

An Assessment of Public Spending Efficiency of Health and Education in Nigeria

Adamu Jibir ^{*1}, Aminu Bello¹ & Abel Amos¹

¹Department of Economics, Gombe State University, Nigeria.

*Correspondence Email: adamujibir@gmail.com

Abstract

This study analysed the efficiency of Nigeria's public spending in the health and education sectors using the non-parametric Data Envelopment analysis (DEA) approach. It further examined the environmental variables (which can be economic, institutional or demographic factors) influencing public spending efficiency in these sectors for the period 2000–2022 using censored Tobit regression and fractional logistic regression. The empirical results showed that the average public spending efficiency scores of health and education are 0.979 and 0.912, respectively, implying that Nigeria can still improve the efficiency of these two sectors even though it is relatively high. The second analyses of the regression results revealed that broad money and the size of government spending are the economic variables which have significant influence on the efficiency of both the health and education sectors. Control of corruption and government effectiveness are the government institutional variables that have a significant influence on efficiency. Both urbanization and population growth have been found to significantly influence public spending efficiency. This study strongly recommends the deliberate implementation of policies and measures that will improve the performance of government institutions and the development of secured urban centres in Nigeria, which will help ensure improvement in public spending efficiency in Nigeria.

Keywords: Public Spending Efficiency; Health Public Spending; Education Public Spending; Data Envelopment Analysis (DEA)

JEL Classification: C34, H51, H52, C80, C67

1. Introduction

As public spending is very important for stimulating economic growth, government is also seen as an instrument for fostering change, and the government level of spending reveals the level of government involvement in the economy (Jibir & Aluthge, 2019). Recognizing the significance of public spending, governments worldwide spend a greater proportion of their national income annually on the economy. For instance, general government expenditure amounted to 46.3% of GDP on average in OECD countries in 2021 (OECD, 2023) while in the case of Nigeria, the average growth of government expenditure from 2000 to 2022 is 17.7% and considering the education and health sectors, the average growth rate of government spending in education and health sectors from 2018 to 2020 are 17.2% and

21.1% respectively (CBN, 2021). Many studies aiming at buttressing the importance of public spending on GDP have postulated a positive relationship between public spending and economic growth (Al-Faryan & Shil, 2022; Angelopoulos, Philippopoulos & Tsionas, 2008; Barro, 1990; Chan, Zaini & Karim, 2012; Maku 2009; Nasiru, 2008; Okoye, Omarkhanlen, Okoh, Urhie & Ahmed, 2019; Ouertan, Naifa & Haddad, 2018; Sumarsono, Qodri & Prayitno, 2022).

However, even though adequate public spending is important for stimulating sound economic growth, many a times, public spending can fail to yield the expected outcome, indicating inefficiency of such spending. This can be due to overspending by the government, poor governance or mismanagement, misallocation of resources or any other economic or social factors that can deter public spending to yield the desired economic outcomes. For example, more expenditure by the government may be ineffective if fiscal discipline is not observed, and this can be seen from poor economic outcomes which are the target of such public spending. In other words, government spending is inefficient if it fails to yield the desired result needed to improve social welfare. Hence, policymakers from time to time must decide on the level of public spending to be exerted to maximize social welfare and ensure efficiency (Afonso, Romero & Monsalve, 2013). To achieve this level of public spending efficiency, Hsu, (2013) emphasize on pro-service oriented public spending.

Therefore, government spending efficiency has now become one of the major issues in public finance because concern about the role of government vis-à-vis its expenditure has shifted from giving much significance to the size of government spending towards its efficiency and effectiveness by assessing public sector activities. This is because a high increase in government expenditure has many implications for the economy, and explaining one of these implications, Diana (2014) stresses that increased public expenditure caused by the desire for public duty sometimes results in high public debt, which accumulates a debt burden on future public budgets and future generations. In addition, an increase in the size government spending may lead to an increase in taxes, as taxes are one of the sources of government revenue. This means that as government expenditure increases, taxpayers can be squeezed the more in other to generate more revenue to meet the needed increase in expenditure. Recognizing this effect, taxpayers demand the efficient use of public spending. Hence, it is very significant for the government to spend the money collected from taxpayers efficiently, as it is accountable to its citizens (Chan *et al*, 2012). However, to avoid the effects of high public debt and high taxes on the public, increasing the performance, effectiveness and efficiency should be a major priority for any government. Hence, an intensive orientation to improve performance in the public sector should aim to reduce the burden of tax, increase public confidence in the government and increase overall productivity. Thus, public economists are now interested in assessing public sector efficiency and in identifying the possible factors that can explain the variations in efficiency both across countries and over time (Wang & Alvi, 2011). It has now been recognized in many studies that not only the size but also, more importantly, the efficiency of government spending is a requisite for fostering economic growth and ensuring a country's economic success (Adam, Delis & Kammas, 2007; Adeboye & Akinyele, 2022; Afonso, Schuknecht & Vito-Tanzi, 2003; Afonso *et al.*, 2013; Cubi-Molla, Buxton & Devlin, 2021; Giordano

and Tommasino, 2011; Heimberger, 2021). This is because while large government spending is desirable due to its multiplier effect, it is not by itself sufficient to guarantee enhancement in service delivery, as poor budget management can lead to ineffectiveness and inefficiency of public expenditure. It should also be noted that the efficiency of public expenditure can be used as an indicator to evaluate the efficiency of government spending policy implementation on health, education, administration, income distribution, and economic stability. This, therefore, shows the importance of studying public spending efficiency, especially in a country such as Nigeria.

Since a more efficient public sector has become a universal target of central importance in economic policy, then the ability of Nigeria's public sector to provide high-quality goods and services in a cost-effective way depends on the efficiency of its government spending, which is highly important for fostering long-term growth. As Nigeria's population is increasing day by day and its economy is growing, the country's economy is facing increased pressure from the demand for public goods stemming from socioeconomic and political demands. This tends to increase Nigerian government spending, proving the well-known Wagner's Law, which states that public spending (expenditure) constantly increases as income growth expands or the economy grows.

In addition, Nigeria is one of the countries that relies on oil, and the major source of government revenue for spending is the oil proceed. However, worldwide trending crises such as the COVID-19 pandemic have led to a decrease in oil revenue while at the same time increase the demand for government expenditures in the economy. For example, the contribution of oil revenue to total revenue in Nigeria decreased from 60.4% in fourth quarter 2019 to 40.1% in second quarter 2021 (CBN Economic Report 2021). With an increase in demand for government intervention through public spending, the non-oil revenue sources such as taxes and borrowing must increase if government targets are to be met. Given that the resources in Nigeria's public sector are mostly generated through oil proceed (which is highly susceptible to international crises), borrowing (which accumulates debt burdens on future public budgets and future generations) and taxes (which create distortions in the allocation of resources), and all of which have limiting effects on economic growth, it is very important that the generated public resources are spent in the most effective and efficient way to foster long-term growth in the country. As proposed by Fonchamnyo & Sama (2016), improving the efficiency and effectiveness of public spending is necessary for maintaining fiscal discipline, which is instrumental in promoting the structural reform agendas of most African countries and permitting nations (such as Nigeria) to achieve a given set objective of their budget at lower or the same levels of spending. Therefore, it is on the above basis that this study attempts to carry out an anatomy of public spending efficiency in Nigeria and determine the possible environmental factors that influence public spending efficiency or explain the differences in efficiencies.

This study contributes to the existing literature on public spending efficiency by first measuring the relative efficiency of public spending in Nigeria over the period 2020 to 2022. Secondly, it explains the variation in technical efficiency (TE), allowing the identification of a battery of environmental variables that could affect policymakers' decisions. The remainder of the paper is organized as follows: Section 2 presents literature

review. Section 3 describes the data and empirical methodology. Section 4 reports the empirical findings and discussion of the results. The study ends with a conclusion and recommendation.

2. Literature Review

Theoretical Review

Wagner's Law of Increasing State Activities: The earliest theory of public expenditure could be traced to the work of Adolph Wagner (1835-1917), who propounded an interesting development thesis, which loosely held that as a nation develops, its public sector and consequently public spending will grow in importance (Ukwueze, 2015). In an attempt to generalize and explain the changes occurring in the level of public spending, Wagner proposed "the Law of Increasing State Activity". According to Wagner, there are in-built tendencies for the activities of different government layers (such as central, state and local governments) to increase both intensively and extensively (Chinedu, Mike & Uchenna, 2008; Maku 2009). Put in other words, as development takes place in an economy, Wagner hypothesizes that it is accompanied by an intensive and extensive increase in the activities and responsibilities of government, which in turn leads to growth in public spending. Therefore, Wagner's law apparently indicates that there is a functional relationship between the growth of an economy and government activities, indicated by the increase in public expenditure.

Wiseman–Peacock Hypothesis: Peacock and Wiseman (1961) in their study of public expenditure in UK for the period 1890-1955 put forth supply side theory of public expenditure operating through the tolerable limits to taxation on the financing of public expenditure as the more important determinant of the growth of public expenditure. The main postulation of this theory is that public expenditure increases in jerks or step-like fashion rather than in a smooth and continuous manner. Normally, due to an insufficient pressure on demand for more public expenditure, revenue constraints dominate and restrain the expansion of public expenditure. However, times come when disturbance takes place creating a need for increased public expenditure, which the existing public revenue (tolerance level of tax) cannot meet. Hence, under these changes caused by the disturbance, the revenue restraints give way, and public spending increases, making the inadequacy of the present revenue clear to everyone. The change from the older level of expenditure and taxation to a new and higher level is the "displacement effect" (because public expenditure is displaced upwards), and after this period of displacement, public expenditure and the tolerance level of tax do not fall back to their original levels. Another effect thought by Peacock and Wiseman to work alongside the "displacement effect" is the "inspection effect". This effect arises as a result of the need for more public activities in the form of increased public spending due to the displacement effect and because public perception of the tolerable level of taxation does not return to its former level. Thus, the government and the electorate review the revenue position and the need to find a solution to the problem of the need for increased public spending. As a result, a new level of tax tolerance is attained, and the government is able to finance a higher level of expenditure so as to expand its scope of services to improve the social condition of the people. In this way, the general level of expenditure and revenue increase and stabilize at a new level until another disturbance

occurs, causing a displacement effect again. Alongside the displacement effect is another influence, called the “concentration effect”. The concentration effect refers to the apparent tendency for central government economic activity to grow faster than that of state and local governments (Peacock and Wiseman, 1967). Here, the concentration effect indicates that each major disturbance (displacement effect) leads to the government assuming a larger proportion of public spending.

Musgrave Theory of Public Expenditure Growth: This theory was put forward by Musgrave (1969). The Musgrave theory of public expenditure growth established a relationship between per capita income and public expenditure. The major postulation of the theory is that at low levels of per capita income, demand for public goods and services tends to be very low because such an income level is devoted to satisfying basic individual needs. However, as per capita income begins to rise above low-level income, the demand for goods and services supplied by the public sector, such as transport, education and health, starts to rise, thereby forcing the government to increase expenditures on these goods and services (Ogbuagu & Ekpenyong, 2015). Therefore, Adegboye and Akindele (2022) concluded that the Musgrave theory postulates a high correlation between per capita income and public sector social service demand with supply.

However, it is important to note that these public expenditure growth theories try only to explain the reasons for increased or higher-level public spending. It does not, however, explain whether these spendings are efficient. This research centres on assessing the efficiency of government spending on the health and education sector in Nigeria and determining the factors that can influence efficiency scores.

Empirical Review

The literature assessing the efficiency of government spending has usually obtained efficiency frontiers by applying either parametric or nonparametric approaches. Stochastic Frontier Analysis (SFA) is a popular parametric approach, and Free Disposal Hull (FDH) and Data Envelopment Analysis (DEA) are the two non-parametric approaches that have been used by many researchers to obtain an efficiency frontier. Although there are literatures on efficiency dating to the 1950s, the empirical literature reviewed in this research spans from 2010 to 2022 to enable us to capture the current trend in efficiency analysis.

Kolesar *et al.* (2022) assessed Cambodia’s public health services technical efficiency using DEA and truncated regression. The results showed that for the public health system to be fully efficient, the output would need to increase by 34 and 73% for hospitals and health centres, respectively. In addition, the results show that public sector service quality, private sector providers, and nondiscretionary financing were found to be statistically significant factors affecting technical efficiency. Using different techniques, that is, SFA and TFE, Adegboye and Akinyele (2022) assess the efficiency of government in Africa and examine the drivers of government spending efficiency. The frontier result shows that there is large variation in the use of input factors among countries in Africa to achieve human development, and this variation can be explained by technical inefficiency. Hence, governments in African countries are not efficient when it comes to government spending. The study also revealed that the size of government spending and colonial legacy affect the

government spending efficiency in Africa. The authors recommend the need to improve the efficiency of government spending in order to situate a framework for African development. Similarly, Wandeda *et al.* (2021), analyzing public spending efficiency among sub-Saharan African countries using panel data for 23 sub-Saharan African countries covering the period 2006-2018, found that the average bias-corrected inefficiency score was 48% between 2006 and 2018, while the uncorrected inefficiency was 32.3%. In addition, institutional quality and domestic saving were found to significantly influence the efficiency of public spending; hence, the need for sub-Saharan African governments to observe fiscal discipline through strengthening the monitoring unit of government expenditure is suggested. Auci *et al.* (2021) uses DEA to assess efficiency and estimate the impact of the size of the public sector on the technical efficiency of 15 countries from 1996 to 2006. The findings of their research reveal that the effect of the size of public sector on efficiency is positive, while the type of public expenditure may have both positive and negative impacts. Afonso *et al.* (2020) measure public sector efficiency by sampling 36 OECD countries over the period between 2006 and 2017. The results show that the average efficiency score throughout the period is approximately 0.6 for the 1-input and 1-output model and approximately 0.7 for the alternative models and that some possible efficiency gains could be achieved with approximately 30% less government spending, on average, without changing the PSP outputs. Syaparuddin and Faradina Zevaya (2020), utilizing DEA and the Tobit model to analyse the efficiency level of health expenditure of entire provinces in Indonesia, found that all the provinces in Indonesia fluctuated in terms of leveraging expenditures to achieve efficiency and optimal health sector development, with Eastern Indonesia possessing a high level of efficiency. Tobit regression on the whole reveal that health expenditure has a positive and significant effect on health development performance in Indonesia.

Olanubi *et al.* (2019) examine the inefficiencies in the utilization of funds allocated to social protection in the euro area during the Great Recession and euro area sovereign debt crisis that Followed. The results revealed large-scale inefficiencies in the utilization of funds allocated to social protection and that countries wasted, on average, 34.6% of funds disbursed to the scheme during this period. On the other hand, Ouertani1, Naifar and Haddad (2018) measure the relative efficiency of Saudi Arabia's public spending over the period 1988–2013 using DEA-Bootstrap analysis. The empirical results show that, on average, public spending is inefficient, implying that Saudi Arabia can improve its health, education and infrastructure performance without increasing spending. Chaluvadi, Raut and Gardas (2018) also evaluate the performance efficiency of 44 Indian commercial banks, 26 of which were from the public sector and 18 of which were from the private sector, for the period of 2008-2013 using a two-stage network data envelopment analysis (DEA) approach. This comparative study reveals that private sector banks (PVBs) are more productive than public sector banks (PSBs). Montes *et al.* (2018) analyse whether countries are making efforts to enhance fiscal transparency and whether fiscal transparency affects government effectiveness. The study using a sample of 82 countries (68 developing and 14 developed) for the period 2006-2014, and panel data analysis revealed that approximately 80% of the countries made efforts to improve fiscal transparency. The results suggest that fiscal transparency is important for reducing public debt and improving government effectiveness and government spending efficiency.

In addition to efficiency measurement, Chan *et al.* (2017) examined the impact of government spending efficiency on the economic growth of 115 countries with a value-added tax (VAT) system and find the following: first, government spending efficiency promotes economic growth; second, the VAT system enhances the effect of efficient government spending on economic growth; and lastly, the moderating role of the VAT system is further enhanced by the quality of democracy and legislative strength of the government. However, Gavurova *et al.* (2017) implement a comparative study to assess the efficiency of government expenditure on secondary education in European countries using the DEA approach. Their findings showed that the average efficiency was 0.955, which suggests that the efficiency in the evaluated countries was relatively high. On the other hand, Olanubi and Osade (2017) focused their study on examining the efficiency of public funds allocated to human resources for health (HRH) during 6 regimes in Nigeria over the period of 1966 to 2016. Their results revealed that spending by government on HRH in Nigeria has been mostly inefficient and therefore suggest that Nigeria should pay more attention to the development of health input.

Study by Olanubi and Osode (2016) examined the efficiency of public funds allocated to human resources for health (HRH) during 6 government regimes in Nigeria over the period of 1966-2014 using DEA and FDH and found that government spending on HRH in Nigeria has been mostly inefficient and suggested that the Nigerian government should therefore devote more attention to the development of this vital health input. Afonso and Kazemi (2016) analysed the public expenditure of 20 OECD countries for the period 2009-2013 from the perspective of efficiency and try to assess whether these developed countries are performing efficiently compared to each other. The results from the DEA analysis showed that the average input-oriented efficiency score is equal to 0.732, indicating that on average countries could have reduced the level of public expenditure by 26.8% and still achieved the same level of public performance, while the average output-oriented efficiency score is 0.769, indicating that, on average, the sample countries could have increased their performance by 23.1% by employing the same level of public expenditure. Using data from more than 400,000 firms across Italy's provinces, Giordano *et al.* (2015) studied the effect of public sector efficiency on firm productivity. The findings show that public sector inefficiency significantly reduces the labor productivity of private sector firms and that increasing public sector efficiency could yield large economic benefits.

Inua and Maduabum (2014) use DEA as an instrument for measuring the performance efficiency of selected broad-based federal universities in Nigeria. The results revealed that only four (i.e., 23.5%) of the 17 federal universities studied can be judged as performing efficiently in terms of input and output phenomenon. On the other hand, Prasetyo and Zuhdi (2013) sampled 81 countries for the period of 2006 to 2010 to examine the efficiency of government spending on human capacity building using the DEA approach. The results of their findings show that only few countries, namely, Japan, Nigeria and Norway, were positioned within the efficiency frontier during the sample period. Hsu (2013) examined government spending efficiency on health for 46 Central Asian countries and Europe using the DEA method. The average level of efficiency scores in Europe and Central Asia as a whole is 0.98, indicating that countries could have increased output by 1.2% given the

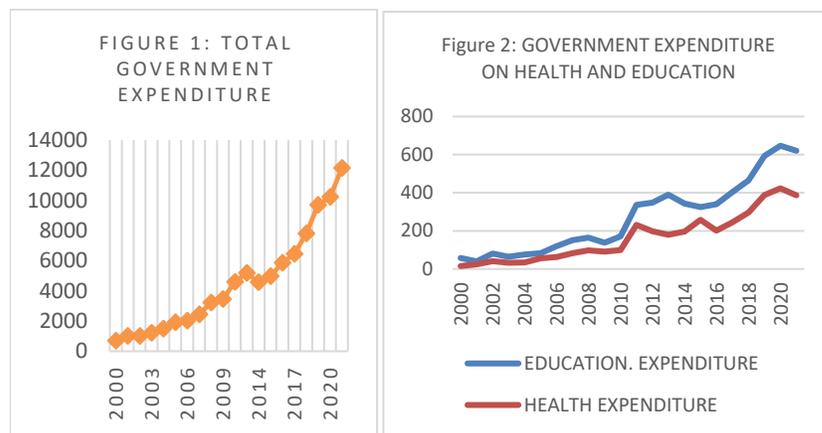
existing level of inputs. In addition, countries with better medical environments and more years of education may enjoy increased efficiency. Afonso *et al.* (2013) compute public sector performance (PSP) and public sector efficiency (PSE) indicators and Data Envelopment Analysis (DEA) efficiency scores for a sample of twenty-three Latin American and Caribbean countries to measure the efficiency of public spending for the period 2001-2010. Their findings show that PSE is inversely correlated with the size of the government, while the efficiency frontier is essentially defined by Chile, Guatemala, and Peru. Tobit analysis reveals that more transparency and control quality improve the efficiency score, while further transparency and control of corruption increase output-oriented efficiency.

Hauner and Kyobe (2010) sampled 114 countries from 1980 to 2006 and used DEA to estimate public sector performance (PSP) and public sector efficiency (PSE). The findings showed that higher expenditures relative to GDP tend to be associated with lower efficiency and that richer countries show better public sector performance and efficiency. Moreover, government accountability and demographic factors play significant roles in determining efficiency. Bergantino & Porcelli (2010) analyse the relative efficiency of Italian provincial capitals using panel data from 2000–2007 and examine its main determinants. The findings from the study reveal that efficiency in the delivery of local transport services seems to be negatively affected by population, the introduction of limited traffic zones, the number of paying car parks, and councils run by Centre-right parties.

The empirical review above indicated that most previous studies on public spending efficiency are biased toward assessing and comparing the efficiency of public spending across countries. These studies concentrated on comparing the public spending efficiency of many countries, either regionally, in developed countries or in combinations of developing and developed countries. Hence, the conclusions drawn from these studies cannot be directly extended to the Nigerian economy, as those studies mostly address intercountry comparisons, and the composition of government spending and priority in economic objectives are significantly different in each country. Unlike previous studies, this research assesses the efficiency of government spending not in relation to other countries but over time. This means that the research measures how government spending in different periods of time is efficiently utilized to produce economic indicators in the health and education sectors.

Trends in Government Expenditure in the Health and Education Sector in Nigeria

The government places great significance on the health and education sector through her spending because of the important impact of these sectors on the labour force and the population in general. A healthy and well-educated population is a prerequisite for improving labour force productivity, growing science and technology and maintaining sustainable economic growth and development. Figures 3.6 and 3.7 below showcase the trend of total government expenditure and total government expenditure in relation to health and education sectors in Nigeria.



The figures above indicate that both total government expenditures and health and education expenditures are increasing between 2000 and 2021. In this period, the average government expenditure is ₦4508.81b, which is 7.46% of the total GDP. The average government expenditures on health and education sectors are ₦165.40b and ₦272.515b, respectively. However, average government expenditures on health and education as a share of total government expenditures over the period of 2000 to 2021 were approximately 3.40% and 6.02%, respectively.

3. Methodology

Data

The main sources of data for this research are World Bank Development Indicators, World Bank Government Indicators and the Central Bank of Nigeria Statistical Bulletin. The main inputs to be used are public spending (government expenditure) on education and health (percentage of total government expenditure). The economic indicators to be used in the education sector as outputs due to the scarcity of data on some indicators are primary and secondary enrolment, while in the health sector, the outputs are life expectancy at birth and immunization against measles and DPT. This in line with the study conducted by Afonso & Kazemi, (2017), Ouertani *et al.* (2018) and Wandeda *et al.* (2021). The data for the second-stage regression model are variables that can affect the efficiency of public spending in Nigeria at the macro level. These are of environmental factors, which include economic, institutional and demographic factors. These variables include size of education and health public expenditure, inflation, urbanization labour productivity, per capita income and the corruption index. The data for both the DEA and regression analysis cover the period spanning 23 years from 2000 to 2023 (however, the research uses only data that are available within the time scope).

DEA Model

Based on the assumption that the government tries to maximize output in each economic sector with a given fixed amount of input expenditure, this research employs the output-oriented variable return to scale (VRS) model. The study adopted the DEA model developed by Banker *et al.* (1984) for calculating technical efficiency and extended by Lynde and Richmond (1999) for the case of time series analysis and used by Ouertani *et al.* (2018) and Wandeda *et al.* (2021). Therefore, in this study, the different period (years) are considered to be a DMU or a producer using a given level of input(s) to produce a given number of output(s) (goods and services). Hence, each DMU in each period will be treated as it were different DMU and this suggest that there would be 23 sets of decision-making units (DMUs) for each sector in every year of the analysis.

Therefore, the model used to evaluate the technical efficiency of Nigeria's public spending for each time t can be written as follows:

$$\begin{aligned} \theta^* = \text{Max} \theta & \dots\dots\dots 1 \\ & \lambda \theta \\ \text{Subject to} & \\ \sum_{t=1}^n \lambda_t x_{it} \leq x_{t0} ; \quad i = 1, \dots, m & \dots\dots\dots 2 \\ \sum_{t=1}^n \lambda_t y_{it} \geq \theta y_{t0} ; \quad r = 1, \dots, s & \dots\dots\dots 3 \\ \sum \lambda_t = 1 \quad (VRS) & \dots\dots\dots 4 \\ \lambda \geq 0 & \\ t = 1, \dots, n & \end{aligned}$$

Where θ is a scalar, and $1/\theta$ is the output-oriented efficiency score and satisfies $0 < 1/\theta \leq 1$, θ^* represents the distance of each time DMU from the efficient frontier, y_t is a vector of outputs for year t , x_t is a vector of inputs for the year t , and λ is $(T \times n)$ dimensional vector of constants that measure the weights used to compute the location of an inefficient DMU if it were to become efficient.

Restriction 4 from the above specification assumes Variable Return to scale. The condition was proposed by Banker *et al.* (1984) to impose convexity on the frontier. Dropping this restriction would lead to the assumption of constant return to scale (CRS), which implies that all DMUs are operating at their technically most efficient scale and able to scale the input and output linearly without increasing or decreasing efficiency.

Second-stage Model (Explaining the Determinant of Efficiency)

After estimating the efficiency scores in the first stage using DEA, the second-stage estimation investigates the factors influencing the efficiency of each sector's public spending. The aim is to identify the variables at the macroeconomic level that could have a significant influence on the public spending efficiency of education and health, thus explaining the efficiency variations across time in Nigeria. This means that in the second stage, the technical efficiency scores generated for health and education are regressed against some explanatory variables to examine the determinants of efficiency in these sectors. Therefore, we can assess the effects of several exogeneous variables, also known as

environmental factors (institutional, social and economic macro factors) on efficiency scores by adopting the regression equation below:

$$\delta_{it} = \alpha + Z_{it} \beta + \varepsilon_{it} \quad t = 1 \dots, n \dots\dots\dots 5$$

Where δ_{it} is a vector of the obtained TE scores (which represent the efficiency score of Nigeria at time t for a particular sector), α is a constant, Z_{it} is a vector of explanatory variables that might affect the efficiency level for year t , β is a vector of parameters assessing the influence of the explanatory variable Z_t on efficiency, and ε_{it} is a continuous random variable uncorrelated with Z_{it} (i.e., a normally distributed error term with zero mean and variance σ_ε^2).

Estimation Strategy

To assess the technical efficiency score of Nigeria's public spending in the health and education sector, this research adopts the DEA output-oriented variable return to scale (VRS). The DEA output-oriented framework is chosen because public spending is always increasing marginally or significantly, and the government tries to maximize output given her level of spending. However, for a robustness check of the VRS output-oriented score, the input-oriented technical scores are obtained and compared.

To investigate the factors influencing the efficiency of each of the health and education sectors' public spending in the second stage, this research adopted the Tobit estimation technique (Tobit regression) adopted by many studies, such as Afonso *et al.* (2006), Afonso (2010), Dobdinga *et al.* (2016), and Fonchamnyo and Sama, (2014). The Tobit model is also called a censored regression model, designed to estimate linear relationship between variables when there is either left or right censoring in the dependent variable. The justification for choosing Tobit regression was based on the fact that the efficiency scores take the values between 0 and 1 and thus censored from both left and right.

4. Results

Efficiency of Public Spending on Education and Health

For a robust result, both the output and input oriented variable return to scale technical efficiency score are presented. Table 1 presents the results of the DEA technical efficiency estimation. On average, the output efficiency score for the health sector in Nigeria is 0.979, while the input efficiency score is 0.968. This result implies that the health sector's inefficiency level is 0.021 and that Nigeria can increase its health performance or efficiency by 2.1% (output orientation) or achieve the same level of output by using 3.2% less input (when considering the input orientation score). The results also reveal that Nigeria's government expenditure on health was efficient for 7 out of the 23 years under study: 2002, 2009, 2011, 2014–2015 and 2019–2020. These years mark the efficiency frontier. This result implies that during these years, government spending in the health sector was used to improve life expectancy and immunization against DPT and measles. The remaining years indicate inefficient performance of public spending. However, the efficiency scores of these years are very close to the average technical efficiency score, implying high performance of public spending in the sector.

On the other hand, looking at the public spending of Nigeria on education over the period under study, Table 1 reveals average output and input efficiency scores of 0.912 and 0.687, respectively. In essence, the results imply that the levels of in efficiency of the sector considering both output and input technical efficiency scores are 0.088 and 0.313, respectively; hence, the government can increase its education performance by 8.8% or decrease input by 31.3%, respectively, while maintaining the same level of output. Further assessment of the results reveals that public spending on education was efficient only in the 4-year period, i.e., 2000 to 2001, 2003 and 2006. This implies that Nigeria was able to improve the rate of primary and secondary enrolment over these periods. The lowest efficiency score of 0.86 was recorded in 2018, and the remaining public spending on education was inefficient because the technical efficiency scores of those years were less than 1.

Table 1: DEA Technical Efficiency Score of Nigeria's Public Spending on Education and Health

YEARS	Health		Education	
	Output Oriented VRS TE	Input Oriented VRS TE	Output Oriented VRS TE	Input Oriented VRS TE
2000	0.969	0.983	1	1
2001	0.971	0.975	1	1
2002	1	1	0.976	0.831
2003	0.966	0.954	1	1
2004	0.945	0.942	0.995	0.867
2005	0.918	0.895	0.998	0.924
2006	0.915	0.889	1	1
2007	0.974	0.983	0.922	0.772
2008	0.971	0.943	0.834	0.695
2009	1	1	0.844	0.627
2010	0.952	0.87	0.835	0.557
2011	1	1	0.888	0.54
2012	0.991	0.985	0.917	0.522
2013	0.982	0.971	0.933	0.438
2014	0.988	0.957	0.895	0.539
2015	1	1	0.906	0.526
2016	1	1	0.833	0.586
2017	0.996	0.978	0.867	0.554
2018	0.994	0.961	0.86	0.566
2019	1	1	0.865	0.56
2020	1	1	0.866	0.563
2021	0.998	0.983	0.868	0.561
2022	0.999	0.992	0.863	0.562
Mean	0.979	0.968	0.912	0.687

Note: VRS: Variable Return to scale, TE: Technical efficiency, Source: Author's Computation

For the purpose of comparison and robustness, Table 1 shows the DEA results for both output and input-oriented efficiency. It can be observed that there is not much difference

between the input and output TE scores. A very close mean efficiency scores have been obtained from the output and input-oriented models in health (0.979 versus 0.968), while the education sector showed a large range of differences between the output and the input scores, (i.e., 0.912 versus 0.687). Furthermore, the periods in which government spending on health and education are efficient (or inefficient) having scores equal to 1 (or less than 1) are the same for both the output and input efficiency scores in both sectors. This result reveals the robustness of the efficiency scores and the efficiency of public spending in these sectors. In addition, both the health and education sectors recorded high mean efficiency scores, which imply high performance of public spending in these sectors.

Combined Efficiency of Health and Education Spending in Nigeria

Table 2 presents the efficiency scores of health and education spending when considered simultaneously. Here, the study considered two inputs (health and education expenditure) and five outcomes (primary and secondary enrolment, life expectancy, immunization against measles and DPT).

Table 2: TE OF Public Spending Health and Education combined over the period of 2000 to 2021

Years	Output Oriented Technical Efficiency Scores		
	VRS TE	CRS TE	SCALE EFFICIENCY
2000	1	1	1.000
2001	1	1	1
2002	1	1	1
2003	1	0.994	0.994
2004	1	0.996	0.996
2005	1	1	1
2006	1	1	1
2007	0.996	0.977	0.981
2008	1	1	1
2009	1	1	1
2010	0.950	0.933	0.983
2011	1	1	1
2012	0.986	0.931	0.944
2013	0.983	0.917	0.933
2014	0.954	0.884	0.926
2015	0.964	0.901	0.934
2016	0.940	0.877	0.933
2017	0.982	0.911	0.928
2018	0.979	0.906	0.926
2019	0.997	0.925	0.928
2020	1	0.953	0.953
2021	0.995	0.908	0.913
2022	0.989	0.905	0.914
Mean	0.988	0.953	0.965

Note: VRS: Variable Return to scale, CRS: Constant Return to scale, TE: Technical efficiency

Source: Author's Computation

Table 3 shows the output-oriented variable return-to-scale (VRS), constant return-to-scale (CRS) technical efficiency scores and the scale efficiency score. The VRS TE score obtained from the combined estimation is slightly the same as the VRS TE scores obtained for both health and education when estimated separately (0.988 versus 0.979 versus 0.912). This result could be attributed to the choice of the same samples of variables used in the estimation. However, the technical and scale efficiency scores are on average high, at 0.988 and 0.965, respectively. This implies high performance with respect to both the pure relationship between input and output combinations and the scale of public spending in these sectors.

Determinants of Public Spending Efficiency

In this section, we relate the scores of the public sector spending efficiency score (DEA scores) to various potential correlates. Hence, Table 3 presents the estimation results of the factors that influence public spending efficiency in both the education and health sectors. The Tobit and fractional logit estimation results are presented. The discussion of the results is grouped into three categories of determinants: (i) economic, (ii) institutional, and (iii) demographic. Given the high correlations between some of the regressors, a regression is run for the economic, social and demographic determinants separately, and some of the regressors are run univariately to avoid multicollinearity.

Economic Determinants

Table 3 (especially from the Tobit regression) reveals that public expenditure has a significant positive effect on public spending efficiency for both the education and health sectors. This finding implies that greater health and education spending in Nigeria increases public sector efficiency. This result is consistent with the findings of Ouertani *et al.* (2018) in their study of public spending efficiency in Saudi Arabia, where they obtained a positive effect of public spending on efficiency in both the health and education sectors. However, Afonso *et al.* (2005), Gupta and Verhoeven (2001), and Hauner and Kyobe (2010) reported a negative effect of public spending on efficiency in both the health and education sectors. Inflation has a negative effect on efficiency only for health, but has a positive effect on the public spending efficiency in the education sector. However, the result is statistically insignificant for both sectors. Only per capita income is found to have a significant positive impact on the efficiency of government spending in the health sector, while the result shows an insignificant negative effect on the efficiency of the education sector. A similar result was obtained by Hauner and Kyobe (2010), who reported that per capita income has a positive impact on education efficiency but negatively impacts the health sector. Broad money, on the other hand, is found to have a positive effect on the efficiency level of health but a negative effect on efficiency in the education sector. The result is statistically significant for both sectors. Ouertani *et al.* (2018) found a similar negative impact of broad money on efficiency in the education sector. Conversely, Fonchamnyo and Sama (2014) obtained a positive impact of broad money on the efficiency level of both sectors.

Institutional Determinants

The effectiveness of institutions is likely to determine the efficiency of public spending in a country. The institutional determinants of efficiency considered in this study are government institutional factors. Control of corruption which is an important and intuitive determinant of

Table 3: Regression results of Factors Determining Public Efficiency in Health and Education in Nigeria.

	Health Efficiency		Education Efficiency	
	Tobit Estimation Coefficient	Logit Estimation Coefficient	Tobit Estimation Coefficient	Logit Estimation Coefficient
Economic Determinants				
<i>Health Expenditure</i>	0.310** (0.004)	10.539** (0.035)		
<i>Education Expenditure</i>			0.294*** (0.000)	4.730*** (0.000)
<i>Inflation</i>	0.002 (0.873)	0.170 (0.637)	-0.0202 (0.174)	0.323 (0.088)
<i>Per Capita income</i>	-0.018 (0.544)	0.056 (0.943)	2.178 * (0.042)	1.167 (0.175)
<i>Broad Money</i>	(0.085) *** (0.000)	(2.701) *** (0.000)	-0.211 *** (0.000)	-4.335 *** (0.000)
Institutional Determinant				
<i>Control of Corruption</i>	0.013 (0.758)	0.286 (0.725)	-0.277 *** (0.000)	-4.724 *** (0.000)
<i>Political Stability</i>	0.053 (0.166)	1.759 (0.307)	0.001 (0.985)	0.710 (0.342)
<i>Government Effectiveness</i>	-0.266 ** (0.004)	-9.759 * (0.040)	0.368 *** (0.000)	4.025 ** (0.001)
<i>Voice accountability</i>	0.068 (0.076)	2.971 (0.108)	-0.020 (0.622)	-0.732 * (0.019)
Demographic Determinant				
<i>Urbanization</i>	0.136 ** (0.006)	5.903 *** (0.000)	-0.428 *** (0.000)	-0.594 ** (0.001)
<i>Population Growth</i>	-0.127 * (0.030)	-7.216 *** (0.000)	0.215 (0.084)	2.298 * (0.036)

Note: P Values in parenthesis, Source: Author's Computation

public spending efficiency, given that corruption breeds waste and is very bad for the growth of any country. The results obtained from the Tobit regression show that, Control of corruption and voice accountability has a positive effect on the efficiency of health spending but negatively affects education spending efficiency. Control of Corruption is found to be statistically significant only in the health sector, while Voice Accountability is significant only for education spending. This finding is supported by Aloka (2015). However, Hauner and Kyobe (2010) obtained the opposite result from their analysis, which showed a decrease in efficiency when control of corruption and voice accountability increases, and vice versa. Political Stability is found to have a positive impact on the efficiency of both health and

education spending even though it is statistically not significant. Government effectiveness also has a significant positive effect on public spending efficiency on education, but has a significant negative effect on health spending efficiency. This result implies that public spending efficiency increases with increase in government effectiveness on education, but decreases in the health sector.

Demographic Determinants

Demographic factors also determine efficiency, and this study considers how urbanization and total population growth affect efficiency in Nigeria. The results from Table 3 above show that urbanization has a significant positive effect on public spending efficiency in the health sector, while it has a significant negative effect on the efficiency of education in public spending. This implies that with an increase in the urban population and in the urban centre, the health public spending efficiency improves. On the other hand, public spending efficiency decreases as urbanization increases in the education sector. This result is consistent with the findings of Sikayena *et al.* (2022). Similarly, Ouertan *et al.* (2018) reported a positive impact of urbanization on health spending efficiency. However, their results on the education sector show that urbanization leads to an increase in public spending efficiency in that sector. On the other hand, population growth has a negative effect on public spending efficiency in health, while it has a positive effect in the education sector. The result is only statistically significant for the education sector, implying that as the population in Nigeria increases, the efficiency of spending improves in the health sector but decreases in the education sector.

Robustness Check

For a robustness check of the Tobit estimate, the results of the fractional logit regression are presented in columns 2 and 4 for the health and education sectors, respectively. The results are quite consistent in terms of their signs and significance levels with those of the Tobit estimation technique. Thus, this shows the robustness of the regression model. The only discrepancies found in the regression results are in inflation and per capita income for the education sector and health, respectively.

5. Conclusion and Recommendations

This study assessed Nigeria's public spending efficiency on health and education from 2000 to 2022 using the nonparametric approach DEA and identified variables that could influence efficiency. On average, the technical efficiency of public spending in Nigeria is relatively high, with average output-oriented VRS TE scores of health and education of 0.979 and 0.912, respectively. The results also reveal that Nigeria's public health spending was relatively more efficient than its education spending.

From the second-stage analyses using the Tobit estimation model, several possible environmental factors that can influence efficiency in these sectors were identified. The results strongly suggest that health expenditure, education expenditure, broad money, government effectiveness, urbanization and population growth have significant relationships with the efficiency of both health and education public spending. However, per capita income, inflation, voice accountability and political stability have no significant relationship with the efficiency of either health or education public spending. Control of corruption was found to have a significant relationship with the efficiency of public spending on education

only. Therefore, this study identified the above-mentioned factors (variables) as playing a significant role in explaining the differences in government spending efficiency over time; hence, policy makers can deliberately control these variables to improve efficiency in the health and education sectors by formulating policies and programs to tackle the effect of poverty, corruption, congestion or overcrowding in urban areas and inflation. Improvement of labour productivity and effectiveness can be encouraged through workshops and training, provision of good incentives to work and cutting down all red-tape and unnecessary bureaucratic process that usually affect public sectors efficiency.

References

- Amos, A., & Jibir, A. (2024). Government spending efficiency in Nigeria: A comparison of economic sectors from 2010-2022. *African Journal of Social and Behavioural Sciences*, 14(1).
- Adam A, Delis MD, Kammas P (2008) "Public sector efficiency: leveling the playing field between OECD Countries." Munich Personal RePEc Archive (MPRA) Paper No. 16493, 1–27. Retrieved from <http://mpra.ub.uni-muenchen.de/16493> on 8/9/2014
- Adegboye, A., & Akinyele, O. D. (2022). Assessing the determinants of government spending efficiency in Africa. *Future Business Journal*, 8(1), 47.
- Afonso, A. (2004). A note on public spending efficiency. CESifo DICE Report, 2(1), 35-39.
- Afonso, A., & Aubyn, M. S. (2005). Nonparametric approaches to education and health efficiency in OECD countries. *Journal of applied economics*, 8(2), 227-246.
- Afonso, A., Schuknecht, L., & Tanzi, V. (2005). Public sector efficiency: an international comparison. *Public choice*, 123(3-4), 321-347.
- Afonso, A., & Fernandes, S. (2006). Measuring local government spending efficiency: Evidence for the Lisbon region. *Regional Studies*, 40(1), 39-53.
- Afonso, A., & Fernandes, S. (2003). Efficiency of local government spending: evidence for the Lisbon region. Available at SSRN 470481.
- Afonso, A., Romero-Barrutieta, A., & Monsalve, E. (2013). Public sector efficiency: Evidence for Latin America.
- Afonso, A., Schuknecht, L., & Tanzi, V. (2010). Public sector efficiency: evidence for new EU member states and emerging markets. *Applied Economics*, 42(17), 2147-2164.
- Afonso, A., Schuknecht, L., & Tanzi, V. (2023). The size of government. In Handbook on Public Sector Efficiency (pp. 6-31). *Edward Elgar Publishing*.
- Al-Faryan, M. A. S., & Shil, N. C. (2022). Nexus between Governance and Economic Growth: Learning from Saudi Arabia. *Cogent Business & Management*, 9(1), 2130157.
- Angelopoulos, K., Philippopoulos, A., & Tsionas, M. (2008). Does public sector efficiency matter? Revisiting the relation between fiscal size and economic growth in a world sample. *Public Choice*, 137, 245–278.
- Auci, S., Castellucci, L., & Coromaldi, M. (2021). How does public spending affect technical efficiency? Some evidence from 15 European countries. *Bulletin of Economic Research*, 73(1), 108-130. <https://doi.org/10.1111/boer.12236>
- Azar Dufrechou, P. (2017). Public education spending: efficiency, productivity and politics. <https://hdl.handle.net/10803/457195>
- Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of political economy*, 98(5, Part 2), S103-S125.

- Babatunde, S. A. (2018). Government spending on infrastructure and economic growth in Nigeria. *Economic research-Ekonomska istraživanja*, 31(1), 997-1014.
- Bank, W. (2018). Building Education Systems That Deliver: SABER Annual Report 2017. Washington, DC: World Bank.
- Bank, W. (2015). Country and lending groups. World Bank.
- Bergantino, A. S., & Porcelli, F. (2011). A measure of Italian local government spending efficiency: The case of transport related expenditure. A preliminary analysis. *Sostenibilità, qualità e sicurezza nei sistemi di trasporto e logistica*. Milano, Franco Angeli, 24-35.
- Bista, R. B. (2023). Estimation of Multiflier Effect of Public Spending on Economic Growth under Multiple Regimes Regime. *Quantitative Economics and Management Studies*, 4(1), 93-106. <https://doi.org/10.35877/454RI.gems766>
- Charnes, A., & Cooper, W.W., (1961). Management Models and Industrial Applications of Linear Programming. *John Wiley and Sons*, New York.
- Chan, S. G., & Karim, M. A. Z. (2012). Public spending efficiency and political and economic factors: Evidence from selected East Asian countries. *Economic Annals*, 57(193), 7-23. <https://doi.org/10.2298/EKA1293007C>
- Chan, S. G., Ramly, Z., & Karim, M. Z. A. (2017). Government spending efficiency on economic growth: Roles of value-added tax. *Global Economic Review*, 46(2), 162-188.
- Chaluvadi, S., Raut, R. & Gardas, B.B.,(2018), "Measuring the performance efficiency of banks in a developing economy: The case study of the Indian public sector vs. the private sector", *Benchmarking: An International Journal*, 25(2), 575-606
- Chinedu, B. E., Mike, I. M., & Uchenna, E. (2008). Inflation Versus Public expenditure growth in the United States: An empirical investigation. "North American Journal of Finance and Banking Research, 2(2), 26 - 40
- Cubi-Molla, P., Buxton, M., & Devlin, N. (2021). Allocating public spending efficiently: is there a need for a better mechanism to inform decisions in the UK and elsewhere? *Applied Health Economics and Health Policy*, 19(5), 635-644.
- Cummins, J. D., Weiss, M. A., Xie, X. & Zi, H. 2010. Economies of scope in financial services: A DEA efficiency analysis of the US insurance industry. *Journal of Banking & Finance*, 34(7), 1525-1539.
- Diana, M. I. H. A. I. U. (2014). Measuring performance in the public sector: between necessity and difficulty. *Studies in Business & Economics*, 9(2).
- Egbo, O., Nwankwo, E., Okoye, N. F., & ESQ, O. O. (2016). Analysis of Government Disaggregated Expenditures and Growth of Nigerian Economy. *Journal of Internet Banking and Commerce*, 21(2), 1.
- Ezirim, C., Muoghalu, M., & Elike, U. (2008). Inflation versus public expenditure growth in the US: An empirical investigation. *North American Journal of Finance and Banking Research*, 2(2).
- Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society*, 120(3):253-281
- Fonchamnyo, D. C., & Sama, M. C. (2016). Determinants of public spending efficiency in Education and health: evidence from selected CEMAC countries. *Journal of Economics and Finance*, 40(1), 199-210. DOI 10.1007/s12197-014-9310-6

- Gavurova, B., Kocisova, K., Belas, L., & Krajcik, V. (2017). The relative efficiency of government expenditure on secondary education. *Journal of International Studies*, 10(2), 329-343.
- Gebreyesus, S. A. (2022). The Relationship Between Government Expenditure and Economic Growth Evidenced From Four Eastern African Countries. *ISPEC International Journal of Social Sciences & Humanities*, 6(1), 1-10.
- Giordano, R. Lanau, S., Tommasino, P., & Topalova, P. (2020). Does public sector inefficiency constrain firm productivity? Evidence from Italian provinces. *International Tax and Public Finance*, 27, 1019 – 1049.
- Gupta, S., & Verhoeven, M. (2001). The efficiency of government expenditure: Experiences from Africa. *Journal of Policy Modelling*, 23(4), 433–467.
- Hauer, D., & Kyobe, A. (2010). Determinants of government efficiency. *World Development*, 38(11), 1527-1542. doi: 10.1016/j.worlddev.2010.04.004
- Heimberger, P. (2021). Does economic globalization affect government spending? A meta-analysis. *Public Choice*, 187(3), 349-374.
- Hsu, Y. C. (2013). The efficiency of government spending on health: Evidence from Europe and Central Asia. *The Social Science Journal*, 50(4), 665-673.
- Iwuagwu, O. (2009). Nigeria and the challenge of industrial development: The new cluster strategy. *African Economic History*, 37(1), 151-180.
- Inua, O. I., & Maduabum, C. (2014). Performance efficiency measurement in the Nigerian Public sector: The federal universities dilemma. *Mediterranean Journal of Social Sciences*, 5(20), 838-838. DOI: 10.5901/mjss.2014.v5n20p838
- Jibir, A. & Aluthge, C. (2019b). Fiscal Policy Operation in Nigeria: Trends, Magnitude
- Jibir, A. & Babayo, H. (2015). Impact of government expenditure and economic in Nigeria. *IOSR Journal of Economics and Finance*. 7(3), 23-45.
- Jibir, A., & Aluthge, C. (2019). Modelling the determinants of government expenditure in Nigeria. *Cogent Economics & Finance*, 7(1).
- Jibir, A., Abdu, M., Bappayaya, B., Wahab, B. A., & Isah, A. (2023). Disaggregated impact of government expenditure on economic growth: Evidence from Nigeria. *Lapai Journal of Economics*, 7(1), 15-32.
- Jibir, A., Abdullahi, S., Abdu, M., Buba, A., & Ibrahim, B. (2018). External debt-growth nexus in Nigeria revisited. *Asian Economic and Financial Review*, 8(1), 117-130.
- Sikayena, I., Bentum-Ennin I., Francis K. A., & Asravor R. (2022). Efficiency of public spending on human capital in Africa. *Cogent Economics & Finance*, 10(1).
- kimaro, E. L., Keong, C. C., & Sea, L. L. (2017). Government expenditure, efficiency and economic growth: a panel analysis of Sub Saharan African low-income countries. *African Journal of Economic Review*, 5(2), 34-54.
- Kithinji, A. M. (2021). The Effect of Public Debt Composition and Government Expenditure on Economic Growth of Kenyan Government. *International Journal of Science and Business*, 5(8), 202-213.
- Kolesar, R. J., Bogetoft, P., Chea, V., Erreygers, G., & Pheakdey, S. (2022). Advancing universal health coverage in the COVID – 19 era: an assessment of public healthy services technical efficiency and applied cost allocation in Cambodia. *Health Economics Review*, 12(1), 10.

- Madaki, G. T., Jelilov, G., & Akyuz, M. (2020) Disaggregated Impact of Government Expenditure on Human Capital Development in Nigeria. <http://www.jomenas.org>
- Mandl, U., Dierx, A., & Ilzkovitz, F. (2008). The effectiveness and efficiency of public spending (No.301). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.
- Syaparuddin & Zeyaya, F. (2020, October). *Mapping Out Health Expenditure Efficiency Associated with Health Sector Performance Development in Indonesia. (Paper presentation)*. 10th International Conference Management, Economics and Humanities. Amsterdam, Neither land. <https://www.dpublication.com/wp-content/uploads/2020/09/937-02.pdf>.
- Maku, O. E. (2009). Does government spending spur economic growth in Nigeria?.
- Montes, G. C., Bastos, J. C. A., & de Oliveira, A. J. (2019). Fiscal transparency, government effectiveness and government spending efficiency: Some international evidence based on panel data approach. *Economic Modelling*, 79, 211-225.
- Mosoti, M. M. (2014). The growth of public expenditure in kenya exploring the causes 1980-2012 (Doctoral dissertation).
- Obi, C. U., Ekiesiobi, S. C., Dimnwobi, S. K., & Mgbemena, E. M. (2016). Government Education spending and education outcome in Nigeria. *International Journal of Economics, Finance and Management Sciences*, 4(4), 223-234.
- OECD (2023), “General government expenditure” in *Government at a Glance 2023*, OECD publishing, Paris. <https://doi.org/10.1787/595b4d0b-en>
- Ogbuagu Matthew, I., & EkpenyongUdom, I. (2015). Estimating the impact of the components of public expenditure on economic growth in Nigeria (a bound testing approach). *International Journal of Economics, Commerce and Management*, 3(3), 1-8.
- Ohene-Asare, K. (2011). Nonparametric efficiency and productivity change measurement of banks with corporate social responsibilities: the case for Ghana. <http://go.warwick.ac.uk/wrap/50224>
- Olanubi, S. O., & Osode, O. E. (2017). The efficiency of government spending on health: A comparison of different administrations in Nigeria. *Journal of Policy Modelling*, 39(1), 79-98. <https://doi.org/10.1016/j.jpolmod.2016.12.002>
- Ouertani, M. N., Naifar, N., & Ben Haddad, H. (2018). Assessing government spending efficiency and explaining inefficiency scores: DEA-bootstrap analysis in the case of Saudi Arabia. *Cogent Economics & Finance*, 6(1).
- Peacock, A. T., & Wiseman, J. (1979). Approaches to the analysis of government expenditure growth. *Public Finance Quarterly*, 7(1), 3-23.
- Prasetyo, A. D. (2013). Measuring government expenditure efficiencies towards peace and human development. *The Asian Journal of Technology Management*, 6(2), 82-91. DOI:10.12695/ajtm.2013.6.2.3
- Prasetyo, A. D., & Zuhdi, U. (2013). The government expenditure efficiency towards the human development. *Procedia Economics and Finance*, 5, 615–622.
- Prasetyo, A. D., & Zuhdi, U. (2013). The government expenditure efficiency towards the human development. *Procedia Economics and Finance*, 5, 615–622.
- Rayp, G., & Van De Sijpe, N. (2007). Measuring and explaining government efficiency in developing countries. *The Journal of Development Studies*, 43(2), 360-381.

- Sagarik, D. (2014). Educational Expenditures in Thailand: Development, trends, and distribution. *Citizenship, Social and Economic Education*, 13(1), 53–66.
- Schuknecht, L., Tanzi, V., & Afonso, A. (2003). Public sector efficiency: An international comparison (No. 242).
- Schuknecht, L., Tanzi, V., & Afonso, A. (2006). Public sector efficiency: evidence for new EU member states and emerging markets (No. 581). <http://hdl.handle.net/10419/153015>
- Sihaloho, E. D. (2018). Efficiency analysis of local government spending of regencies and cities in West Java, 2001-2010. *Review of Indonesian Economic and Business Studies*, 6(2), 111-126.
- Sijabat, R. (2022). The Impact of Health Spending, Education Spending and Economic Growth on Human Development: A Provincial Panel Analysis. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 5(4), 29584-29598.
- Simar, L., & Wilson, P. W. (2007). Estimation and inference in two-stage, semi-parametric models of production processes. *Journal of Econometrics*, 136, 31–64.
- Sumarsono, H., Qodri, L. A., & Prayitno, P. H. (2022). Government Spending, Domestic Investment, Human Development Index and Indonesian Gross Domestic Product. *Jurnal Pendidikan Ekonomi Dan Bisnis (JPEB)*, 10(2), 150-157. <https://doi.org/10.21009/JPEB.010.2.5>
- Ouertani, M. N., Naifar, N., & Ben Haddad, H. (2018). Assessing government spending efficiency and explaining inefficiency scores: DEA-bootstrap analysis in the case of Saudi Arabia. *Cogent Economics & Finance*, 6(1), 1493666.
- Peacock, A. T and Wiseman J., (1967). *Growth of Public Expenditure in the United Kingdom*. Rev edn., George Allen & Unwin Ltd., London.
- Ukwueze, E. R. (2015). Determinants of the size of public expenditure in Nigeria. *SAGE Open*, 5(4), 1-9.
- Wandeda, D. O., Masai, W., & Nyandemo, S. M. (2021). The Efficiency of Public Spending in Sub-Saharan Africa. *European Scientific Journal ESJ*, 17(19), 173-193.
- Wang, E. C., & Alvi, E. (2011). Relative efficiency of government spending and its determinants: Evidence from East Asian countries. *Eurasian Economic Review*, 1(1), 3-28.
- Wardhani, R., Rossieta, H., & Martan, D. (2017). Good governance and the impact of government spending on performance of Local government in Indonesia. *International Journal of Public Sector Performance Management*, 3(1) 77-102