African Journal of Business and Economic Research (AJBER)
(Online) ISSN 1750-4562 (Print) ISSN 1750-4554

Indexed by SCOPUS, UGC CARE List, IBSS, EBSCO, ProQuest, ABDC, SAJE, COPERNICUS, ERIH PLUS, CABELL, Sabinet and J-Gate

Vol. 20, (Issue3), September 2025

Pp 299–320

Efficiency Evaluation of Public Health Spending in SADC and OECD Countries

DOI: https://doi.org/10.31920/1750-4562/2025/v20n3a13

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Abstract

Health system efficiency has become topical and pivotal as part of the health systems strengthening agenda within the broader context of health economics. The onset of the new millennium has heralded a sharp and unprecedented increase in health systems efficiency research, a phenomenon that points towards the unsustainability of increased health financing as a panacea for attaining improved health outcomes. The current study evaluated public health spending efficiency in SADC and OECD countries using the stochastic frontier analysis and the data envelopment analysis for the period 2010-2022. The results established that OECD countries generally exhibit higher efficiency in

[1] This paper is extracted from my PhD thesis supervised by Prof T Sunde and Dr S Abel

managing public health resources compared to SADC countries. The findings reinforce the fact that while developed coun tries have optimised their public health expenditure more effectively, developing countries, particularly in the SADC region, have considerable potential to enhance efficiency. Rather than focusing on increasing health expenditure allocations and meeting the Abuja target, SADC countries should look for ways to increase efficiency.

Keywords: *Public health spending, Efficiency, DEA, SFA*

1. Introduction

Economists have tirelessly devoted significant efforts to evaluating and improving the efficiency of economic systems to elevate people's living standards and eradicate systemic poverty (Stiglitz, 2014 & 2017; Kimaro et al., 2017 & Kararach et al., 2022). The focus on efficiency and its relevance in economic growth has been central in macroeconomics for years. This has been extended to understand sector-specific efficiency analysis, such as the health sector. Health system efficiency has become topical and pivotal as part of the health systems strengthening agenda as well as the broader context of health economics. The onset of the new millennium has heralded a sharp and unprecedented increase in health systems efficiency research, a phenomenon that points towards the unsustainability of increased health financing as a panacea for attaining improved health outcomes.

The World Health Organisation (WHO) (2010) asserts that studies on health system efficiency help in effective resource allocation by focusing effort on areas of success and promoting accountability and transparency. Measuring performance, particularly efficiency in public health expenditure, reflects a country's commitment to health and is essential for achieving excellence, driving growth, and delivering value. Thus, higher public health expenditure levels are associated with improved access to healthcare services, better health outcomes, and stronger healthcare systems (Collaborative Africa Budget Reform Initiative (CABRI),2015; International Monetary Fund (IMF), 2015; Alshehri et al,2023) and foster sustainable economic development (WHO, 2015; 2018; IMF, 2015 & 2018).

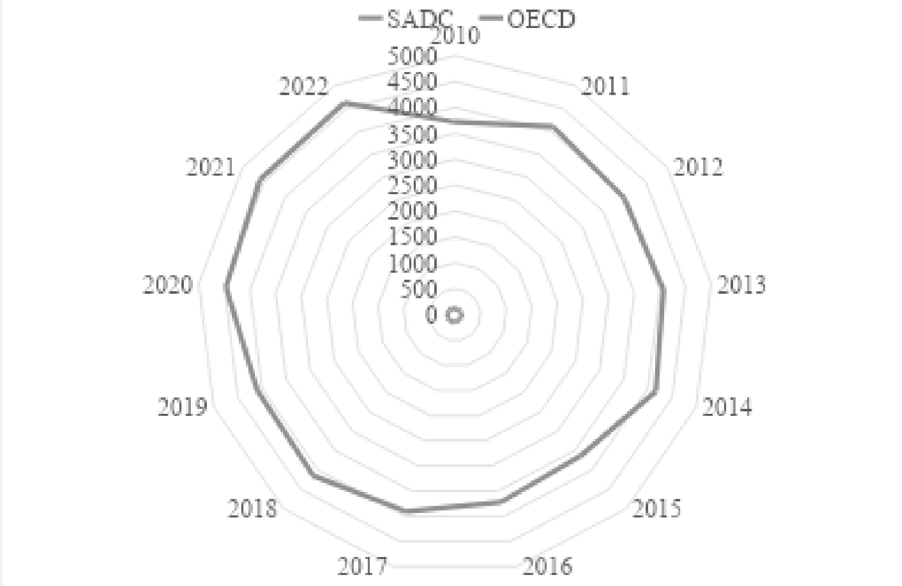
The correlation between high or low levels of health funding and enhanced health outcomes may not be that direct. The WHO's assertion underscores the significance of moving beyond simplistic associations between health funding and outcomes (WHO, 2010). Instead, emphasis should be placed on the pivotal role of resource efficiency and equity in determining the efficacy of health financing. This perspective accentuates the necessity for a nuanced understanding of health funding dynamics beyond fiscal allocation. The WHO (2010) revealed that an estimated 20% to 40% of healthcare resources are wasted, highlighting pervasive inefficiencies within the healthcare system.

The efficiency of health systems is intrinsically linked to broader economic considerations, and addressing the financing burden many countries face requires a comprehensive approach that encompasses both economic and healthcare policy domains. By prioritising efficiency and resilience in health systems, countries can better safeguard public health, promote economic stability, and advance societal well-being (Yip & Haffez, 2015; Arhin et al., 2023; James, 2024). The current study seeks to evaluate the efficiency of public health spending in Organisation for Economic Co-operation and Development (OECD) and Southern Africa Development Community (SADC) countries.

2. Background

The health sector plays a pivotal role in driving economic growth, particularly in low- and middle-income nations. Healthcare investments contribute to improving overall well-being and foster job creation while promoting social and political stability. Furthermore, the healthcare sector serves as a catalyst for technological advancements and increased productivity. Notably, between 2000 and 2015, the global health economy grew at an annual rate of 4.0%, outpacing the overall global economic growth rate of 2.8% (WHO, 2018). This sharp increase in health expenditure has ignited interest in health system efficiency. Figure 1 shows public health expenditure trends in SADC and OECD for the period 2010 to 2022.

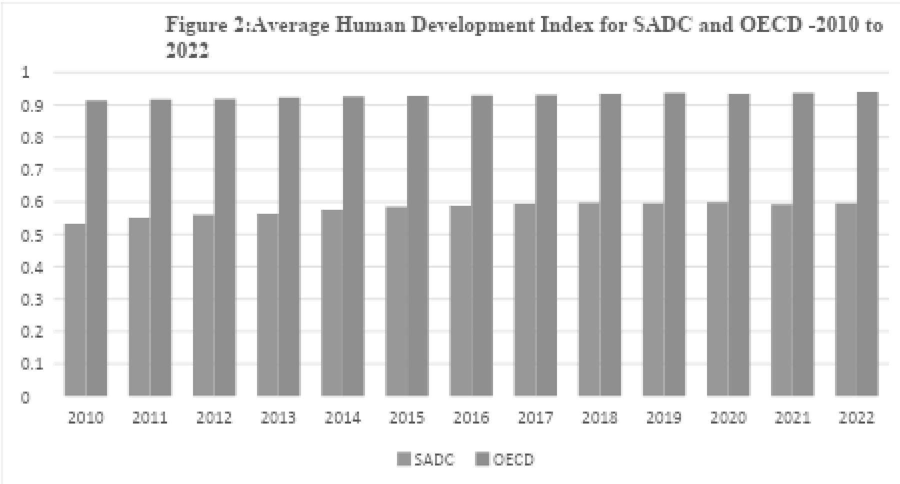
Figure 1: Average Public health expenditure for OECD and SADC (2010 to 2022)



Source: *Adapted from World Bank (2010 to 2022)*

Public health expenditure in both the OECD and SADC regions has been rising for the period 2010 to 2022 (Figure 1). However, the OECD has expended more towards public health finance compared to SADC countries. The disparities are indicative of the broader economic and developmental contrasts observed between these regions.

Furthermore, the OECD countries have also consistently shown a higher Human Development Index (HDI) than SADC countries, signifying a better quality of life, as shown in Figure 2.



Source: *World Development Reports (2010 to 2022)*

The disparities in the HDI also serve as an indicator of the broader differences in economic development, education, healthcare access, and the overall quality of life experienced in these regions.

As nations move towards achieving Universal Health Coverage (UHC), they need to ratchet up and enhance three key health support dimensions often visualised as a "cube": expanding population coverage, broadening the range of services offered, and improving financial protection levels (WHO, 2005, CABRI, 2015). However, to expand these dimensions, a concurrent increase in the fiscal space allocated to healthcare is required. The fiscal space, which is crucial for health sector financing, can be conceptualised through a "fiscal space diamond." This metaphorical diamond represents four primary sources of potential financial resources for health, namely domestic revenue, sovereign debt, foreign grants, efficiency improvements and waste reduction. These four corners of the fiscal space diamond illustrate how countries can mobilise resources to expand their healthcare coverage, enhance service quality, and ensure greater financial protection for their populations. Each corner of the diamond represents a critical facet that policymakers must strategically leverage to achieve sustainable and inclusive healthcare financing and increase efficiency under the framework of UHC. The concept of efficiency is usually not given greater prominence as compared to the other three methods of domestic revenue, sovereign debt, and foreign grants mobilisation; hence, the need to analyse how efficiency can be used as a source of resources for health improvement.

3. Literature Review

Evans and Tandon (2000) conducted a comprehensive analysis employing DEA across 191 WHO member states for the period 1993 to 1997. Results showed a substantial correlation between spending levels and efficiency ratings, singling out Oman, Chile, and Costa Rica as efficient performers while flagging several African nations for their relative inefficiency. Greene (2003) also examined the same WHO panel data, highlighting the challenges in differentiating between country-specific heterogeneity and inefficiency using fixed and random effects models. Greene proposed that unmeasured heterogeneity rather than inefficiency might explain the observed disparities in efficiency across countries. Dinca et al. (2018) employed the DEA method to identify the most efficient healthcare systems among 17 EU Member States, categorised into Beveridge and Bismarck groups based on their health system financing strategies. The results showed that Sweden, the UK and Romania have the most efficient healthcare systems. The results on Romania were in stark contrast to those by Lo Storto and Goncharuk (2017). Gavurova et al. (2021) also conducted a study to evaluate the efficiency of OECD health systems in 2000, 2008, and 2016. The study employed dynamic network data envelopment analysis (DNDEA), which allows for the investigation of the healthcare system's overall efficiency and efficiency due to the effectiveness of interconnected sectors. The results show that the average overall efficiency was 0.8801 in 2000, 0.8807 in 2008, and 0.8472 in 2016, while the average OECD overall efficiency of healthcare systems for the time period was 0.8693, showing an inefficiency of around 13%.

While most health efficiency studies were conducted in developed regions, particularly OECD and EU countries, there has also been a proliferation of studies in developing countries. Grigoli and Kapsoli (2013) examined the efficiency of health expenditure across 80 emerging and developing economies from 2001 to 2010 using the SFA model. Public health spending in emerging and developing countries was found to be notably lower than in developed nations. Particularly, African economies exhibited the lowest efficiency. Husseiny (2022) investigated the efficiency of Arab healthcare systems using a two-stage DEA approach and compared efficiency in 2019 to 2010. The DEA approach yielded efficiency benefits ranging from 0.4% to 16% in 2019 for both output-oriented and input-oriented approaches. Hamidi and Akinci (2016) employed SFA to evaluate the efficiency of 20 health systems in the MENA region from 1995 to 2012. They identified an average inefficiency rate of 6.9%, ranging from 5.7% to 7.9%.

Top et al. (2020) compared the efficiencies of healthcare systems across 36 African nations using DEA. The results revealed that among the 36 healthcare systems in Africa, 21 (58.33%) were considered efficient. Asbu et al. (2022) undertook research that utilised panel data from 2000 to 2015 and applied a time-varying stochastic frontier production function to evaluate the health efficiency of 50 African countries. The findings unveiled mean technical efficiency scores of 79.3% in 2000, 81% in 2005, 85.6% in 2010, and 88.3% in 2015. Over four periods, Cabo Verde was efficient, while Eswatini and Sierra Leone displayed the lowest efficiency scores. In a recent study, Manenge (2024) utilised DEA alongside the Tobit regression approach to assess the technical efficiency of the healthcare system and its determinants. It was found that the average efficiency of SADC countries stands at 78 per cent, indicating significant inefficiencies within the health systems.

4. Research Methodology

The efficiency of the health system has been assessed using the data envelopment analysis (Fare, Groskopf, and Lovell, 1985) and stochastic frontier technique (Aigner, Lovell, and Schmidt, 1977; Battese & Coelli, 1988; Meeusen & Van Den Broeck, 1977). Extensive research has revealed a lack of consensus on the preferred method between the DEA and SFA approaches. The current study's joint use of parametric and non-parametric methodologies to measure efficiency may help bridge this gap.

DEA, developed by Charnes et al. (1978), is a non-parametric method rooted in microeconomic production theory. It evaluates the relative efficiency of the Decision Making Unit (DMU) using multiple inputs to produce multiple outputs. DEA utilises frontier production to examine productivity convergence (Skare and Rabar, 2016). The DEA is deterministic and assumes no specific functional form for the production frontier. Any deviation between actual production and the frontier is categorised as inefficiency without any allowance for randomness (Ji and Lee, 2010).

The DEA model for this study is based on data for $\boldsymbol{K}$ inputs and $\boldsymbol{M}$ outputs for $\boldsymbol{N}$ decision-making units (DMU). X and Y represent the vector of inputs and outputs, respectively, for each i^{th} SADC and OECD country. Thus, KX*N is the input matrix, while MY *N is the output matrix for all DMUs. The DEA mathematical programming problem for each SADC and OECD country, as adopted from Coeli (1995), is specified in equation (1):

$$
\begin{aligned}
&\max_{\mu,v}(\mu' y_{it}),\\
&\text{s.t} \quad v' x_{it} = 1\\
&\mu' y_{it} / v' x_{it} \leq 1, \; i = 1,2\ldots,N,\\
&\mu, v \geq 0 \qquad (1)
\end{aligned}
$$

The above equation (1) is the multiplier form of the linear programming problem for solving public health expenditure efficiency in SADC and OECD countries; hence, an equivalent envelopment form to be solved can be derived using the linear programming duality of this equation (1) to give.

$$
\begin{aligned}
&\min_{\theta,\lambda} \theta,\\
&\text{s.t} \quad -y_{it} + Y_t\lambda \geq 0\\
&x_{it} - X_t\lambda \geq 0,\\
&\lambda \geq 0 \qquad (2)
\end{aligned}
$$

In the model above (2), is a scalar and λ is a $N*1$ vector of constants. The above model in (2) is the solved model because it involves lesser constraints. The value of θ is the public health expenditure efficiency score for each SADC and OECD country. It satisfies the Farell (1957) condition of efficiency, that is, **$\theta \leq 1$** where a value of 1 indicates a country operating on the efficient frontier and 0 indicates fully inefficient country.

The SFA accounts for deviations from the production function and presumes that these deviations comprise both random error and inefficiency. The **SFA** methodology is more suitable for measuring efficiency because it decomposes the composite error term into components that capture measurement errors, noise, and efficiency.

For the SFA methodology, we first assume that a SADC and OECD country produces output (economic growth) g_i using a single input (public health expenditure) $,x_i$, and has a Cobb-Douglas stochastic production frontier as

$g_i = x_i^{\beta}$ (3)

The mathematical form of the above equation (3) has an econometric specification given below.

$g_i = \alpha_o + x_i^{\beta} + v_i - u_i$(4)

Log linearising equation (4) gives the following equation.

$$Ing_i = \alpha_o + \beta \ln x_i + v_i - u_i \qquad (5)$$

The above equation (5) can also be written as below.

$$g_i = exp(\alpha_o + \beta \ln x_i + v_i - u_i) \qquad (6)$$

Equation (6) can further be written as;

$$g_i = exp(\alpha_o + \beta_1 \ln x_i) \times \left(exp(v_i) \times exp(u_i)\right) \qquad (7)$$

Equation (7) has been decomposed into the deterministic component $exp(\alpha_o + \beta_1 \ln x_i)$ and the composite error term e, which is further decomposed into noise effect (v_i) and inefficiency effect (u_i).

Technical efficiency (TE) is therefore expressed as the ratio of observed output to the corresponding stochastic frontier output (adopted from Coeli, 1995) as given below:

$$TE_i = \frac{g_i}{exp(X_i'\beta + v_i)} = \frac{exp(X_i'\beta + v_i - u_i)}{exp(X_i'\beta + v_i)} = exp(-u_i) \qquad 8)$$

The TE scores range between 0 and 1 and measure the output of the i-th SADC and OECD country in relation to the output that could be produced by a fully efficient SADC country using the same input vector (Coelli et al., 2005).

The stochastic frontier production function for an unbalanced panel model for this thesis can now be specified as below and is adopted from Battese and Coelli (1992);

$$Y_{it} = X_{it}\beta + (V_{it} - U_{it}), \qquad i = 1, \dots, N, t = 1, \dots, T$$
$$\varepsilon_{it} = v_{it} - u_{it}$$
$$v_{it} \sim N(0, \sigma_v^2)$$
$$u_{it} \sim F$$

(9)

Where Y_{it} represents the log of per capita real GDP growth for the i-th SADC and OECD countries. X_{it} is a vector of logs of input variables that include health expenditure data for 2010 to 2022. β is a vector of unknown parameters, V_{it} are random errors, while U_i are non-negative random variables assumed to account for public health expenditure inefficiency.

The model used for the SFA for this thesis is explicitly specified below.

$$lnHDI_{it} = \alpha_0 + \beta_1 lnHexp_{it} + \beta_2 lnNOD_{it} + \beta_3 lnNON_{it} + \beta_4 lnNOB_{it} + \beta_5 lnNS_{it} + v_{it} - u_{it} \qquad 10)$$

where,

HDI_{it} = Human Development Index for SADC and OECD country

$Hexp_{it}$ = Public Health expenditure for a SADC and OECD country

NOD_{it} = Number of doctors/Physicians for each country (per 10,000 population)

NON_{it} = Number of Nurses for each country (per 10,000 population)

NOB_{it} = Number of Hospital Beds for each country (per 10,000 population)

NS_{it} = Nutritional Status (NS) (Inverse of Global Hunger Index)

The DEA model does not need any specification (reference); however, it uses the same inputs and outputs as specified in the SFA model. This paper adopted the output-oriented Variable Returns to Scale (VRS) approach to measure public health expenditure efficiency in OECD and

SADC countries. Including both the DEA and SFA methodologies was meant to leverage the advantages inherent in each approach to deliver a thorough efficiency analysis, alongside validation, cross-validation, and robustness checks. Due to its parametric framework, **SFA** is particularly effective at addressing random noise or outliers present in the dataset. In contrast, DEA provides valuable insights without the necessity of assuming a specific functional form and is useful where there are limited observations, such as in this study.

5. Data Sources

The data used in this study is primarily sourced from comprehensive datasets provided by the World Health Organisation (WHO), the World Bank's World Development Indices (WDI), Human Development Reports (HDRs), and Global Hunger Index (GHI) Reports. These curated datasets offer robust statistical insights into global health, development, and nutritional status. Data analysis was done using MaxDEA software for DEA, while STATA was used for SFA.

6. Results and Discussion

Table 1 below presents descriptive statistics of all variables included in both the Stochastic Frontier Analysis and the Data Envelopment Analysis models.

Table 1: Descriptive Statistics for the Inputs and Outputs for the DEA and SFA

	HDI	NOB	NOD	NON	NS	PHE	SFA	DEA
Mean	0.768	32.806	21.020	81.392	0.1811	2321.835	0.949	0.953
Median	0.905	28.100	24.500	90.905	0.208	3024.580	0.953	0.979
Maximum	0.967	138.000	70.620	319.300	0.556	7857.195	0.982	1.000
Minimum	0.404	2.000	0.100	2.400	0.022	1.324	0.830	0.754
Std.Dev	0.189	24.043	17.584	64.379	0.128	2159.948	0.023	0.057
Observations	468	468	468	468	468	468	468	468

Source: *Own Calculation*

The results show that the HDI exhibits considerable variability across the countries, ranging from a minimum of 0.404000 in SADC countries to a maximum of 0.967000 in OECD nations, with an average HDI of

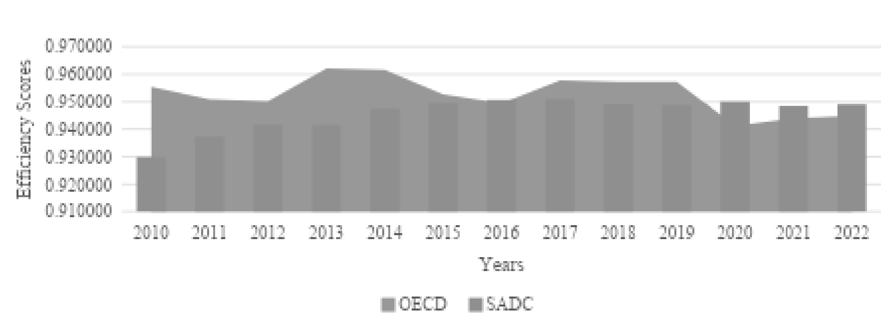
0.768487 in the two regions. This disparity underscores significant differences in socioeconomic development levels, reflecting diverse levels of education, life expectancy, and income across these two regions.

One of the striking observations in the data is that public health expenditure varies significantly between the two regions. SADC reports the lowest per capita expenditure at $1.3240.00, while OECD countries report the highest at $7,857.195. The two regional averages are $2,321.835 per capita, reflecting the varying spending levels across these diverse economic contexts. These figures underscore the substantial disparities in financial resources allocated to healthcare, highlighting the diverse capacities and priorities in healthcare financing across different global regions. These findings further reveal that the highest per capita health expenditure among OECD countries (Norway at $7,857.195) surpasses the highest figure observed in SADC (represented by Seychelles at $620.392) by a significant margin of 12.66 times. This disparity underscores substantial variations in healthcare investment and financial capacity between these regions.

In terms of human resources in healthcare, the results show that the average number of doctors stands at 21.02201, ranging from a minimum of 0.100000 in SADC countries to a maximum of 70.62000 in OECD nations. In contrast, the average number of nurses stands at 81.39158, with the lowest figure observed at 2.400000 in SADC countries and peaking at 319,300 in OECD nations. These figures underscore significant disparities in healthcare workforce distribution and capacity between regions, influencing healthcare delivery, patient care, and overall health system performance across diverse economic contexts. In contrast, the mean number of hospital beds in both OECD and SADC regions was 32.80692, with a minimum of 2.000000 in SADC and a maximum of 138.0000 in OECD countries. This significant variation highlights these regions' stark disparities in healthcare infrastructure and capacity. The availability of hospital beds is a crucial indicator of healthcare system readiness and the ability to meet population health needs.

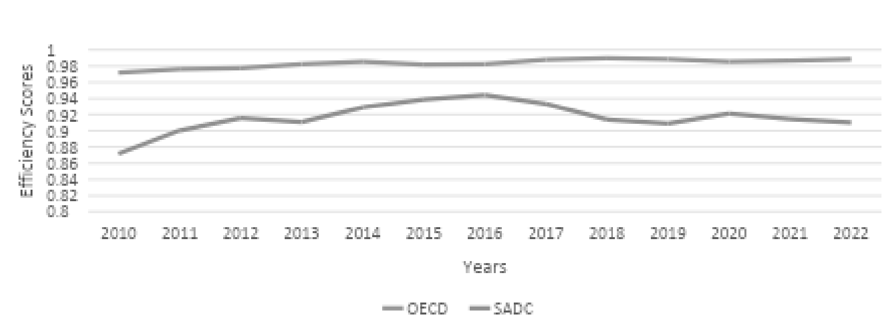
The disparity in nutritional status is evident across nations in the results, with SADC countries demonstrating the lowest level at 0.022000 and OECD nations displaying the highest at 0.556000. This variation emphasises substantial discrepancies in dietary patterns, food security, and healthcare accessibility, which contribute to diverse global health outcomes and well-being indicators.

Figure 4: SADC Versus OECD SFA Average Efficiency scores



Source: *Author's own findings*

Figure 5: SADC versus OECD DEA Average Efficiency scores



Source: *Author's own findings*

The results in Figure 4 and Figure 5 show that the SFA and DEA efficiency scores exhibited a consistent upward trajectory, with OECD nations consistently surpassing the efficiency scores of SADC countries from 2010 to 2022. The OECD consistently outperformed the SADC in terms of average SFA and DEA efficiency scores from 2010 to 2019, indicating superior healthcare system efficiency in the OECD countries compared to their SADC counterparts. However, a significant shift occurred from 2020 to 2022, during which SADC countries exceeded the OECD average SFA efficiency scores. A notable trend observed from 2016 onwards shows that there has been a discernible decline in DEA efficiency scores within the SADC region. There has also been a decrease in DEA efficiency scores in OECD countries since 2019. This downward trend in DEA efficiency scores indicates potential challenges or disruptions that may have impacted healthcare system performance, possibly due to economic fluctuations, healthcare funding constraints, or other unique systemic issues within the respective regions. It is also important to note that this period coincides with the emergence of the COVID-19 pandemic, which exerted economic shocks globally.

The emergence of the COVID-19 pandemic towards the end of 2019 seems to have had a far-reaching impact on SFA and DEA efficiency scores in both SADC and OECD countries. Throughout this period, efficiency scores decreased in the two regions, indicating the challenges and disruptions faced by healthcare systems worldwide because of the pandemic. Contributing factors to this decline may encompass a surge in demand for healthcare services, limitations in resources, logistical hurdles, and a shift in healthcare priorities towards efforts in response to the pandemic. OECD nations, which had operated near their efficiency frontier, encountered notable challenges. Disruptions induced by the pandemic unveiled vulnerabilities in their elaborate infrastructure, impeding rapid adaptation and resulting in inefficiencies. Conversely, numerous SADC countries, with less developed health systems, exhibited greater potential for enhancement. The pandemic functioned as a driver of health reform, enabling these nations to swiftly and effectively implement changes and substantially improving efficiency. Ultimately, OECD countries grappled with inefficiencies stemming from system complexity and limited flexibility, while SADC countries leveraged their adaptability and targeted support to enhance efficiency markedly. Despite rising healthcare expenditures, public health expenditure efficiency did not increase during this period, largely due to logistical challenges, human resources shortages and overwhelmed hospitals. These results buttress Kuzior's (2022) findings, which also found disruptions in health systems efficiency during the COVID-19 era.

Table 2: Comparative SFA and DEA Efficiency Scores and Rankings

COUNTRY	DEA SCORE	SFA SCORE	DEA RANKING	SFA RANKING
Angola	0.964150866	0.9567029	24	15
Australia	0.983386491	0.956899292	13	12
Austria	0.977456433	0.923849038	19	33
Belgium	0.976828609	0.940548392	20	26
Botswana	0.970841159	0.969345577	23	6
Canada	0.99845201	0.980542538	1	1
Comoros	0.900188584	0.950455646	31	20
Denmark	0.987679667	0.955035354	10	16

DR Congo	0.790405277	0.911091192	36	35
Eswatini	0.902983433	0.9426126	30	24
Finland	0.978804209	0.934745462	17	28
France	0.949342174	0.953862346	26	17
Germany	0.988769167	0.944068331	6	23
Iceland	0.99258481	0.950003415	3	21
Ireland	0.979754751	0.956771908	16	14
Italy	0.981421676	0.962180438	14	11
Japan	0.978485157	0.953201892	18	18
Lesotho	0.857618453	0.928953454	34	31
Luxembourg	0.97641822	0.963885877	21	10
Madagascar	0.975768212	0.931373985	22	30
Malawi	0.922819086	0.932691531	27	29
Mauritius	0.980287012	0.9657207	15	9
Mozambique	0.831974616	0.909498254	35	36
Namibia	0.894089471	0.956846315	32	13
Netherlands	0.988205722	0.967567446	8	8
New Zealand	0.994570048	0.973507754	2	3
Norway	0.989825498	0.911708485	4	35
Seychelles	0.9210046	0.967641338	28	7
South Africa	0.962676243	0.971468792	25	5
Sweden	0.984801218	0.937466462	11	27
Switzerland	0.989449286	0.928051262	5	32
Tanzania	0.987810826	0.944459669	9	22
United Kingdom	0.988475188	0.976835285	7	2
USA	0.984683001	0.972235608	12	4
Zambia	0.914045583	0.950651569	29	19
Zimbabwe	0.883441396	0.941974554	33	25

***Source**: Author's own findings*

The data presented in Table 2 show that the average SFA efficiency of public health expenditure in OECD countries is 95.2%. This signifies a potential opportunity for OECD countries to enhance the efficiency of their public health expenditure by up to 4.8% with their existing resources. On the other hand, SADC countries demonstrate an average public health expenditure efficiency of 94.6%, suggesting that there is scope for these countries to improve their efficiency by 5.4% with their existing resources. These results show a near convergence of SFA results, on average, among OECD and SADC countries. The convergence can be attributed to several key factors, including significant investments in public health in both regions despite differences in income and infrastructure.

The sensitivity of the SFA result to the number of inputs and outputs cannot be ruled out, which may have impacted the results. These results support the findings of Frogner and Parente (2015), who investigated efficiencies in 25 OECD countries. Their study highlighted that the rankings derived from SFA were often considered non-robust due to inconsistencies from conflicting statistical techniques and that SFA can be sensitive to the assumptions and statistical models used, leading to variations in efficiency rankings. Furthermore, the inherent complexity of SFA can lead to inconsistent country rankings due to different model specifications and data variations, making it difficult to assess relative efficiency and making it challenging to draw definitive conclusions.

In addition, the data presented in Table 2 exhibits an impressive average OECD DEA efficiency score of 98.5%, indicating minimal wastage of only 1.5% in their expenditure and limited potential for further optimisation. In contrast, SADC countries display an average efficiency of 91.4%, signifying an 8.6% inefficiency and substantial opportunity for improvement. These disparities highlight the considerable challenges and inefficiencies faced by SADC countries, while also underscoring the proximity of OECD countries to optimal resource utilisation due to their more advanced health systems. The findings suggest that OECD nations should prioritise fine-tuning their systems, whereas SADC countries require targeted reforms to enhance management practices and reduce wastage, presenting significant potential for efficiency gains.

The SFA and DEA results consistently show that OECD countries are generally more efficient than their SADC counterparts. Specifically, both DEA and SFA methods show that the most efficient countries were Canada, New Zealand and the United Kingdom,which are in the OECD region. Conversely, both methods show that the least efficient countries were Mozambique, Lesotho and DRC, found in SADC. These results are in sync with those by Gonzalez et al. (2010) as quoted by Dinca et al.

(2018), who found that high-income OECD countries demonstrated the highest levels of efficiency. Furthermore, Mbau et al. (2022) indicates that Jayasuriya and Woodon (2002) found the SADC countries, namely Mozambique, to be inefficient.

The efficiency disparity between OECD and SADC countries resonates with the World Bank and IMF findings that ascribed such gaps to various contributing factors. OECD countries seem to benefit from sophisticated economic structures, elevated levels of human capital from superior educational and skill development opportunities, exceptional institutional quality ensuring effective governance and regulation, and greater financial resources available for investment and innovation. Meanwhile, SADC countries seem to grapple with significant structural and institutional challenges that impede their efficiency levels (World Bank, 2011; 2015; 2018; 2022). In SADC, a plethora of the stated economic structural issues impede on their capacity to effectively finance the health system, while governance deficiency further compounds the challenges by diverting and wasting resources meant to finance health, resulting in inefficiency.

Using both SFA and DEA, notable results show that the most efficient SADC countries were Mauritius, Botswana, and South Africa, which have managed to hold their own against OECD countries. The efficiency of public health expenditures in Mauritius, Botswana, and South Africa can be attributed to a combination of effective governance, well-structured public health policies that include UHC goals, and robust economic strategies. These nations have successfully integrated preventive care, optimised resource allocation, and established strong public-private partnerships (PPPs) within their health systems. Furthermore, their economic stability facilitates sustained investments in healthcare, positioning it as a priority within their development agendas. On the other hand, the least efficient among the OECD countries were Austria, Belgium and Finland. Supporting these results, Novignon & Lawanson (2014) conducted a study on the health system efficiency of SSA and found Mauritius to be also efficient. The remarkable efficiency demonstrated by these SADC countries (Mauritius, Botswana, and South Africa), sometimes surpassing less efficient OECD nations, serves as a testament to the power of economic structure and stability, effective resource management, political stability, human capital investment, economic diversity, and developed infrastructure that is experienced in these countries.

Furthermore, the results show that the SFA and DEA rankings were mixed for both OECD and SADC countries, except for the most efficient and least efficient countries, which were mostly consistent. Rankings for countries in the middle vary significantly between SFA and DEA methodologies. The differences in efficiency scores and significant variations in rankings between SFA and DEA, particularly for Botswana, Germany, Iceland, Norway, Seychelles, South Africa, Sweden, Switzerland, and the USA, can be attributed to differences in the methods' underlying assumptions, treatment of noise and randomness, approach to handling environmental factors, data characteristics and quality, as well as the manner in which they delineate the efficiency frontier. Therefore, combining the DEA and SFA methods was meant to validate efficiency results. However, despite the mixed rankings, it is discernible from the data that OECD (developed) countries generally demonstrate higher efficiency in managing public health expenditures compared to SADC (developing) countries. This discernment corresponds with the findings of Grigoli and Kapsoli (2013), whose extensive examination of health expenditure efficiency across 80 emerging and developing economies found developed nations to be more efficient, with African economies showing the lowest levels of efficiency.

Conclusion

The research indicates that countries within the SADC are allocating significantly lower public health expenditure levels than their OECD counterparts. OECD countries generally exhibit higher public health spending efficiency compared to SADC countries. Both SFA and DEA methodologies show that OECD countries are closer to the efficient frontier due to advanced economic structures, high levels of human capital, strong institutional quality, and substantial financial resources. Conversely, SADC countries face structural and institutional issues that hinder optimal resource allocation and utilisation. Despite some notable exceptions within SADC, the general trend indicates wastage and substantial room for improvement across the region. SADC countries should, therefore, look at ways to increase efficiency rather than focusing on increasing health expenditure allocations and meeting the Abuja target. SADC countries can enhance healthcare efficiency through improving governance while combating corruption to utilise resources effectively. Capacity building is also vital, which includes training healthcare professionals, upgrading facilities, and enhancing resource management to deliver quality care. Additionally, SADC nations should consider innovative health financing models, including public-private partnerships and national health insurance schemes, to ensure more sustainable financing. Adopting digital health technologies, including telemedicine and electronic health records, can streamline operations and reduce costs, leading to improved efficiency to align with global best practices. The WHO and the World Bank can assist SADC countries in enhancing the efficiency of their public health spending by offering targeted support for developing and managing healthcare policies. By sharing best practices, they can help SADC to optimise their resource allocation and minimise waste.

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