Determinants of Public Health Spending

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Abstract: - An essential component of any economy's growth is the health sector, which receives substantial funding, mostly from the government. The research community is now interested in understanding the determinants of substantial financial support to health , given the shrinking budgetary space in most African countries. The study investigates how economic growth, government effectiveness, government revenue, technology, and labour participation rate affect public health spending in the SADC region. The autoregressive distributed lag model was adopted as the methodology for the study. The results show that public health spending is influenced positively by economic growth. Technology, total government spending, and government effectiveness negatively affect public health spending. The policy recommendation drawing from the study is that governments should institute pro-growth policies to improve health spending and spur better health outcomes.

Keyword: - Health, Public Spending, ARDL, Technology, Fiscal Space, SADC

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1 Introduction

The health system is an essential service sector for any community since it has a major impact on a nation's socioeconomic development [1]. Poor health has a devastating effect on the country's productivity and economic growth, [2], [3]. The importance of the health sector has been realised by governments, the private sector, and non-governmental organisations, which have invested substantial funds to ensure improved care in communities and nations. Despite the overinvestment in the health systems, scholars have identified that the return on investment and the health outcomes have slightly improved [4]. This anomaly brings to the fore the question of the effectiveness of health spending on enhancing health outcomes. In a country such as South Africa, the government spends around 9 percent of gross domestic product, a figure well above 5 percent recommended by the World Health Organisation, yet the health sector continues to face challenges.

Public health spending continues to draw lots of discussion, especially considering shocks and natural calamities which have been affecting several countries. Lots of resources were poured into the health sector during and post Covid 19 pandemic, but the sector remains seriously constrained. This then raises the important question of what factors drive public health spending. Despite an extensive body of knowledge on the determinants of health spending, there is no consensus given the ever-evolving socio-political developments in different nation's leading to changing funding models of the health systems.

This study seeks to add to this body of knowledge by evaluating the determinants of public health spending in the Southern African Development Community (SADC) region. This is a grouping of 16 countries in Southern Africa, part of the Sub-Saharan Africa. The region is faced by the persistent health issues posed by infectious diseases such as HIV/AIDS, TB, and malaria, coupled with the rising prevalence of non-communicable diseases (NCDs), the effects of climate change on health systems, and food security. Other challenges affecting the region include the ongoing lack of qualified healthcare professionals, difficulties in obtaining sexual and reproductive health care, and the requirement for efficient regional cooperation in order to control outbreaks and enhance general health outcomes.

Despite several studies evaluating the determinants of public health spending, there remain gaps in the comprehensive list of determinants of health spending. Previous studies have established the importance of a country's income as a major determinant of health expenditure. The rising income in a household or economy leads to high demand for health services due to increasing marginal utility from health care rather than from goods and services. As such, many previous studies have considered income as the main contributing demand factor in explaining changes in health care expenditure [5].

Quality of governance is one of the factors perceived to influence health spending. Governments that are more efficient are better able to develop and carry out public health programs at a lower expense, increasing life expectancy and reducing death rates [4]. Other scholars have included non-income variables such as demographic factors. For example, the age structure of a population is an important indicator of health care expenditure across countries. The share of the population of dependents (less than fifteen years and above sixty-five years of age) spends a large proportion of health care expenditure, about five folds as compared to younger adults and this holds true for Americans in treating chronic diseases, [6], [7].

Technological progress is another key factor that explains the variations in health care expenditure. Since there is no appropriate proxy for capturing variations in the medical care technologies, various studies used health care specific research and development expenditure [8], infant mortality and life expectancy at birth [9], time index as a proxy for the impact of technology change [10]. Technological innovations are viewed as the main contributing factor in the increasing health care cost. Life expectancy is a measure of the general health of the population, which may be a result of the availability of cutting-edge medical technology, which lowers health care costs [11]. Research has shown that corruption can reduce the returns to investment in healthcare [12]. The incidence of high infant mortality rates and low birthweight of babies can both be decreased by curbing corruption in public healthcare services [13]. This implies that corruption stands in the way of reducing health expenditure. Studies have revealed that patients are incentivized to pay bribes through the promise of better-quality healthcare in public hospitals, [14], [15].

The objective of this study is to evaluate the determinants of public health spending. Specifically, the study assesses the role of government effectiveness, fiscal space, technology, and labour participation rate on public health expenditure in SADC.

2 Study Hypotheses

The discourse on the determinants of public health spending has produced mixed and inconclusive results. Against this backdrop, the current study interrogates the nexus between economic growth, government effectiveness, government revenue, technology, labour participation rate, and public health spending in SADC. The study introduces a novel dimension into the discourse, offering a more nuanced and context-specific understanding of the structural and institutional determinants of public health spending in emerging regional economies.

Evidence from various countries indicates that factors such as Gross Domestic Product (GDP), revenue, governance, technology, and labour significantly influence public health spending. However, the magnitude and even the direction of these influences can vary based on income level, geographical region, and specific analytical frameworks.

We hypothesize as follows;

H1: Economic growth positively affects public health spending.

H2: Government expenditure negatively affects public health spending.

H3: Government revenue positively affects public health spending.

H4: Technology negatively impacts public health spending.

H5: Labour participation rate positively affects public health spending.

3 Research Methodology

This section presents the methodology of the study. The aim of this study was to investigate the effects of government effectiveness, government revenue, technology, and labour force participation rate on public health expenditure among sixteen selected SADC countries for the period of ten years from 2012 to 2022. The data for this study were obtained from World Economic Indicators.

Prior to testing for cointegration, the data were subjected to an integration test. The study performed a cointegration test to ensure that all the variables under investigation are cointegrated as a condition before performing or estimating the panel ARDL model. [16] tests were used in testing cointegration.

Two alternative estimators of panel ARDL analysis (mean group and pooled mean group) were applied to estimate the effects of government effectiveness, government revenue technology, and labour force participation rate on public health expenditure. The panel annual data of selected macroeconomic indicators from sixteen SADC countries from 2012 to 2022 were employed. The analysis using panel data involves a combination of cross-sectional and time series observations. In this investigation, cross sections are equal to 16 countries, and time series observations are from 2012 to 2022. The use of panel ARDL is preferred because of its capability to simultaneously estimate long-run and short-run parameters of the model, yet it eliminates stationary data glitches.

In [17] highlights that the dynamic heterogeneity of panel regression is that it can be incorporated into the error-correction model using the ADRL (p, q) technique, where p is the lag of the dependent variable and q is the lag of independent variables. The optimal lag is selected based in AIC which is more suitable and superior to other criteria in cases with small sample observations [18] in [19]. AIC minimises the chance of underestimation while maximising the chance of recovering the true lag length.

The general ARDL model (p, q, q, … q) is specified as:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \quad \ldots\ldots 1$$

$$where\ t = 1, 2, \ldots T\ and\ i = 1, 2, \ldots N$$

y_{it} is the dependent variable (public health expenditure), x_{it} is a k x *1* vector of explanatory variables (government effectiveness, government revenue, technology and labour force participation rate) which are cointegrated. μ_i is the fixed effects, λ_{ij} is the coefficient of the lagged dependent variable called *the scalar* and δ'_{ij} is a *k* x *1* coefficient vectors. p, q are optimal lag order, and ε_{it} is the stochastic error term.

The ARDL (p, q, q, … q) error correction model with parameters is specified as:

$$\Delta y_{it} = \emptyset_i \left(y_{i,t-1} + \beta'_i X_{i,t}\right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} \Delta X_{i,t-j} + \mu_i + \epsilon_{it} \quad \ldots\ldots 2$$

Where y is a dependent variable (public health expenditure) and x is a set of explanatory variables

Where $\emptyset_i = -(1 - \sum_{j=1}^{p-1} \lambda_{ij})$, $\beta'_i = \sum_{j=0}^{q-1} \delta'_{ij}$, $\lambda_{ij} = \sum_{m=j+1}^{p} \lambda^*{}_{im}$, *j=1, 2, …, p -1 and*

$\delta_{ij} = \sum_{m=j+1}^{p} \delta^*{}_{im}$, *j = 1, 2, … q -1*

A panel ARDL model can be estimated with variables of different orders of integration. The short-run and long-run effects are estimated at the same time from a data set with cross-sections and dimensions. The coefficients from an ARDL model are consistent despite the chances of endogeneity because it includes lags of dependent and independent variables, [16] in [17] and [20]. The key characteristics of three different panel ARDL estimators are presented in Table 1 below.

Table 1: Panel ARDL Estimators

Panel ARDL Estimator	Features
Pooled Mean Group (PMG)	Allows for short-run coefficients, intercepts, speed of adjustments, and error variance to be heterogeneous between countries, whereas long-run coefficients are homogeneous between countries. For the existence of a long-run relationship between variables of interest, the coefficient on the error-correction term must be negative. Residuals from the error-correction model must be serially uncorrelated, and explanatory variables are treated as exogenous.
Mean Group (MG)	Regression for each country is separated both in the long-run and short-run, and coefficients are computed as unweighted means for the estimated coefficients for each country. To keep the results consistent and valid, enough large time series and cross-sectional data are needed. Coefficients can be heterogeneous in the long-run and the short-run.

Source: created by the authors

The Hausman test was employed to identify the best model that can be used in the analysis by checking for a significant difference that may be present between PMG and MG. The null hypothesis is that there is no significant difference between PMG and MG. If the P-Value is less than 5%, the null hypothesis will be rejected. If the null hypothesis is not rejected, the PMG estimator is preferred.

4 Results Presentation and Analysis

This section of the study evaluates the role of government effectiveness, government revenue, technology, and labour force participation rate on public health expenditure using panel ARDL models. Descriptive statistics and Correlation coefficients are presented in Table 2 and Table 3, respectively, as shown in the Appendix.

Public health expenditure ranged from the lowest of 1.324 to a maximum of 630.329 for the SADC countries for the period 2012 to 2022. It has a mean of 105.1333. Standard deviation shows public health expenditure deviates by an average of 145.5124 from its mean. GDP growth in the SADC ranged between -14.547 and 21.452. The data deviates by an average of 4.283193 from the value of 3.532466. Government expenditure has a mean of 0.601431, ranging between -1.538395 and 2.104319, and deviates from its mean by an average of 1.123613. For technology, it deviates by an average of 6.900307 from a mean of 27.69701 and ranged from the lowest of 13.9 to the highest of 46.85. Government revenue mean is 22.50784, ranged from a minimum of 5.6 to a maximum of 44.59, and standard deviation of 9.62728, meaning that it deviates by an average of 9.62728 from its mean, and lastly labour participation rate ranged between 44.2 and 87.642 with a standard deviation of 10.70661 from the mean of 67.16986.

Table 3 shows the correlation of variables under study, and it be seen that there is weak negative correlation between PHE and GDPG, GE and GDPG, Technology and government revenue to labour participation rate. PHE and GE, GDPG and LPR, GE and technology, government revenue and LPR, and LPR and technology have shown a weak positive correlation. PHE on GREV and technology have a strong positive correlation.

Panel cointegration test was performed to ensure that the variables were cointegrated before running the panel ARDL model, and the results are presented in Table 4 in the Appendix.

For the tests performed the probabilities were significant at the one percent level. However, the unadjusted modified Dickey-Fuller test was significant at five percent level. This means that the variables under study were all cointegrated at the 5 percent level of significance.

The Hausman test will output a chi-squared statistic and a p-value. The null hypothesis is that the PMG estimator is appropriate. If the p-value is greater than the chosen significance level (0.05), you fail to reject the null hypothesis, and the PMG estimator is preferred. If the p-value is less than the significance level, you reject the null hypothesis, and the MG estimator is preferred. Based on the results shown in Table 5 below, the Hausman test results showed a p-value (0.4855) greater than 0.05, which means that we failed to reject the null hypothesis and conclude that the PMG model is preferred compared to the MG, as depicted in Table 5 in the Appendix.

As guided by the Hausman test, PMG is the preferred model in this study. The results show that all variables presumed to be factors affecting public health expenditure were significant in the long run but at different levels. GDP growth, government expenditure, and labour force participation rate are significant at 1% level. Labour force participation rate and government expenditure have negative coefficients (-0.6152219 and -3.395133, respectively), which means that in the long run, an increase in these two variables will reduce public health expenditure. However, GDP growth has a positive coefficient (0.0964092), meaning that increasing GDP growth will increase public health expenditure in the long run. Government revenue is statistically significant at 5% level with a negative coefficient (-0.088846). Lastly, technology is significant at 10% level and negatively (-0.1277974) affects public health expenditure in the long run. These findings are in line with those of other researchers,[21], [22] , [23],[24], [25], [26], 27], [28] in different regions.

Meanwhile, the short run model shows a negative (-0.5452846) error correction coefficient (ECM), with the correct sign, which means after a shock take place and 54% of disequilibria is corrected in the current year. Alternatively, after a shock, 54% of disequilibria of previous years converge back to the long run equilibrium in the current year. GDP growth, government revenue and technology have positive coefficients meaning that they would positively affect or influence public health expenditure in the short run whereas, government expenditure and labour force participation rate would negatively affect public health expenditure in the short run.

5 Conclusion and Recommendations

The above results have very significant implications for policy formulation for public health expenditure in the SADC region. The results give credence to the idea that policies that aim to raise GDP growth in SADC member countries would be beneficial to government investment in the health sector. However, policies that aim to reduce government expenditure, technology, government revenue, and labour force participation rate would be recommended to improve the government's investment in the public health sector in the long run. Given the rapid population growth and spread of some diseases in the SADC region, it is imperative that governments in this block prioritise increasing their spending on public health expenditure to ensure an efficient health system. It can be concluded that, economic factors play an important role in determining health care expenditure in the SADC region.

All the variables under study were significant in affecting public health expenditure. GDP growth has been shown to be an essential, which shows a positive relationship with public health expenditure. Other variables, government revenue, government effectiveness, technology, and labour participation rate are also essential in making policy decisions as they negatively affect public health expenditure. As previously noted, this study was conducted to find out the socio-economic factors that drives public health expenditure in the SADC region using data from 2012 to 2022.

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Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

APPENDIX

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
PHE	208	105.1333	145.5124	1.3240	630.3920
GDPG	208	3.5324	4.2832	-14.5470	21.4520
GE	208	0.6014	1.1236	-1.5384	2.1043
TECHNO	208	27.6970	6.9003	13.9000	46.8500
GREV	208	22.5078	9.6273	5.6000	44.5900
LPR	208	67.1699	10.7066	44.2000	87.6420

Source: created by the authors

Table 3: Correlation

	PHE	GDPG	GE	TECHNO	GREV	LPR
PHE	1.0000					
GDPG	-0.0223	1.0000				
GE	0.0301	-0.1021	1.0000			
TECHNO	0.6113	-0.0442	0.0254	1.0000		
GREV	0.6031	-0.0970	0.2068	0.3379	1.0000	
LPR	-0.1855	0.1024	0.2469	-0.0270	-0.2614	1.0000

Source: created by the authors

Table 4: Panel Cointegration Test

Pedroni Test		Kao Test		Westerlund Test	
Modified Phillips-Perron t	4.5213*** (0.0000)	Modified Dickey-Fuller t	-0.1631 (0.4352)	Variance Ratio	3.7931*** (0.0001)
Philips-Perron t	-5.8129*** (0.0000)	Dickey-Fuller t	-3.4351*** (0.0003)		
Augmented Dickey-Fuller t	-6.7405*** (0.0000)	Augmented Dickey-Fuller t	0.6588 (0.2550)		
		Unadjusted Modified Dickey-Fuller t	-2.1700** (0.0150)		
		Unadjusted Dickey-Fuller t	-4.6720*** (0.0000)		

Source: created by the authors. *Numbers in brackets refers to p-values. Notes; *, **, and *** indicate significance at 10%, at 5% and at 1%.*

Table 5: Panel ARDL Estimation

Mean Group

D.PHE	Pooled Mean Group	Mean Group
GDPG	.0964092 (0.002) ***	4.507251 (0.180)
GE	-3.395133 (0.000) ***	-65.70705 (0.627)
TECHNO	-0.1277974 (0.096) *	-0.0.295447 (0.996)
GREV	-0.088846 (0.017) **	3.159711 (0.210)
LPR	-0.6152219 (0.000) ***	-17.28061 (0.111)
_ECT	-0.5452846 (0.000) ***	322.5344 (0.315)
(GDPG)D1.	.2450254 (0.552)	564.3713 (0.319)
(GE)D1.	-1.566329 (0.948	20004.71 (0.299)
(GREV)D1.	.8462094 (0.607)	-318.9272 (0.318)
(TECHNO)D1.	.1368659 (0.862)	-2670.109 (0.317)
(LPR)D1.	-31.06556 (0.247)	21744.55 (0.318)
_CONS	79.64229 (0.009) ***	-211059.4 (0.321)
Hausman test		

Source: created by the authors. *Notes: *, **, and *** indicate significance at 10 %, at 5 %, and at 1 % respectively. The pooled mean group and mean group control country and time effects. While the first panel shows long-run effects, the second panel reports both short-run effects (SR) and the speed of adjustment (ECT). The lag structure is ARDL (1, 1, 1, 1, 1, 1).*