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Fiscal Devolution And Technical Efficiency Of County Governments In Kenya

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Abstract
Several fiscal decentralization and revenue independence programmes have been instituted since independence in Kenya in order to attain technical efficiency in the delivery of public goods and services. Notably, the enactment of the Constitution 2010 ushered in fiscal devolution as the main driver of economic growth through technical efficiency in delivering public goods and services. Technical efficiency is to be attained through reduction in costs associated with allocations and rent-seeking activities as they focus on transparency and allocative efficiency. A smaller and productive government is believed to enhance technical efficiency by reducing wastage of expenditure and raising income growth. However, being responsible for a larger fiscal capacity can offer both challenges and opportunities for local governments in developing countries. As the devolved funds increase to the counties in Kenya, it is expected that technical efficiency would also increase in the county public service provision as more inputs would be available in relatively small size government. Despite the fact that the allocations to counties have been increasing and increased independence through tax assignments, there seems to be no evidence of improved technical efficiency as there has been no significant improvement in provision of goods and services for devolved functions including health and agriculture. There has also been a decline in the county growth domestic product over the years. Additionally, revenue collections at the counties have remained low and declining, despite higher targets that are set by the county governments. The main objective of the study was to measure the technical efficiencies in the counties. Specifically, the study estimated technical efficiency index for the 47 county governments. The model used in the analysis was a Cobb Douglas Stochastic Frontier Analysis to compute the mean technical efficiency. The average technical efficiency across counties is 84 percent, implying an average of 16 percent technical inefficiency. Technical efficiency varies significantly across counties operating between 50 and 90 percent technical efficiency. Based on these findings, the study recommends that counties should optimize resource utilization to close the 16 percent efficiency gap.

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I. Background

Fiscal decentralization is the transfer by the central government of certain responsibilities to local governments, granting them both administrative authority and revenue autonomy to fulfil the functions assigned to them (World Bank, 1999). It involves transferring revenue, revenue sources, and spending responsibilities to local governments, bringing resources and governance closer to the citizens. Over the years, fiscal decentralization has become one of the major reforms adopted by many countries worldwide to achieve greater technical efficiency in the production of public goods and service delivery (Hamalainen 2003).

The argument provided by the theory of fiscal decentralization is that the inhabitants of the different jurisdictions have different tastes (Musgrave 1959). Together with the effort of reducing transaction costs, providing sufficient information and fiscal incentives along with healthier investment climate, fiscal decentralization end up enhancing technical efficiency in the devolved sectors. Smaller and productive government is believed to be a source of technical efficiency that potentially reduces waste of expenditure and raises income growth (Brennan and Buchanan 1980). Technical efficiency is equivalent to achieving productive efficiency which entails maximizing results or minimizing the cost of production factors per unit of product.

Though technical efficiency imperative is a necessary condition for sub government performance measure and not a sufficient condition due to its role in income distribution and social protection to the society. Technical efficiency propels economic growth both at national and at the sub national levels. It is supposed to reduce costs associated with inefficiency and rent seeking activities as it focuses on transparency and accountability (Hamalainen 2003).

While smaller jurisdictions with more homogeneous populations may be better suited to match the provision of public goods with the preferences of their constituents, an exceedingly small scale of operation may be economically unviable (Oates, 1972). The desire to increase revenue and narrow budget deficits, regional governments are noted to introduce additional taxes, fees, and charges that are not conducive to private sector growth. Fiscal decentralization may also exacerbate the central government's inability to deal with structural fiscal imbalances and fiscal inefficiencies. In addition, localities might engage in destructive competition to attract industry (Muriu, 2013). In addition, the undesired rise of rent seeking and corruption at the regional government levels have diminished the ability of governments to efficiently allocate resources (Muriu, 2013).

The foregoing notwithstanding, much of the recent worldwide clamor for fiscal decentralization has been driven by the belief that it is likely to have a positive effect on resource allocation. Contrary to expectations and predictions, fiscal decentralization resulted to a relative increase in current expenditures at the expense of capital expenditures in a number of countries like Germany, India, Mexico, Spain, and USA before the year 2009 (Rodríguez-Pose, Tijmstra and Bwire, 2009). The test in these countries, of the assumption that fiscal decentralization has a positive effect on technical efficiency established that fiscal decentralization was associated with decline in technical efficiency and lower levels of economic growth. According to Apezteguía (2018), there are cases where there exists negative relationship between fiscal decentralization and technical efficiency. This suggests that most local governments in a devolved systems could achieve, on average, the same level of output using fewer resources, improving performance without necessarily increasing spending (Kalb, 2009).

The foregoing implies that technical efficiency from fiscal decentralization and revenue independence is not that obvious. There are serious drawbacks that should be considered when and after designing the devolution program. In many cases the problem is not so much whether a certain service should be provided by a central, regional, or local government, but rather how to organize the joint production of the service by the various levels to achieve efficiency (Tiebout, 1956). In many cases, such measures have enormous potential and could, if properly designed and implemented, significantly improve the efficiency of the public sector.

Fiscal Decentralization in Kenya

Fiscal decentralization in Kenya has been evolving over the years. It dates back to independence when the first form of devolution, known as *majimbo* was introduced. This initial form of fiscal decentralization in Kenya was implemented immediately after gaining independence in 1965, when the government outlined its first development agenda in Sessional Paper No. 10, aimed at reducing extreme poverty and improving education and healthcare in the country (Government of Kenya (GoK), 1965). Subsequently, the government devised a range of decentralization programmes. These included the District Development Grant Programme (1966) and the Rural Works Programme Grants in 1974, both designed to provide discretionary funds outside ministries' budgets for small, labor-intensive, locally defined projects (Bagaka, 2008). These two financing mechanisms were later combined to form the Rural Development Fund (RDF).

Several other fiscal decentralization programs have been instituted since independence to combat growing regional disparities. The Programmes include the Special Rural Development Program (1972), the District Focus for Rural Development (DFRD) in 1983, and Regional Development Authorities (RDA's). However, it is from Mid-90s, that the government introduced numerous fiscal decentralization initiatives, namely the National Government Constituency Development Fund (NGCDF), Local Authorities Transfer Fund (LATF), Poverty Eradication Fund (PEF) and Women Enterprise Fund (WEF), among many others, in a bid to decentralize decision making and participatory governance (GoK, 2000).

The main form of fiscal decentralization in Kenya was established following the promulgation of the Constitution of Kenya, 2010. This resulted in a unitary state (National Government) with 47 County Governments. The implementation of this decentralization began after the 2013 general election. The creation of the 47 county governments aimed to improve service delivery and involved a substantial re-organization of government functions, which now had discretion over significant budgets, staff, and programmes. The constitution also requires that at least 15 per cent of audited revenue be transferred to the counties yearly. Several government functions were devolved, and counties were assigned to perform them, including health and agriculture. However, their performance has shown stagnation and decline over time. Figure 1.2 illustrates the expanded budget at the county level and the performance of selected (devolved) economic activities in the country.

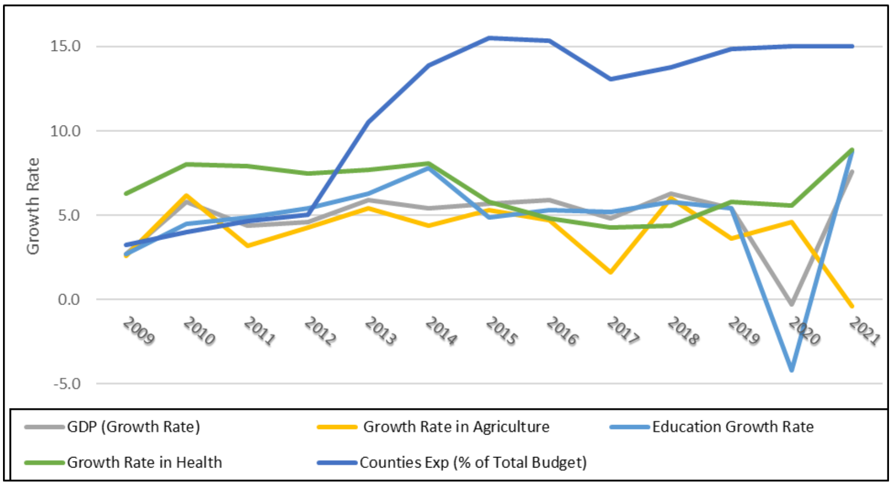

Figure 1: Counties Expenditure and Performance of Selected Economic Activities

Source of Data: Economic Surveys (2010-2022)

As the devolved funds increase to the counties, the performance of devolved economic activities remains unappealing, as shown in Figure 1.2. Following the enactment of the 2010 Constitution, resources allocated to counties increased exponentially from below 4 per cent of the total government expenditure in 2009 to about 15 per cent in 2009. However, the performance of selected development indicators shows stagnation and decline over the same period. The growth rates of the National GDP, Education, Health, and Agriculture indicate stagnation from 2009 to 2013, followed by a decline. This decline has happened during a period when fiscal decentralization expanded rapidly. The benefits of fiscal decentralization are supposed to enhance the performance of these economic sectors, which should be reflected in improved output, health, and education outcomes. As the country decentralizes, it was expected to bring much-needed growth, development, and ultimately balanced regional growth. According to proponents of fiscal decentralization, such as Hayek (1945), Tibout (1956), and Musgrave (1959), fiscal decentralization improves the public sector through enhanced efficiency. However, from Figure 1.1, it appears that the effect of fiscal decentralization on economic performance may not have contributed to its improvement.

Statement of the problem

The transfer of powers and resources from national governments to lower tiers of county governments, carried out through the enactment of the 2010 constitution, was expected to better align public policies with local needs and thus improve the efficient allocation of resources. This, in turn, was anticipated to enhance local economic performance and outcomes. In anticipation of this, there were calls for national authorities to transfer fiscal powers from the national to local governments to achieve a more effective response to local needs. The enactment of the 2010 constitution marked the beginning of devolution as a key strategy for attaining technical efficiency in the delivery of public goods and services. This created one unitary state (1 National Government and 47 county governments). The formation of the counties was intended to deliver public goods and services more efficiently. Kenya adopted this approach because fiscal decentralization would promote technical efficiency and better resource allocation. For this reason, several functions were devolved, including health and agriculture. However, issues such as disagreements between the National Government and County governments over funding, poor or no consultation on matters affecting County Governments, limited technical support for implementing functions, inadequate allocations and delayed disbursements of funds by the National Treasury, lack of capacity and skills to deliver services, corruption, and lack of public participation have hampered implementation of the function efficiently at the county level. These challenges have significantly impacted on the performance of county functions, including health and agriculture. Despite increased transfers from the national government to county governments, Kenya continues to perform poorly in devolved sectors such as health and agriculture.

Despite the fact that gains in technical efficiency in the provision of public goods through fiscal decentralization and revenue independence, and the linkages thereof, have attracted considerable attention in development economics literature, their effects in Kenya have not received sufficient focus so far. Most studies on fiscal decentralization concentrate on measuring and analyzing the effects of fiscal decentralization on poverty (Mwiathi, Wawire and Onono, 2018), the significance of own source revenue in the provision of public goods (Development Initiative, 2018), and on own source revenue potential and the tax gap (Adam Smith International, 2016). The technical efficiency indexes for Kenyan counties had not yet been estimated, which would enable the ranking of counties. Against this backdrop, the current study aimed at estimating the counties' technical efficiency indexes in Kenya.

Objectives of the Study

The purpose of this study was to Estimate the Technical Efficiency Index for the 47 County Governments in Kenya

Significance of the Study

This study contributes to the literature on fiscal decentralization and provides policy recommendations related to fiscal decentralization. First, the study estimated technical efficiency for the 47 county governments. This informs the counties in terms of their performance compared to the others through ranking. The efficiency index also informs the counties and the public in terms of resources allocation. Additionally, the study contributed to the growing theoretical and empirical literature on fiscal decentralization and technical efficiency.

Scope of the study

The study focused on Kenya for the period 2013 to 2021. A model was developed to assess the effect of fiscal decentralization. The study employed a panel analysis of all the counties in Kenya.

II. Methodology

This study falls under the purview of relationships between variables. The study employs a non-experimental retrospective research design. In the design, cross-county panel data for the period 2013 to 2021 was collected and used for analysis. The combination of time series with cross-sections enhanced the quality and quantity of the data set in ways that would be impossible using only one of these two dimensions.

Theoretical Framework

The study used Frontier production functions and technical efficiency models by Battesse and Coelli (1995). Production theory with a stochastic frontier production function was used as theoretical framework for objective one. The study used the theory by employing Frontier Production Function on technical efficiency. The theory assumes one firm where, a production function is defined in terms of the maximum output that can be produced from a set of inputs given the existing technology. The stochastic frontier production function gives the maximum feasible or potential output that can be produced by a production unit such as farm, given level of input and technology. The actual production function (corresponding to the production unit's actual output) is written as:

$Q_i = f(X_i ; \beta) \exp(-u_i)$ and $0 \le u_i < \infty$; i= 1, 2 , ... , n. ……….. 1

where Q_i represents the actual output for the i-th sample (production) unit; X_i is a vector of inputs and β is a vector of parameters that describe the transformation process; f(.) is the frontier production function and u_i is a one-sided (non-negative) residual term. If the production unit is inefficient, the actual output is less than the potential output. Therefore, the ratio of the actual output Q_i and the potential output f(.) is treated as a measure of the technical efficiency of the production unit given as in in Equation 2

$TE = \frac{Qi}{f(Xi ; \beta)\ \exp(-ui)}$ …………………………..2

TE represents Technical Efficiency. u_i will be zero if the production unit produces the potential output (full TE) and is less than zero when production is below the frontier (less than full TE). A random noise variable, v_i (independently and identically distributed normal with mean 0 and variance $\sigma^v = 2$) is included in the Equation 1 to capture the effect of other omitted variables that can influence the output. This expression is presented as in Equation 3

$Q_i = f(X_i ; \beta) \exp(v_i - u_i)$…………………………………3

This model gives stochastic production frontier function. It shows the normal production function with a composite disturbance term that has been split into two. The first part is the is normal random noise whose normal characteristics of independently and identically distribution with mean zero and constant variance maintained. The second term represents inefficiency.

Empirical Model

In order to bring out technical efficiency in the production of goods and services under stochastic frontier production function, Stochastic Frontier Analysis (SFA) is used. SFA method is applied in measurement of the TE in the provision of public goods and services in public sector. This parametric frontier approach establishes a functional form for the cost, profit, or production relationship among inputs, outputs, and environmental factors, and allows for random shocks. Both inefficiencies and random shocks are assumed to be orthogonal to input, output, or environmental variables determined in the estimating equation. Under SFA, it is also possible that for some decision-making units, the influence of random noise dominates the influence of inefficiency.

Stochastic frontier production function in terms of the original production values is the starting point of this parametric approach. Equation 3 is rewritten to Equation 4

$Y_{it} = \exp(X_{it}\beta + V_{it} - \mu_{it})$ 4

where Y_{it} is the output of the i^{th} county (i = 1, 2, … , *47*) in the t^{th} period *(t* = 2013, 2014,…, *2021)*; X_{it} is a (1× k) vector of input quantities of the i^{th} county in t^{th} period; β is a (k ×1) vector of unknown parameters to be estimated; V_{it} is a random variable which is assumed to be independent and identically distributed [N (0, σ^2)] and independent of μ_{it} ; the μ_{it} is non-negative random variable, associated with technical inefficiency of production, which is assumed to be independently distributed and truncations at zero of the N (u ,σ_U^2) distribution; where $u = Z_{it}$ δ and variance σ_U^2 ; and Z_{it} is a (1× P) vector of explanatory variables associated with technical inefficiency in the county provision of public good and services over time; where δ is a (P×1) vector of unknown parameters.

The study used SFA using the form of production function as Cobb-Douglas function. This is given in Equation 5

$$LnY_{it} = \beta_0 + \sum_{i=1}^{K} \beta_{it}\, LnX_{it} + V_{it} - \mu_{it} \qquad 5$$

To avoid making assumption on elasticity or substitution elasticity between the inputs, the study tested for restrictions by making Equation 5 a trans-logarithmic function as suggested by Baten, Kamil and Haque (2009) which is an extension of the more basic Cobb-Douglas function. This is by allowing the data to indicate the real curve of the formulation rather than imposing a priori assumptions. The trans-log model was estimated using Equation 6

$$LnY_{it} = \beta_0 + \sum_{i=1}^{K} \beta_{it}\, LnX_{it} + \frac{1}{2}\sum_{i=1}^{K}\sum_{j=1}^{K} \beta_{ijt}\, LnX_{it}LnX_{jt} + V_{it} - \mu_{it} \qquad 6$$

Where, X_{it} and X_{jt} are the row inputs vector of county i during period t. When $\beta_{ijt} = 0$, the trans-logarithmic function reduces to a Cobb–Douglas form in Equation 5. μ_{it} is a function representing the technical inefficiencies with a set of explanatory variables Z_{it} and an unknown vector of coefficients δ as shown in Equation 7. It therefore gives the stochastic model for estimating inefficiency.

$\mu_{it} = Zit\ \delta + W_{it}$ 7

Where the random variable W_{it} follows truncated normal, half normal or exponential distribution with a mean and variance σ^2 such that the point of truncation is $-Zit\ \delta$, that is $W_{it} > -Zit\ \delta$. The method of maximum likelihood was used for simultaneous estimation for parameters of the stochastic frontier in Equation 6 and the model in Equation 7 for the technical inefficiency of the counties. The likelihood estimation of the function was expressed in terms of the variance parameters estimates given as,

$\sigma^2 = \sigma_V^2 + \sigma_\mu^2\ and\ \gamma = \frac{\sigma_\mu^2}{\sigma_V^2 + \sigma_\mu^2}$ 8

Where σ^2 is the total variance for the model 6, σ_V^2 is the variance of the error term, σ_μ^2 is the inefficiency variance and γ represents the proportion of the output deviation that can be associated with technical inefficiencies. After obtaining the estimates of μ_{it}, the TE of the i^{th} county at t^{th} observation, was given by Equation 9

$TE_{it} = \exp(-\mu_{it}) = \exp(-Zit\ \delta - W_{it})$ 9

The Technical Efficiency Score (TE) was then calculated as developed by Battesa and Coelli (1995) Kumbhakaret al., 1991; Battese and Coelli, 1993; Bhandari and Maiti, 2007; Lio and Hu, 2009). This estimation model is given in Equation 10

$$TE_{it} = \exp\left[-\mu_{it} + \frac{1}{2}\sigma^{*2}\right] X \left[\frac{1 - \emptyset\left(\sigma^* - \frac{\mu_{it}}{\sigma^*}\right)}{1 - \emptyset\left(-\frac{\mu_{it}}{\sigma^*}\right)}\right] \qquad 10$$

Variables μ_{it} and σ^* are estimated as in Equations 11 and 12 respectively, and $\emptyset(.)$ denotes the cumulative distribution function of the normal variable whereas σ is the variance.

$$\mu_{it} = (1-\gamma)\left(\alpha_0 + \sum_{j=1}^{q} \alpha_1 Z_{jit}\right) - \gamma w_{it} \qquad 11$$

$$\sigma^{*2} = \gamma(1-\gamma)\sigma^2 \qquad 12$$

$\gamma = \frac{\sigma_U^2}{\sigma_V^2 + \sigma_U^2}$ as in Equation 8, $\sigma^2\ and\ \gamma$ are as earlier defined, where γ must lie between 0 and 1. If γ is statistically different from zero using a likelihood test, then there is presence of inefficiency in the model. With inefficiency, the production frontier method is more appropriate than ordinary least squares with normal Cobb-Douglas model. The equation showing inefficiency was then developed from Equation 2 to give Equation 13

$$\mu_{it} = \alpha_0 + \sum_{j=1}^{q} \alpha_1 Z_{jit} + \varphi_t + w_{it} \qquad 13$$

Where t is the time subscript, and q denotes the number of exogenous variables in Z. The random variable w is defined by the truncation of the normal distribution with zero mean and variance σ_w^2. The time trends φ_t were included to control both technical change (in the stochastic frontier) and time-varying inefficiency effects. W_{it} is the error term. Z represents exogenous variables j for county i and time t for the technical inefficiency model of county governments. The determinants for county government inefficiencies used for Equation 13 and represented by variable Z are, County's Land Size, Own Source Revenue (OSR), Labor Force, Human Development Index and Population Size.

To estimate Equation 13, the method of maximum likelihood was used. The TE scores were within the range of 0 to 1 with 1 being the most efficient. Average efficiency score from the year 2013 to 2021 was used as efficiency index for each county.

Definitions and Measurement of Variables

Table 2: Definitions and Measurement of Variables

Variable	Definitions of Variables	Measurements of variables
Fiscal Decentralization (FD)	This refers to taking the fiscal power from national government to local government	It was measured as a ratio of share of county government's expenditure on a public/service good (g) to total county expenditure per fiscal year.
Revenue Independence/ Own Source Revenue (OSR)	This is the county government's own revenue.	It was measured as a ratio of own revenue to total revenue by a county in a given financial year.
Human Development Index (HDI)	This is defined as a summary measure for assessing progress in human development	Measured in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.
Gross County Product (GCP)	This is the estimated total level of output per county.	This was measured as the total value of county output per fiscal year; the unit of measurement will be Kenya Shillings
County's Land Size (CLS)	They are geographical units as delineated by the 2010 Constitution of Kenya as the units of devolved government.	Measurements were in square kilometers
Labor Force (LF)	The labor force comprises all persons of either sex who furnish the supply of labor for the production purposes in a county.	All individuals between the ages of 15 and 65 who were employed or unemployed each year

The data was sourced from Controller of Budget Reports, Economic Survey, Various government publications, Budget Estimates Books and Budget Statements.

Diagnostic Tests and Data Analysis

To avoid spurious regressions, stationary time series in panel data sets were required. Panel data unit root tests were conducted to rule out the existence of non-stationary time-series. Where non stationarity was established, the data was differenced until stationary. Log-likelihood Ratio Test was used to test for the type of model between restricted form and unrestricted form. The log likelihood is used in the Likelihood Ratio Chi-Square test of whether all predictors' regression coefficients in the model are simultaneously equal to zero.

Objective one was accomplished by constructing a technical efficiency score for each county from the year 2013 to 2021 using SFA by use of Equation 13. The technical efficiency scores were within the range of 0 to 1 with 1 being the most efficient.

III. Data Analysis

The county macroeconomic variables considered by the study are identified using the devolution objectives that resulted in devolving health, agriculture, and economic development functions of the counties. The indicators identified included HDI, County GDP, Labor Force, Own Source Revenue, and Devolved Fund. The method of analysis used was a two-stage approach; a Cobb Douglas stochastic frontier analysis and a Tobit regression to compute the mean technical efficiency and determine factors influencing technical efficiency. The summary statistics are given in Table 3

Table 3: Summary Statistics

Variable	Number of Observations	Mean	Std. Dev.	Min	Max
Land Size (Sq KM)	423	12318.24	17251.7	219	70961
HDI (score)	423	.5024704	.0572099	.37	.64
Labor force	423	520082.9	384272.2	55663	2895579
GCP (Ssh. million)	423	164370.4	312327.7	12909	2755389
OSR (KSh. M)	423	687.4164	1521.157	27.42	11710.01

Fiscal Decentralization (FD) (KSh. M)	423	5922.551	3271.342	145.1018	19861.01

Source: Own Computation

Land is one of the factors of production. However, large part of land in Kenya is arid or semi-arid. This has made it to be categorized as a liability in most counties. The current study has taken into consideration that where land cannot support crop farming, it is used as grazing land by pastoralists, ranches, parks/reserves, forests, water mass, settlements/housing, or mining/quarries. It is, therefore, utilized efficiently or inefficiently and therefore determines the technical efficiency of the counties. From Table 4.1, the mean size of land in the counties is 12,318.24 square kilometres (km^2) with a standard deviation of 17,251 (km^2). This indicates a major difference in land size among the counties. The minimum land size is 219 $km^{2,}$ and a maximum of 70,961 (km^2).

The Human Development Index (HDI) is a summary measure for assessing progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. The HDI emphasizes that people and their capabilities should be the ultimate criteria for assessing the development of a country and not economic growth alone since two countries/regions with the same level of GNI per capita can end up with such different human development outcomes.

The labor force represents the economically active population. The labour force comprises all persons of either sex who furnish the supply of labour for production purposes in a county. The study used all individuals between the ages of 15 and 65 who were employed or unemployed each year in every county. Labour availability can reflect counties' ability to generate higher output. The labor force in the counties averaged 520083 with the highest accounting for 2,895,579 size of labor force and the least accounting for 55663 size of labor force. The standard deviation was 384272 over the period, indicating a huge disparity in labor force distribution amongst the counties.

Gross County Product (GCP) is a geographic breakdown of Kenya's Gross Domestic Product (GDP) that gives an estimate of the size and structure of county economies. It also provides a benchmark for evaluating the growth of county economies over time. The GCP estimates are consistent with the published national GDP in the sense that the sum of the GCP is equal to national-level GDP. The average GCP was KSh. 164370.4 million with a standard deviation of Ksh. 312,327.7 million and the least county having an average GCP of Ksh. 12,909 million and the highest county recording an average of Ksh. 2,755,389 million over the period.

Own Source Revenue (OSR) represents the counties' power to collect their own revenue as enshrined in the constitution and Act of Parliament. The counties are allowed to impose levies for activities that do not undermine national economic activities and policies or impact the national distribution of services, goods, labour, or capital. The average county's collection of own revenue was KSh. 687.4 million with a standard deviation of KSh. 1,521.2 million, an indication of differing capacity for counties to raise their own revenue. The highest county's own revenue collection averaged KSh. 11,710.01 million and the least county averaging Ksh. 27.42 million over the study period.

Devolved Funds represented the disbursement of finances from the central government for revenue allocation and expenditure in the sub-national governments. The main form of fiscal decentralization in Kenya was realised after the new Constitution was enacted in the year 2010. This created a unitary state (National Government) with 47 counties. The implementation of this decentralization started after the year 2013 general election. The average county devolved funds between 2013 and 2020 were KSh. 5,922.6 million with a standard deviation of KSh. 3,271.3 million. The highest devolved fund received in the counties averaged KSh. 19,861 million, and the least received averaged KSh. 145 million over the period.

Technical Efficiency Index for Kenya's 47 County Governments

The TE was computed in the public sector's provision of public goods and services using the SFA methodology. Using the parametric frontier technique, which considers inefficiencies together with the random error, the relationship between inputs, outputs, and environmental factors was constructed in terms of cost and production. The method of maximum likelihood was used for the simultaneous estimation of parameters of the stochastic frontier in Equation 10 and the model in Equation 13 for the technical inefficiency effects. To estimate the TE, Equation 10 can be estimated in restricted form or unrestricted form. To test for the right model, the log-likelihood Ratio Test was used. The test is recommended by Kumbakar, Wang and Homcastle (2015). Equation 14 is used for the test.

$$-2\{L(H_0) - L(H_1)\} \qquad 14$$

Where $L(H_0)$ and $L(H_1)$ represent the log-likelihood values computed from the Restricted Cobb-Douglas production Function model and the Unrestricted Trans-log Production Function, respectively, with a degree of freedom representing the imposed restrictions. Critical Values for the tests were obtained from Kodde and Palm (1986) Econometrica with 1 degree of freedom and 0.1 level of significance being 5.412. The Results of the tests are given in Table 4

Table 4: Log-Likelihood Ratio Test Results

Restricted Model		Log-likelihood Ratio	**Unrestricted Model**		Log-likelihood Ratio	$-2[L(H_0)- L(H_1)]$
Time Invariant	Half Normal	137.6741	Time Invariant	Half Normal	-254.0015	-783.351
Time Variant	Truncated Normal	Not Converging	Time Variant	Truncated Normal	Not Converging	N/A
	Half Normal	390.9040		Half Normal	Not Converging	N/A
	Exponential	385.1461		Exponential	Not Converging	N/A
Time Variant	Half Normal	390.9040	Time Invariant	Half Normal	-254.0015	-1289.81
Time Variant	Exponential	385.1461	Time Invariant	Half Normal	-254.0015	-1278.3

Source: Author Computation

The null hypothesis is that unrestricted model is not the appropriate model. If the Log-likelihood Ratio is less than the critical value, then the restricted model becomes the true model. The test results show that the null hypothesis is not rejected. The unrestricted model is not the true model. The study adopted the restricted model with half normal distribution as it has the highest Log likelihood ratio.

Technical Efficiency Score (TE) was determined in accordance with the formula created by Battesa and Coelli (1995) (Kumbhakaret al., 1991; Battese and Coelli, 1993; Bhandari and Maiti, 2007; Lio and Hu, 2009). The SFA model results are presented in Table 5

Table 5: SFA-Panel Model Output

Model: True Random Effect (Half-normal)		
Log simulated likelihood = 390.9040 Wald chi-square =20200.45 Prob > Chi 2 = 0.0000		
Observations 423		
Dependent Variable	County Gross Product	
Independent Variable	Coefficient	Standard Error
Labour	0.819503***	0.0130034
Land	-0.1715995***	0.0064532
Devolution	0.0116055***	0.0040987
Own Source Revenue	0.0326765***	0.0107557
Years	0.0779785***	0.001253
Usigma	-4.18963***	0.0976045
Vsigma	-7.962798***	0.5284432
Theta	0.3004651***	0,0052144
Sigma_U	0.123093***	0.0060072
Sigma_V	0.0186595***	0.0049302
Labda	6.596798***	0.0095532

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The study used the True Random Effect (TRE) to separate time invariant from time variant variables given the counties unique features that included poverty, difference in literacy and development. These differences were captured using the Average Human Development Index over the period. In addition, the uniqueness in terms of geographical features was captured by using percentage of arable land to the total county area and capacity to generate revenue using a percentage of OSR to total county revenue. The unique features were believed to contribute to the differences in performances other than from technical inefficiencies.

The diagnostic statistics such as Wald chi-square, log likelihood and lambda are presented together with the results of efficient use of resources (TE). The estimations Log likelihood equals to 390.9040 with a Prob > Chi-squared of 0.000. This indicates that the model output is significant. The Wald Chi-square statistics means statistical significance, with the implication that all the variables that were included in the stochastic production function jointly influenced technical efficiency. The value of lambda is 6.596798 and is found to be statistically significant at 1 percent significant level.

The Frontier model estimation shows that counties' output has positive elasticity with respect to labor, devolution and OSR, and are statistically significant at one percent level. However, the elasticity of output with respect to land is negative and statistically significant. This implies that land size has no advantage in the county's productivity. The size of land is a cost to public land provision. The variable "Year" was as a control for technological growth over the period. The variable is positive and statistically significant. This means that there has been significant technological development over the study period. V-sigma shows that the idiosyncratic error component is heteroscedastic, with the variance expressed as a function of the covariates. Solving for gamma (γ) gives the proportion of the output deviation that can be associated with technical inefficiencies. This is given in equation 15

$$\gamma = \frac{\theta_u^2}{\theta_v^2+\theta_u^2} = \frac{0.1230093^{2}}{0.1230093^{2}+0.0186595^{2}} = 0.977537 \quad 15$$

This means that the variation of the counties' production from the PPF is 98 percent due to technical inefficiencies. Cyclical shocks only account for about 2 percent of the variations. Table 6 gives a list of each county's technical efficiency index, listed from the least to the highest technical efficient county, and a summary of the counties' technical efficiencies over the years.

Table 6: Technical Efficiencies Summary

No.	County	2013	2014	2015	2016	2017	2018	2019	2020	2021	County Average PE
1	Narok	0.5352	0.5107	0.5358	0.5448	0.6151	0.5566	0.5018	0.5385	0.7571	0.5017
2	Busia	0.6480	0.5864	0.6104	0.6124	0.6754	0.7513	0.7039	0.7501	0.6951	0.6704
3	Samburu	0.6749	0.6086	0.6938	0.7428	0.7004	0.6562	0.6976	0.6949	0.8344	0.7004
4	Mandera	0.7619	0.6342	0.6799	0.6773	0.7496	0.7724	0.7355	0.7178	0.7241	0.7170
5	Baringo	0.8152	0.7528	0.7391	0.7169	0.7421	0.7171	0.7178	0.7412	0.7930	0.7484
6	Makueni	0.7988	0.7826	0.7918	0.7945	0.7985	0.7688	0.7127	0.6994	0.6476	0.7550
7	Vihiga	0.7764	0.7246	0.7510	0.7486	0.8110	0.7802	0.7713	0.8012	0.7893	0.7726
8	Migori	0.8219	0.8090	0.7477	0.7322	0.8091	0.8385	0.7808	0.7994	0.7981	0.7930
9	Tharaka-Nithi	0.8040	0.8178	0.8016	0.7899	0.8699	0.8376	0.7527	0.7484	0.7678	0.7989
10	Kakamega	0.8243	0.8332	0.7935	0.8193	0.8460	0.8505	0.7791	0.7218	0.7220	0.7989
11	Isiolo	0.7268	0.7498	0.7881	0.8098	0.8291	0.8311	0.7979	0.8241	0.8843	0.8046
12	Mombasa	0.8788	0.8820	0.8630	0.8558	0.8606	0.7903	0.7736	0.7496	0.6979	0.8168
13	Garissa	0.8317	0.8749	0.7381	0.8088	0.8341	0.8449	0.8171	0.8182	0.8277	0.8217
14	Siaya	0.7889	0.8445	0.8300	0.8296	0.8226	0.8584	0.8413	0.8466	0.7724	0.8260
15	wajir	0.8724	0.7791	0.7787	0.8160	0.8289	0.8415	0.8596	0.8520	0.8230	0.8279
16	Bungoma	0.8523	0.9007	0.8166	0.7919	0.8225	0.8254	0.8093	0.8084	0.8725	0.8333
17	Laikipia	0.8681	0.8233	0.8426	0.8499	0.8495	0.8685	0.8039	0.8155	0.7952	0.8352
18	Murang'a	0.8718	0.8482	0.8355	0.8292	0.8514	0.8582	0.8124	0.8401	0.8382	0.8428
19	Kirinyaga	0.8410	0.8626	0.8388	0.8237	0.8663	0.8483	0.8399	0.8490	0.8518	0.8468
20	Nyeri	0.8478	0.8560	0.8381	0.8452	0.8613	0.8463	0.8569	0.8781	0.8607	0.8545
21	Kericho	0.8977	0.8435	0.8573	0.8477	0.8613	0.8746	0.8575	0.8583	0.8375	0.8595
22	Kajiado	0.9030	0.8827	0.8397	0.8692	0.8723	0.8658	0.8237	0.8656	0.8220	0.8605
23	Kisii	0.8319	0.8502	0.8542	0.8634	0.8894	0.8874	0.8673	0.8700	0.8548	0.8632
24	Kisumu	0.8755	0.8747	0.8472	0.8443	0.8544	0.8720	0.8771	0.8743	0.8660	0.8651
25	Uasin Gishu	0.8717	0.8841	0.8623	0.8742	0.8888	0.8751	0.8682	0.8679	0.8180	0.8678
26	Homa Bay	0.8588	0.8659	0.8551	0.8415	0.8775	0.9029	0.9054	0.8295	0.8935	0.8700
27	Trans Nzoia	0.8781	0.8837	0.8604	0.8387	0.8940	0.9008	0.8689	0.8727	0.8768	0.8749
28	Tana River	0.8950	0.8824	0.9113	0.9063	0.8984	0.8508	0.8656	0.8578	0.8249	0.8769
29	Kitui	0.8730	0.8811	0.8769	0.8354	0.8756	0.8868	0.8855	0.8901	0.9023	0.8785
30	Nyandarua	0.7910	0.8856	0.8868	0.8856	0.9025	0.8887	0.8907	0.8922	0.8854	0.8787
31	Taita-Taveta	0.8640	0.8982	0.8733	0.8927	0.8980	0.8956	0.8663	0.8696	0.8620	0.8800
32	Nyamira	0.9103	0.8480	0.8669	0.8779	0.8989	0.9073	0.8759	0.8717	0.8849	0.8824
33	Turkana	0.9277	0.8606	0.8891	0.8792	0.8572	0.8970	0.8948	0.8921	0.8785	0.8862
34	Kwale	0.8752	0.8717	0.8624	0.8728	0.8990	0.8924	0.8880	0.9051	0.9105	0.8864
35	Kilifi	0.8955	0.8979	0.8960	0.8954	0.8881	0.8996	0.8809	0.8710	0.8547	0.8866
36	Kiambu	0.9188	0.9102	0.8929	0.8852	0.8979	0.9038	0.8763	0.8747	0.8665	0.8918
37	Bomet	0.8505	0.8468	0.8811	0.9063	0.9034	0.9183	0.9072	0.9114	0.9183	0.8937
38	Nandi	0.9165	0.9079	0.8742	0.8927	0.9013	0.9148	0.9053	0.8873	0.8911	0.8990
39	Embu	0.9210	0.9229	0.8817	0.8960	0.8951	0.9026	0.8703	0.8910	0.9114	0.8991
40	Nakuru	0.9066	0.8961	0.8967	0.9020	0.9151	0.8967	0.8904	0.8900	0.9081	0.9002
41	Machakos	0.9234	0.9042	0.9030	0.9060	0.8979	0.9088	0.8850	0.8888	0.8887	0.9007
42	Lamu	0.9279	0.9262	0.9153	0.9177	0.9157	0.9160	0.9012	0.8731	0.8533	0.9051
43	West Pokot	0.9126	0.9035	0.8863	0.9018	0.9018	0.9059	0.9009	0.9327	0.9375	0.9092
44	Elgeyo-Marakwet	0.8977	0.9200	0.8719	0.8978	0.9244	0.9342	0.9326	0.9368	0.9510	0.9185
45	Meru	0.9239	0.9202	0.9106	0.9128	0.9169	0.9256	0.9274	0.9383	0.9363	0.9236
46	Marsabit	0.9289	0.9348	0.9237	0.9205	0.9088	0.9331	0.9375	0.9378	0.9417	0.9296
47	Nairobi	0.9329	0.9256	0.9262	0.9270	0.9314	0.9348	0.9351	0.9356	0.9280	0.9510
	Average	0.8500	0.8406	0.8323	0.8368	0.8555	0.8560	0.8372	0.8400	0.8437	0.8436
Observations =423 Standard Deviation = 0.0782264											

The mean TE is 0.84 with a standard deviation of 0.08. The lowest efficient county accounts for 0.5 while the highest accounts for 0.95 percent for all the years under devolution. This means that output levels at the county can be increased by about 16 percent without devolving more funds. This suggests that most local governments in a devolved system could deliver extra 16 percent output without extra resources and enhance performance without spending more. This finding agrees with Oates, 1972, that although smaller regions are more aligned with the structure for providing public goods and services, small-scale operations may not be economically feasible. Regional governments are noted to operate in a way that may undermine the growth of the local areas. Fiscal decentralization also can undermine the central government's ability to address fiscal inefficiencies. Additionally, the rise of corruption and rent-seeking operations within the regions may render the government inefficient in allocating resources (Muriu, 2013). There is a problem in achieving a joint production of goods and services through the local governments effectively demonstrated by low efficiency.

The formation of the 47 county governments, that implied a massive reorganization of government functions with discretion over significant budgets, was to deliver public goods and services more efficiently. However, the high inefficiencies being experiences has caused stagnation and decline of the devolved functions over the period. As the devolved funds increase to the counties, the performance of the devolved economic activities is not appealing. After the 2010 Constitution enactment, resources to counties increased exponentially, going from under 4 per cent of the expenditure by the public sector to about 15 per cent in the year 2020. However, the performances of the devolved functions show stagnation and decline. As the country decentralizes, it is expected to bring much-needed growth, development, and eventually balanced regional growth. As the proponents of fiscal decentralization, Hayek (1945), Tibout (1956), and Musgrave (1959) postulate that fiscal decentralization improves the public sector through enhanced efficiency. It is imperative, from the study findings, that the impact of fiscal decentralization on efficiency may not have assisted in improving it. Although smaller regions with consistent populations are more aligned with the structure for providing public goods and services, small-scale operations may not be economically feasible (Oates, 1972).

Looking at per county's efficiency performance, the study finds that various counties have realized differing technical efficiency in producing public goods and service delivery, with the economically giant counties noted to be less technically efficient compared to the small and historically marginalized counties. From Table 6, Nairobi County is noted to be the most technically efficient county in its use of resources at 95 percent efficiency followed by Marsabit, Meru, Elgeyo-Marakwet and West Pokot at 92.96, 92.36, 91.85 and 90.92 percent respectively. The counties listing and their TE are shown in Figure 2

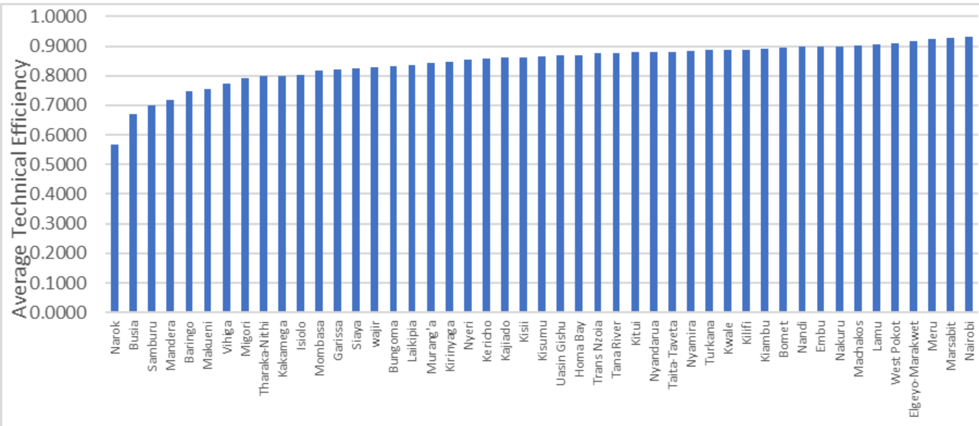

Figure 2: Technical Efficiency Index for the Counties

Narok county is the least efficient, followed by Busia, Samburu, Mandera, and Baringo counties. Ten counties are below 80 percent Technical Efficiency. Most of the counties indicate efficiency decline over the period apart from the years 2017 and 2018. This is shown in Figure 3

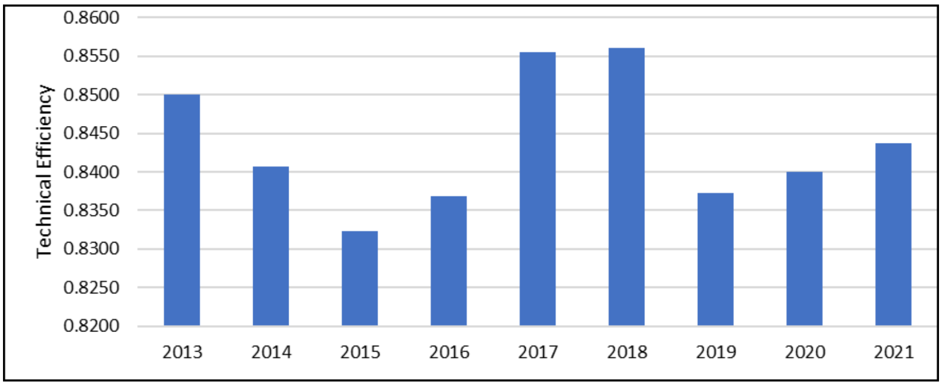

Figure 3: Average Technical Efficiency for the Counties for the Period 2013 to 2021

Average Technical Efficiency was about 85 percent at the onset of the counties in the year 2013. However, the average TE declined to around 83 percent in the year 2015 before hitting the maximum in the year 2018. This demonstrates improvement in TE towards the electioneering periods. The least average TE was observed in the year 2015 and 2019 which signifies the mid-term of the elected leaders at the counties. The highest was observed in the year 2017 and 2018 with improvements of TE observed in the years 2013 and 2021, immediately after and a year before the election. This indicates TE being pegged to the periods of elections. Similar results were found by Barasa et al. (2021) for the health sector. County technical efficiency scores ranged from 42.69 percent to 91.99 percent for technical efficiency of county health systems in Kenya. The mean technical efficiency score of county health systems was found to be 69.72 percent, indicating that on average, county health systems could increase their output by 30.28 percent at the same level of input.

The technical inefficiencies in counties are occasioned by the use of inappropriate production functions characterized by the existence of excess production inputs and suboptimal outputs (Rithaa et al., 2021). Some of the low efficient counties are said to experience low productivity within the agriculture sector attributable to farmers' inability to exploit available technologies resulting into inefficiencies in the production system (Najjuma et al., 2016). In addition, the more urbanized counties are said to experience enormous population growth, urbanization, and rampant soil degradation and this has lessened available land for agricultural activities, lowering productivity (Najjuma et al., 2016). Despite the various agriculture technological innovations, moderate food increments have been observed in the urbanized counties. The increase in food production has been attributed to rural counties due to an increase in the area under production and not technology and this gives higher efficiency index to the counties. It is believed that efficient use of technologies to improve agriculture productivity has also increased together with cost effective in rural counties compared to urban counties. In addition, some counties are void of land ownership which makes land use agreements for infrastructure investments difficult and has kept communities at a bargaining disadvantage in the design and implementation of investments. Notably some projects have paid a hefty price in contract adjustments and penalties owing to delays in gaining access to investment sites which require completion of required safeguard actions.

IV. Summary, Conclusions And Policy Implications

Kenya has been implementing fiscal devolution since the year 1963 with differing dimensions. This is with the aim of improving efficiency in resources allocation and provision of public goods. The Constitution 2010 whose main dimension was devolution in order to attain technical efficiency in the delivery of public goods and services. The provision of fiscal decentralization under the country's law was aimed at enhancing technical efficiency through revenue independence. This was then to realize productive government that was to reduce wastage in expenditure and tailor-make locally focused production at the counties. Fiscal devolution was also to take advantage of local competitive advantage. However, as the devolved funds increased and the fact that the allocations to counties and enhanced revenue independence, there seems to be no evidence of improved technical efficiency as there has been no significant improvement in the provision of goods and services for devolved functions, including health and agriculture. There is an observed decline in the county's growth in domestic product over the years. In this regard, the study's aim was to determine technical efficiency at the counties. The data used was obtained from Kenya National Bureau of Statistics and Government Publications for the period 2013 to 2021. The Stochastic Frontier Analysis model was used to estimate a production function. The mean TE across all counties from 2013 to 2021 is 84 percent. This implies that counties could potentially increase their output by 16 percent without requiring additional resources. Technical efficiency varies substantially across counties, with economically stronger counties were less efficient than smaller or historically marginalized ones. It is concluded that counties have room for efficiency improvements since there was wide variation in efficiency, with some counties having efficiency levels as low as around 50 percent.

Based on these findings, the study recommends the following: There is need to enhance technical efficiency at the county levels especially for those counties with relatively low efficiency should optimize resource utilization. This optimization would require rationalizing use of inputs such as human resources and operation and maintenance. In addition, performance oversight should be enhanced and institutionalized by the county assemblies and auditor general. The national government through the National Treasury, Commission for Revenue Allocation and ministry of devolution should also build capacities of the counties in optimal use of resources.

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