mandera	3,464,067,241	9,019,754,392	9,552,460,000	10,196,940,000	9,536,834,566	12,041,768,445	11,550,317,338	11,672,314,270
Marsabit	2,508,093,389	4,387,988,225	5,278,740,000	6,141,490,000	6,567,655,420	7,467,697,766	7,166,347,658	7,203,307,455
Meru	3,822,661,756	6,253,441,343	6,211,580,000	8,344,020,000	6,800,382,251	9,780,472,891	9,462,136,105	10,073,355,450
Migori	4,247,332,907	4,763,261,190	5,873,040,000	5,818,790,000	5,933,702,084	6,367,053,942	6,600,145,196	7,334,564,159

Mombasa	5,209,822,896	7,717,426,250	8,545,040,000	9,133,630,000	10,301,855,116	12,529,114,701	10,795,462,690	11,531,272,052
Murang'a	3,855,330,990	5,419,338,904	6,046,820,000	6,432,310,000	6,568,128,822	7,161,417,906	7,410,604,469	7,718,183,539
Nairobi City	17,774,928,454	21,022,564,017	23,951,020,000	24,858,640,000	24,541,532,416	29,398,171,029	23,353,435,308	30,135,645,468
Nakuru	5,863,995,855	8,203,821,085	10,385,610,000	10,663,210,000	9,553,738,353	10,136,907,720	14,078,804,748	13,879,300,928
Nandi	2,423,755,352	4,687,017,805	4,994,580,000	5,300,800,000	4,796,043,880	6,726,989,905	6,084,086,626	6,957,055,964
Narok	4,232,737,427	6,658,956,907	7,238,910,000	7,473,960,000	8,249,563,520	9,960,207,298	10,631,366,512	8,872,763,356
Nyamira	2,406,916,693	3,639,435,865	4,317,690,000	4,501,600,000	4,231,119,328	5,602,349,236	5,772,173,922	5,745,978,988
Nyandarua	2,889,765,287	3,932,375,067	4,874,850,000	4,963,020,000	4,544,715,052	5,475,874,023	6,572,793,883	6,662,333,256
Nyeri	4,274,564,744	4,815,225,000	4,965,450,000	5,685,090,000	5,646,340,567	7,045,398,473	7,381,649,121	7,750,919,947
Samburu	2,090,555,944	3,282,827,896	3,659,640,000	4,167,400,000	3,587,022,007	4,183,009,897	5,064,078,464	5,230,213,013
Siaya	2,462,908,040	4,171,559,804	4,933,300,000	5,630,160,000	4,111,030,339	5,702,239,901	6,870,485,746	6,951,774,493
Taita/Taveta	2,010,889,182	3,506,908,844	3,462,230,000	3,385,030,000	3,337,559,347	5,066,791,654	4,439,998,645	5,345,346,158
Tana River	1,325,029,179	2,351,204,627	3,865,020,000	3,546,370,000	3,176,890,422	4,792,063,129	8,159,350,352	4,677,455,784
Tharaka -Nithi	2,198,133,441	2,704,669,179	2,696,240,000	2,773,840,000	3,650,798,158	4,602,549,597	4,213,479,284	4,934,885,916
Trans Nzoia	3,021,643,466	4,091,276,905	5,333,330,000	6,004,440,000	4,215,196,185	6,387,939,881	6,318,225,907	7,407,518,718
Turkana	3,409,318,999	9,015,129,381	10,159,960,000	11,191,410,000	8,130,907,780	10,349,110,728	12,351,693,452	12,209,888,148
Uasin Gishu	2,732,564,439	5,537,473,208	6,212,300,000	5,594,560,000	6,329,252,789	6,745,257,261	8,099,769,807	8,281,247,912
Vihiga	2,486,940,458	3,505,769,668	3,008,250,000	3,718,680,000	2,705,377,042	5,699,066,956	4,886,427,459	5,713,490,864
Wajir	4,429,045,221	6,573,111,101	7,767,050,000	8,248,190,000	6,414,549,695	10,381,365,278	9,618,405,692	9,245,952,757
West Pokot	2,898,163,654	4,086,170,985	4,350,600,000	4,804,090,000	4,409,880,000	5,519,414,979	5,351,181,446	6,263,869,950
Total	169,352,359,923	257,998,137,321	295,297,450,000	319,055,800,000	303,830,684,752	376,434,735,086	383,788,163,360	398,014,097,144

Source: KNBS, 2013 - 2021

Appendix 7: County Fiscal Transfers 2013-2021

YEAR	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
Central Gvt Development Budget	1,300,000,000,000	1,600,000,000,000	1,900,000,000,000	2,100,000,000,000	2,100,000,000,000	2,400,000,000,000	2,600,000,000,000	2,900,000,000,000
Baringo	3,281,383,323	3,926,106,431	4,656,934,428	5,233,961,425	5,549,975,184	5,827,026,254	5,346,126,671	6369394592
Bomet	3,473,870,878	4,162,524,827	4,909,906,160	5,408,349,433	5,709,103,301	6,623,843,955	5,888,307,950	6691099118
Bungoma	6,271,462,041	6,783,170,481	8,029,195,903	8,876,380,198	9,430,278,865	10,120,206,226	9,559,282,453	10659435192
Busia	3,463,379,155	4,799,492,252	5,668,513,352	6,256,557,033	6,894,545,788	6,734,461,089	6,380,802,839	7172162009
Elgeyo Marakwet	2,413,729,091	2,894,583,377	3,471,543,872	3,823,933,460	3,978,773,535	4,468,666,793	4,168,579,087	4606532480
Embu	3,100,540,129	3,571,958,959	4,205,121,593	4,771,935,686	4,843,574,583	5,332,064,788	5,071,559,213	5125243762
Garissa	4,431,683,790	5,190,150,287	6,351,245,243	6,911,228,790	7,518,607,376	8,107,741,132	7,756,509,712	7927212254
Homa Bay	4,182,101,595	4,991,175,873	5,911,122,678	6,516,573,708	7,092,167,990	7,347,022,677	6,917,660,883	7805353300
Isiolo	2,247,835,837	2,682,961,881	3,199,678,723	3,537,827,614	4,081,810,947	4,448,645,119	4,582,738,856	4710388265
Kajiado	3,253,239,859	3,890,104,860	4,650,358,927	5,215,256,318	6,198,702,283	6,868,668,078	6,858,827,932	7954768229
Kakamega	6,931,155,657	8,090,604,228	9,646,227,641	10,703,578,916	11,062,919,682	12,151,853,991	11,364,377,058	12389412168
Kericho	3,353,059,897	3,973,438,352	4,748,554,101	5,252,797,896	5,656,013,322	6,462,014,445	5,851,807,047	6430664924
Kiambu	5,980,601,386	6,707,156,605	8,207,917,647	9,264,204,773	10,927,610,972	12,743,464,400	11,685,344,546	11717525720
Kilifi	5,518,308,482	6,574,938,022	7,842,163,405	8,563,981,588	10,650,268,698	12,071,640,899	10,968,181,930	11641592941
Kirinyaga	2,621,282,589	3,122,463,813	3,727,560,086	4,159,808,773	4,876,384,036	4,667,131,239	4,672,393,818	5196177952
Kisii	5,487,250,383	6,361,766,497	7,772,145,310	8,664,058,165	8,592,553,305	9,188,768,347	8,681,167,050	8894274509
Kisumu	4,615,876,577	5,262,002,848	6,324,406,000	6,994,542,675	7,369,015,486	8,668,928,630	8,002,954,342	8026139240
Kitui	5,348,827,428	6,407,041,897	7,583,499,487	8,389,946,573	9,340,897,458	9,642,235,292	9,366,103,294	10393870413
Kwale	3,788,132,670	4,531,614,262	5,405,264,065	5,986,544,213	7,781,601,282	8,250,731,235	8,277,600,796	8265585516
Laikipia	2,557,539,642	3,037,429,843	3,651,034,608	4,104,689,637	4,954,234,811	4,849,785,160	4,443,200,058	5136265679
Lamu	1,509,775,102	1,802,318,513	2,172,952,802	2,509,540,339	2,756,251,476	4,035,239,884	2,900,546,366	3105649643
Machakos	5,114,071,345	6,134,394,187	7,346,493,531	8,166,790,848	8,376,122,984	10,348,955,784	9,241,732,805	9162304232
Makueni	4,403,546,303	5,255,759,064	6,234,615,763	6,857,630,551	7,606,334,087	8,201,942,271	7,877,135,250	8132783562
Mandera	6,569,847,929	7,851,533,937	9,224,728,949	10,084,615,714	10,354,026,318	11,281,577,308	10,376,501,495	11190382598
Marsabit	3,805,077,542	4,554,700,287	5,363,688,014	5,861,348,668	7,021,526,717	7,823,178,728	6,896,898,151	7277004032
Meru	5,006,846,175	5,811,720,035	8,068,730,716	8,695,004,808	8,690,203,884	9,353,128,740	8,772,346,923	9493857338
Migori	4,339,034,161	5,178,050,161	6,179,702,331	6,742,468,649	6,996,366,222	7,820,468,252	7,485,532,833	8005020448
Mombasa	4,291,377,471	4,805,790,006	5,856,541,422	6,460,495,121	8,966,848,169	9,352,443,798	8,352,861,230	7567354061
Murang'a	3,964,995,471	4,733,688,227	5,605,841,727	6,224,115,350	6,717,512,470	6,825,658,407	6,754,270,617	7180155855
Nairobi	9,729,818,320	11,441,036,548	13,534,170,793	14,946,783,245	16,323,790,299	16,155,037,800	12,275,944,442	19249677414
Nakuru	6,647,425,748	7,503,232,007	8,909,150,835	9,841,244,944	10,330,202,245	11,705,865,445	11,835,626,599	13026116323
Nandi	3,513,121,827	4,196,573,747	4,958,627,028	5,469,004,415	5,566,010,582	6,059,176,633	5,887,466,815	6990869041

Narok	3,897,497,831	4,664,355,024	5,537,068,743	6,064,109,450	7,144,507,576	7,033,037,443	8,241,585,349	8844789456
Nyamira	3,081,787,287	3,684,498,196	4,358,048,612	4,831,602,226	5,119,041,340	5,392,141,405	5,181,195,051	5135340036
Nyandarua	3,176,663,544	3,797,904,157	4,490,760,352	4,936,245,833	5,438,755,918	5,851,792,816	5,206,042,897	5670444228
Nyeri	3,685,716,476	4,138,865,733	5,042,278,330	5,600,339,382	5,748,259,017	6,365,159,120	6,153,112,067	6228728555
Samburu	2,604,240,722	3,118,803,006	3,700,905,733	4,080,440,211	4,206,339,743	5,009,568,253	4,847,706,557	5371346037
Siaya	3,717,804,335	4,436,323,009	5,246,071,112	5,797,489,075	6,082,340,216	6,617,589,780	6,051,299,399	6966507531
Taita Taveta	2,443,413,498	2,922,341,963	3,488,332,869	3,842,745,714	4,264,020,622	4,594,827,610	4,577,484,533	4842174698
Tana River	2,921,556,211	3,495,601,069	4,137,496,801	4,627,810,651	5,713,763,880	6,022,998,660	6,006,330,570	6528408765
Tharaka Nithi	2,316,285,957	2,764,643,356	3,305,463,744	3,652,470,953	4,029,081,994	4,101,461,962	4,267,685,324	4214198593
Trans Nzoia	3,768,041,967	4,490,618,357	5,323,073,849	5,856,599,951	6,134,099,222	6,530,339,029	6,351,147,129	7186157670
Turkana	7,674,315,857	9,178,804,658	10,748,014,432	11,709,814,817	10,804,298,494	11,535,858,600	10,482,638,028	12609305994
Uasin Gishu	3,811,462,902	4,564,237,642	5,390,581,097	5,947,601,606	6,175,278,868	7,261,061,866	7,061,214,379	8068858318
Vihiga	2,860,896,942	3,420,828,036	4,054,531,396	4,470,649,135	4,843,027,689	5,221,923,141	5,198,851,298	5067356827
Wajir	5,311,159,775	6,355,760,549	7,470,850,704	8,159,999,887	8,716,567,070	9,418,866,978	8,474,445,051	9474726151
West Pokot	3,177,935,726	3,795,568,370	4,511,622,736	4,942,855,225	5,171,692,585	5,592,259,659	5,252,167,523	6297284329
Grand Total	195,664,976,833	231,058,635,439	276,222,737,650	305,015,973,642	331,805,308,591	360,086,459,121	337,853,294,216	369,999,899,998

Source: KNBS, 2013 – 2021

Appendix 8: Consolidated Data Summary

Year	Public Debt Ratio	Interest-growth Rate Differential	Primary Balance Ratio	Revenue Ratio	Expenditure Ratio	Fiscal Transfers Ratio
2013/14	44.20	0.25276	6.20000	8.96650	48.21002	0.32020
2014/15	45.50	-0.24296	9.30000	10.43569	59.64715	0.30730
2015/16	53.80	-0.06738	7.70000	9.71075	60.36397	0.30930
2016/17	57.60	-1.25612	8.90000	7.93133	55.11046	0.30900
2017/18	57.30	-0.12786	6.70000	7.35540	50.64314	0.33620
2018/19	62.40	-1.06927	7.60000	8.10117	55.39557	0.31920
2019/20	65.70	-6.85340	7.80000	0.00693	52.88291	0.27650
2020/21	69.00	-1.16214	8.40000	5.67299	49.84497	0.27150

Key:
Public Debt Ratio: County government Public debt (central government public debt apportioned to counties pro-rata population basis)
Interest-growth Rate Differential: Interest rate paid on total debt minus the GCP growth rate
Primary Balance Ratio: County government revenue minus the county government expenditure as a percentage Central government revenue minus the central government expenditure
Revenue Ratio: County government revenue as a percentage of central government total revenue
Expenditure Ratio: County government expenditure as a percentage of the central government total expenditure
Fiscal Transfers Ratio: Fiscal transfers from the national government to the county governments as a percentage of the central government development budget

Source: Data and Result Analysis, 2022

Appendix 9: Kenya, Gross County Product 2013-2021

	County	2013 /14	2014 /15	2015 /16	2016 /17	2017 /18	2018/19	2019 /20	2020/21
1	BARINGO	46,891	48,386	50,400	51,367	54,892	54,156	59,408	59,642
2	BOMET	81,679	84,159	89,594	100,563	105,326	114,440	114,113	121,387
3	BUNGOMA	128,112	137,418	135,686	137,119	146,373	153,325	157,087	156,999
4	BUSIA	51,755	53,215	55,030	57,305	58,501	61,840	68,915	71,153
5	ELGEYO MARAKWET	54,508	58,224	50,922	57,741	64,045	76,336	82,172	83,396
6	EMBU	104,661	98,989	99,604	110,211	108,828	118,065	114,651	121,412
7	GARISSA	33,954	35,368	36,644	42,138	42,731	46,838	47,872	50,092
8	HOMA BAY	78,299	81,646	82,188	82,970	86,344	92,641	93,771	93,235
9	ISIOLO	15,656	15,357	17,288	17,882	18,316	20,435	22,065	22,465
10	KAJIADO	89,215	93,688	97,111	107,864	106,773	116,223	124,728	126,633
11	KAKAMEGA	133,939	140,339	145,163	153,829	152,596	162,745	170,174	169,332
12	KERICHO	101,727	108,641	110,581	113,619	119,173	125,948	128,793	133,866
13	KIAMBU	358,143	375,967	398,008	417,022	427,146	435,641	457,744	453,872
14	KILIFI	130,301	136,278	145,327	148,001	153,129	158,516	167,516	163,818
15	KIRINYAGA	81,667	83,360	87,782	91,645	96,449	95,553	101,992	101,500
16	KISII	122,892	128,736	133,230	140,651	147,121	147,649	149,431	150,454
17	KISUMU	156,704	161,522	169,982	173,977	184,041	196,103	207,326	210,540
18	KITUI	76,037	82,708	87,402	82,015	87,429	94,953	103,534	102,772
19	KWALE	75,198	75,830	74,970	76,668	84,384	88,658	90,274	92,577
21	LAIKIPIA	53,235	54,250	61,119	67,322	66,294	70,913	73,628	74,155
21	LAMU	19,380	19,782	21,544	21,794	23,257	25,624	27,431	26,861
22	MACHAKOS	218,816	226,474	238,078	241,146	246,942	261,253	264,050	265,962
23	MAKUENI	67,069	68,953	74,800	77,054	78,146	85,563	92,088	88,687
24	MANDERA	31,039	30,875	33,342	34,630	35,361	39,675	43,228	47,699
25	MARSABIT	31,770	31,058	34,874	36,303	34,445	38,120	48,834	50,186
26	MERU	196,582	206,350	215,504	219,506	222,453	228,268	242,357	243,190
27	MIGORI	75,738	81,321	80,914	77,883	88,172	92,405	97,172	96,457
28	MOMBASA	317,699	330,391	342,291	360,607	382,064	399,119	416,151	402,373
29	MURANGA	129,266	135,675	138,092	141,567	137,995	144,211	147,170	153,219
30	NAIROBI	1,612,572	1,707,029	1,817,432	1,912,001	2,020,743	2,137,131	2,268,114	2,267,447
31	NAKURU	285,854	318,470	338,995	366,157	352,340	366,443	391,562	388,539
32	NANDI	92,775	98,632	100,916	107,119	108,127	118,134	115,286	117,952
33	NAROK	96,444	96,676	105,024	110,543	119,067	125,904	130,555	131,624
34	NYAMIRA	68,749	67,982	70,945	75,393	76,996	85,852	86,544	89,311
35	NYANDARUA	77,294	84,597	95,657	94,896	104,138	101,197	109,895	107,389
36	NYERI	128,188	135,428	143,708	146,313	145,284	149,998	160,715	164,267
37	SAMBURU	16,224	15,900	19,001	20,921	20,380	21,743	24,574	24,394
38	SIAYA	62,265	65,638	69,541	66,852	71,616	77,045	81,919	82,471
39	TAITA TAVETA	38,742	41,368	43,148	44,822	45,810	48,196	50,587	50,280
40	TANA RIVER	18,995	17,545	21,827	20,410	19,662	20,982	23,447	24,314
41	THARAKA NITHI	36,893	37,485	38,971	40,723	42,828	45,876	46,386	48,320
42	TRANS NZOIA	93,263	97,382	103,544	104,415	107,948	124,705	125,619	129,367
43	TURKANA	60,515	61,295	68,948	68,983	70,925	79,766	86,329	87,077
44	UASIN-GISHU	144,209	150,122	157,315	164,641	173,523	181,918	191,598	189,017
45	VIHIGA	50,474	49,977	50,869	54,064	54,465	59,406	62,186	62,636
46	WAJIR	29,602	28,170	34,235	35,965	37,222	38,279	40,935	41,150
47	WEST POKOT	40,965	42,887	47,587	52,040	48,660	52,795	57,534	61,784
	Total	6,015,951	6,301,542	6,635,134	6,926,656	7,178,460	7,580,588	7,967,464	8,001,274

Source: KNBS. 2022

Appendix 10: County Public Debt

County	Year	central Gvt debt (ksh billions)	Population 2019	county public debt (ksh)
Total			47,564,316	
Baringo	2013	44.2	666,763	619,601.56
Baringo	2014	45.5	666,763	637,825.14
Baringo	2015	53.8	666,763	754,175.66
Baringo	2016	57.6	666,763	807,444.57
Baringo	2017	57.3	666,763	803,239.13
Baringo	2018	62.4	666,763	874,731.62
Baringo	2019	65.7	666,763	920,991.47
Baringo	2020	69	666,763	967,251.31
Bomet	2013	44.2	875,689	813,749.82
Bomet	2014	45.5	875,689	837,683.64
Bomet	2015	53.8	875,689	990,491.87
Bomet	2016	57.6	875,689	1,060,452.26
Bomet	2017	57.3	875,689	1,054,929.07
Bomet	2018	62.4	875,689	1,148,823.28
Bomet	2019	65.7	875,689	1,209,578.36
Bomet	2020	69	875,689	1,270,333.44
Bungoma	2013	44.2	1,670,570	1,552,407.36
Bungoma	2014	45.5	1,670,570	1,598,066.39
Bungoma	2015	53.8	1,670,570	1,889,581.80
Bungoma	2016	57.6	1,670,570	2,023,046.69
Bungoma	2017	57.3	1,670,570	2,012,509.99
Bungoma	2018	62.4	1,670,570	2,191,633.91
Bungoma	2019	65.7	1,670,570	2,307,537.63
Bungoma	2020	69	1,670,570	2,423,441.35
Busia	2013	44.2	893,681	830,469.22
Busia	2014	45.5	893,681	854,894.78
Busia	2015	53.8	893,681	1,010,842.62
Busia	2016	57.6	893,681	1,082,240.43
Busia	2017	57.3	893,681	1,076,603.76
Busia	2018	62.4	893,681	1,172,427.13
Busia	2019	65.7	893,681	1,234,430.49
Busia	2020	69	893,681	1,296,433.84
Elgeyo Marakwet	2013	44.2	454,480	422,333.75
Elgeyo Marakwet	2014	45.5	454,480	434,755.33
Elgeyo Marakwet	2015	53.8	454,480	514,062.35
Elgeyo Marakwet	2016	57.6	454,480	550,371.59
Elgeyo Marakwet	2017	57.3	454,480	547,505.07
Elgeyo Marakwet	2018	62.4	454,480	596,235.88
Elgeyo Marakwet	2019	65.7	454,480	627,767.59
Elgeyo Marakwet	2020	69	454,480	659,299.29
Embu	2013	44.2	608,599	565,551.62
Embu	2014	45.5	608,599	582,185.49
Embu	2015	53.8	608,599	688,386.36
Embu	2016	57.6	608,599	737,008.44
Embu	2017	57.3	608,599	733,169.86
Embu	2018	62.4	608,599	798,425.81
Embu	2019	65.7	608,599	840,650.25
Embu	2020	69	608,599	882,874.70
Garissa	2013	44.2	841,353	781,842.48
Garissa	2014	45.5	841,353	804,837.84
Garissa	2015	53.8	841,353	951,654.42
Garissa	2016	57.6	841,353	1,018,871.64
Garissa	2017	57.3	841,353	1,013,565.02
Garissa	2018	62.4	841,353	1,103,777.61
Garissa	2019	65.7	841,353	1,162,150.47
Garissa	2020	69	841,353	1,220,523.32
Homa Bay	2013	44.2	1,131,950	1,051,884.99

Homa Bay	2014	45.5	1,131,950	1,082,822.78
Homa Bay	2015	53.8	1,131,950	1,280,348.70
Homa Bay	2016	57.6	1,131,950	1,370,782.25
Homa Bay	2017	57.3	1,131,950	1,363,642.76
Homa Bay	2018	62.4	1,131,950	1,485,014.10
Homa Bay	2019	65.7	1,131,950	1,563,548.50
Homa Bay	2020	69	1,131,950	1,642,082.90
Isiolo	2013	44.2	268,002	249,045.70
Isiolo	2014	45.5	268,002	256,370.57
Isiolo	2015	53.8	268,002	303,137.07
Isiolo	2016	57.6	268,002	324,548.24
Isiolo	2017	57.3	268,002	322,857.89
Isiolo	2018	62.4	268,002	351,593.93
Isiolo	2019	65.7	268,002	370,187.84
Isiolo	2020	69	268,002	388,781.75
Kajiado	2013	44.2	1,117,840	1,038,773.02
Kajiado	2014	45.5	1,117,840	1,069,325.16
Kajiado	2015	53.8	1,117,840	1,264,388.88
Kajiado	2016	57.6	1,117,840	1,353,695.15
Kajiado	2017	57.3	1,117,840	1,346,644.66
Kajiado	2018	62.4	1,117,840	1,466,503.08
Kajiado	2019	65.7	1,117,840	1,544,058.53
Kajiado	2020	69	1,117,840	1,621,613.98
Kakamega	2013	44.2	1,867,579	1,735,481.53
Kakamega	2014	45.5	1,867,579	1,786,525.10
Kakamega	2015	53.8	1,867,579	2,112,418.69
Kakamega	2016	57.6	1,867,579	2,261,622.99
Kakamega	2017	57.3	1,867,579	2,249,843.70
Kakamega	2018	62.4	1,867,579	2,450,091.57
Kakamega	2019	65.7	1,867,579	2,579,663.72
Kakamega	2020	69	1,867,579	2,709,235.87
Kericho	2013	44.2	901,777	837,992.57
Kericho	2014	45.5	901,777	862,639.41
Kericho	2015	53.8	901,777	1,020,000.01
Kericho	2016	57.6	901,777	1,092,044.62
Kericho	2017	57.3	901,777	1,086,356.88
Kericho	2018	62.4	901,777	1,183,048.33
Kericho	2019	65.7	901,777	1,245,613.39
Kericho	2020	69	901,777	1,308,178.45
Kiambu	2013	44.2	2,417,735	2,246,723.93
Kiambu	2014	45.5	2,417,735	2,312,804.05
Kiambu	2015	53.8	2,417,735	2,734,700.17
Kiambu	2016	57.6	2,417,735	2,927,857.43
Kiambu	2017	57.3	2,417,735	2,912,608.17
Kiambu	2018	62.4	2,417,735	3,171,845.55
Kiambu	2019	65.7	2,417,735	3,339,587.38
Kiambu	2020	69	2,417,735	3,507,329.21
Kilifi	2013	44.2	1,453,787	1,350,957.84
Kilifi	2014	45.5	1,453,787	1,390,691.89
Kilifi	2015	53.8	1,453,787	1,644,378.54
Kilifi	2016	57.6	1,453,787	1,760,524.24
Kilifi	2017	57.3	1,453,787	1,751,354.84
Kilifi	2018	62.4	1,453,787	1,907,234.59
Kilifi	2019	65.7	1,453,787	2,008,097.96
Kilifi	2020	69	1,453,787	2,108,961.33
Kirinyaga	2013	44.2	610,411	567,235.45
Kirinyaga	2014	45.5	610,411	583,918.85
Kirinyaga	2015	53.8	610,411	690,435.91
Kirinyaga	2016	57.6	610,411	739,202.76
Kirinyaga	2017	57.3	610,411	735,352.74
Kirinyaga	2018	62.4	610,411	800,802.99
Kirinyaga	2019	65.7	610,411	843,153.15
Kirinyaga	2020	69	610,411	885,503.30

Kisii	2013	44.2	1,266,860	1,177,252.54
Kisii	2014	45.5	1,266,860	1,211,877.62
Kisii	2015	53.8	1,266,860	1,432,945.40
Kisii	2016	57.6	1,266,860	1,534,157.16
Kisii	2017	57.3	1,266,860	1,526,166.76
Kisii	2018	62.4	1,266,860	1,662,003.59
Kisii	2019	65.7	1,266,860	1,749,898.01
Kisii	2020	69	1,266,860	1,837,792.43
Kisumu	2013	44.2	1,155,574	1,073,838.02
Kisumu	2014	45.5	1,155,574	1,105,421.49
Kisumu	2015	53.8	1,155,574	1,307,069.80
Kisumu	2016	57.6	1,155,574	1,399,390.72
Kisumu	2017	57.3	1,155,574	1,392,102.23
Kisumu	2018	62.4	1,155,574	1,516,006.61
Kisumu	2019	65.7	1,155,574	1,596,180.04
Kisumu	2020	69	1,155,574	1,676,353.47
Kitui	2013	44.2	1,136,187	1,055,822.30
Kitui	2014	45.5	1,136,187	1,086,875.89
Kitui	2015	53.8	1,136,187	1,285,141.17
Kitui	2016	57.6	1,136,187	1,375,913.22
Kitui	2017	57.3	1,136,187	1,368,747.01
Kitui	2018	62.4	1,136,187	1,490,572.66
Kitui	2019	65.7	1,136,187	1,569,401.02
Kitui	2020	69	1,136,187	1,648,229.38
Kwale	2013	44.2	866,820	805,508.15
Kwale	2014	45.5	866,820	829,199.56
Kwale	2015	53.8	866,820	980,460.14
Kwale	2016	57.6	866,820	1,049,711.97
Kwale	2017	57.3	866,820	1,044,244.72
Kwale	2018	62.4	866,820	1,137,187.97
Kwale	2019	65.7	866,820	1,197,327.72
Kwale	2020	69	866,820	1,257,467.47
Laikipia	2013	44.2	518,580	481,899.83
Laikipia	2014	45.5	518,580	496,073.36
Laikipia	2015	53.8	518,580	586,565.86
Laikipia	2016	57.6	518,580	627,996.16
Laikipia	2017	57.3	518,580	624,725.35
Laikipia	2018	62.4	518,580	680,329.18
Laikipia	2019	65.7	518,580	716,308.12
Laikipia	2020	69	518,580	752,287.07
Lamu	2013	44.2	143,920	133,740.26
Lamu	2014	45.5	143,920	137,673.80
Lamu	2015	53.8	143,920	162,787.92
Lamu	2016	57.6	143,920	174,285.95
Lamu	2017	57.3	143,920	173,378.21
Lamu	2018	62.4	143,920	188,809.78
Lamu	2019	65.7	143,920	198,794.91
Lamu	2020	69	143,920	208,780.04
Machakos	2013	44.2	1,421,932	1,321,356.00
Machakos	2014	45.5	1,421,932	1,360,219.41
Machakos	2015	53.8	1,421,932	1,608,347.35
Machakos	2016	57.6	1,421,932	1,721,948.09
Machakos	2017	57.3	1,421,932	1,712,979.61
Machakos	2018	62.4	1,421,932	1,865,443.77
Machakos	2019	65.7	1,421,932	1,964,097.04
Machakos	2020	69	1,421,932	2,062,750.32
Makueni	2013	44.2	987,653	917,794.39
Makueni	2014	45.5	987,653	944,788.35
Makueni	2015	53.8	987,653	1,117,134.35
Makueni	2016	57.6	987,653	1,196,039.75
Makueni	2017	57.3	987,653	1,189,810.38
Makueni	2018	62.4	987,653	1,295,709.73
Makueni	2019	65.7	987,653	1,364,232.84

Makueni	2020	69	987,653	1,432,755.96
Mandera	2013	44.2	867,457	806,100.09
Mandera	2014	45.5	867,457	829,808.92
Mandera	2015	53.8	867,457	981,180.65
Mandera	2016	57.6	867,457	1,050,483.37
Mandera	2017	57.3	867,457	1,045,012.11
Mandera	2018	62.4	867,457	1,138,023.66
Mandera	2019	65.7	867,457	1,198,207.60
Mandera	2020	69	867,457	1,258,391.54
Marsabit	2013	44.2	459,785	427,263.52
Marsabit	2014	45.5	459,785	439,830.09
Marsabit	2015	53.8	459,785	520,062.83
Marsabit	2016	57.6	459,785	556,795.90
Marsabit	2017	57.3	459,785	553,895.92
Marsabit	2018	62.4	459,785	603,195.56
Marsabit	2019	65.7	459,785	635,095.32
Marsabit	2020	69	459,785	666,995.09
Meru	2013	44.2	1,545,714	1,436,382.66
Meru	2014	45.5	1,545,714	1,478,629.21
Meru	2015	53.8	1,545,714	1,748,357.18
Meru	2016	57.6	1,545,714	1,871,847.09
Meru	2017	57.3	1,545,714	1,862,097.88
Meru	2018	62.4	1,545,714	2,027,834.35
Meru	2019	65.7	1,545,714	2,135,075.58
Meru	2020	69	1,545,714	2,242,316.82
Migori	2013	44.2	1,116,436	1,037,468.32
Migori	2014	45.5	1,116,436	1,067,982.10
Migori	2015	53.8	1,116,436	1,262,800.81
Migori	2016	57.6	1,116,436	1,351,994.92
Migori	2017	57.3	1,116,436	1,344,953.28
Migori	2018	62.4	1,116,436	1,464,661.16
Migori	2019	65.7	1,116,436	1,542,119.21
Migori	2020	69	1,116,436	1,619,577.25
Mombasa	2013	44.2	1,208,333	1,122,865.27
Mombasa	2014	45.5	1,208,333	1,155,890.72
Mombasa	2015	53.8	1,208,333	1,366,745.51
Mombasa	2016	57.6	1,208,333	1,463,281.44
Mombasa	2017	57.3	1,208,333	1,455,660.18
Mombasa	2018	62.4	1,208,333	1,585,221.56
Mombasa	2019	65.7	1,208,333	1,669,055.39
Mombasa	2020	69	1,208,333	1,752,889.22
Murang'a	2013	44.2	1,056,640	981,901.81
Murang'a	2014	45.5	1,056,640	1,010,781.28
Murang'a	2015	53.8	1,056,640	1,195,165.55
Murang'a	2016	57.6	1,056,640	1,279,582.45
Murang'a	2017	57.3	1,056,640	1,272,917.96
Murang'a	2018	62.4	1,056,640	1,386,214.32
Murang'a	2019	65.7	1,056,640	1,459,523.73
Murang'a	2020	69	1,056,640	1,532,833.14
Nairobi	2013	44.2	4,397,073	4,086,059.53
Nairobi	2014	45.5	4,397,073	4,206,237.75
Nairobi	2015	53.8	4,397,073	4,973,529.47
Nairobi	2016	57.6	4,397,073	5,324,819.66
Nairobi	2017	57.3	4,397,073	5,297,086.22
Nairobi	2018	62.4	4,397,073	5,768,554.63
Nairobi	2019	65.7	4,397,073	6,073,622.42
Nairobi	2020	69	4,397,073	6,378,690.21
Nakuru	2013	44.2	2,162,202	2,009,265.27
Nakuru	2014	45.5	2,162,202	2,068,361.31
Nakuru	2015	53.8	2,162,202	2,445,666.78
Nakuru	2016	57.6	2,162,202	2,618,409.04
Nakuru	2017	57.3	2,162,202	2,604,771.50
Nakuru	2018	62.4	2,162,202	2,836,609.80

Nakuru	2019	65.7	2,162,202	2,986,622.82
Nakuru	2020	69	2,162,202	3,136,635.83
Nandi	2013	44.2	885,711	823,062.95
Nandi	2014	45.5	885,711	847,270.68
Nandi	2015	53.8	885,711	1,001,827.75
Nandi	2016	57.6	885,711	1,072,588.82
Nandi	2017	57.3	885,711	1,067,002.42
Nandi	2018	62.4	885,711	1,161,971.22
Nandi	2019	65.7	885,711	1,223,421.62
Nandi	2020	69	885,711	1,284,872.02
Narok	2013	44.2	1,157,873	1,075,974.40
Narok	2014	45.5	1,157,873	1,107,620.71
Narok	2015	53.8	1,157,873	1,309,670.20
Narok	2016	57.6	1,157,873	1,402,174.79
Narok	2017	57.3	1,157,873	1,394,871.80
Narok	2018	62.4	1,157,873	1,519,022.69
Narok	2019	65.7	1,157,873	1,599,355.62
Narok	2020	69	1,157,873	1,679,688.55
Nyamira	2013	44.2	605,576	562,742.44
Nyamira	2014	45.5	605,576	579,293.69
Nyamira	2015	53.8	605,576	684,967.04
Nyamira	2016	57.6	605,576	733,347.61
Nyamira	2017	57.3	605,576	729,528.09
Nyamira	2018	62.4	605,576	794,459.91
Nyamira	2019	65.7	605,576	836,474.62
Nyamira	2020	69	605,576	878,489.33
Nyandarua	2013	44.2	638,289	593,141.59
Nyandarua	2014	45.5	638,289	610,586.93
Nyandarua	2015	53.8	638,289	721,968.72
Nyandarua	2016	57.6	638,289	772,962.79
Nyandarua	2017	57.3	638,289	768,936.94
Nyandarua	2018	62.4	638,289	837,376.36
Nyandarua	2019	65.7	638,289	881,660.68
Nyandarua	2020	69	638,289	925,945.01
Nyeri	2013	44.2	759,164	705,466.86
Nyeri	2014	45.5	759,164	726,215.89
Nyeri	2015	53.8	759,164	858,690.44
Nyeri	2016	57.6	759,164	919,341.43
Nyeri	2017	57.3	759,164	914,553.20
Nyeri	2018	62.4	759,164	995,953.22
Nyeri	2019	65.7	759,164	1,048,623.82
Nyeri	2020	69	759,164	1,101,294.42
Samburu	2013	44.2	310,327	288,376.97
Samburu	2014	45.5	310,327	296,858.65
Samburu	2015	53.8	310,327	351,010.88
Samburu	2016	57.6	310,327	375,803.47
Samburu	2017	57.3	310,327	373,846.16
Samburu	2018	62.4	310,327	407,120.43
Samburu	2019	65.7	310,327	428,650.84
Samburu	2020	69	310,327	450,181.25
Siaya	2013	44.2	993,183	922,933.25
Siaya	2014	45.5	993,183	950,078.34
Siaya	2015	53.8	993,183	1,123,389.34
Siaya	2016	57.6	993,183	1,202,736.54
Siaya	2017	57.3	993,183	1,196,472.29
Siaya	2018	62.4	993,183	1,302,964.58
Siaya	2019	65.7	993,183	1,371,871.36
Siaya	2020	69	993,183	1,440,778.15
Taita Taveta	2013	44.2	340,671	316,574.68
Taita Taveta	2014	45.5	340,671	325,885.70
Taita Taveta	2015	53.8	340,671	385,332.98
Taita Taveta	2016	57.6	340,671	412,549.81
Taita Taveta	2017	57.3	340,671	410,401.11

Taita Taveta	2018	62.4	340,671	446,928.96
Taita Taveta	2019	65.7	340,671	470,564.63
Taita Taveta	2020	69	340,671	494,200.30
Tana River	2013	44.2	315,943	293,595.74
Tana River	2014	45.5	315,943	302,230.91
Tana River	2015	53.8	315,943	357,363.14
Tana River	2016	57.6	315,943	382,604.40
Tana River	2017	57.3	315,943	380,611.67
Tana River	2018	62.4	315,943	414,488.10
Tana River	2019	65.7	315,943	436,408.15
Tana River	2020	69	315,943	458,328.19
Tharaka Nithi	2013	44.2	393,177	365,366.83
Tharaka Nithi	2014	45.5	393,177	376,112.91
Tharaka Nithi	2015	53.8	393,177	444,722.52
Tharaka Nithi	2016	57.6	393,177	476,134.15
Tharaka Nithi	2017	57.3	393,177	473,654.29
Tharaka Nithi	2018	62.4	393,177	515,812.00
Tharaka Nithi	2019	65.7	393,177	543,090.52
Tharaka Nithi	2020	69	393,177	570,369.03
Trans Nzoia	2013	44.2	990,341	920,292.27
Trans Nzoia	2014	45.5	990,341	947,359.69
Trans Nzoia	2015	53.8	990,341	1,120,174.75
Trans Nzoia	2016	57.6	990,341	1,199,294.90
Trans Nzoia	2017	57.3	990,341	1,193,048.57
Trans Nzoia	2018	62.4	990,341	1,299,236.14
Trans Nzoia	2019	65.7	990,341	1,367,945.75
Trans Nzoia	2020	69	990,341	1,436,655.35
Turkana	2013	44.2	926,976	861,409.20
Turkana	2014	45.5	926,976	886,744.76
Turkana	2015	53.8	926,976	1,048,502.60
Turkana	2016	57.6	926,976	1,122,560.40
Turkana	2017	57.3	926,976	1,116,713.73
Turkana	2018	62.4	926,976	1,216,107.10
Turkana	2019	65.7	926,976	1,280,420.46
Turkana	2020	69	926,976	1,344,733.81
Uasin Gishu	2013	44.2	1,163,186	1,080,911.61
Uasin Gishu	2014	45.5	1,163,186	1,112,703.12
Uasin Gishu	2015	53.8	1,163,186	1,315,679.74
Uasin Gishu	2016	57.6	1,163,186	1,408,608.79
Uasin Gishu	2017	57.3	1,163,186	1,401,272.29
Uasin Gishu	2018	62.4	1,163,186	1,525,992.86
Uasin Gishu	2019	65.7	1,163,186	1,606,694.40
Uasin Gishu	2020	69	1,163,186	1,687,395.95
Vihiga	2013	44.2	590,013	548,280.24
Vihiga	2014	45.5	590,013	564,406.13
Vihiga	2015	53.8	590,013	667,363.73
Vihiga	2016	57.6	590,013	714,500.95
Vihiga	2017	57.3	590,013	710,779.59
Vihiga	2018	62.4	590,013	774,042.69
Vihiga	2019	65.7	590,013	814,977.64
Vihiga	2020	69	590,013	855,912.59
Wajir	2013	44.2	781,263	726,002.76
Wajir	2014	45.5	781,263	747,355.78
Wajir	2015	53.8	781,263	883,686.61
Wajir	2016	57.6	781,263	946,103.14
Wajir	2017	57.3	781,263	941,175.52
Wajir	2018	62.4	781,263	1,024,945.07
Wajir	2019	65.7	781,263	1,079,148.90
Wajir	2020	69	781,263	1,133,352.72
West Pokot	2013	44.2	621,241	577,299.42
West Pokot	2014	45.5	621,241	594,278.82
West Pokot	2015	53.8	621,241	702,685.72
West Pokot	2016	57.6	621,241	752,317.80

West Pokot	2017	57.3	621,241	748,399.48
West Pokot	2018	62.4	621,241	815,010.95
West Pokot	2019	65.7	621,241	858,112.49
West Pokot	2020	69	621,241	901,214.03