

GOVERNMENT EDUCATION EXPENDITURE AND ECONOMIC PERFORMANCE IN SOUTH AFRICA: INSIGHTS FROM TIME SERIES ANALYSIS

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ABSTRACT

This study investigates the impact of government education expenditure on economic growth in South Africa for the period spanning from 1994 to 2021. Drawing on the human capital theory and employing a modified Cobb-Douglas production function, the study incorporates gross fixed capital formation, labour force, education expenditure, and poverty as key determinants of economic growth. Using the autoregressive distributed lag (ARDL) bounds testing approach, the analysis examines both short- and long-run dynamics, whilst the Granger causality test explores the direction of relationships among the variables. Empirical results reveal a positive and significant long-run and short-run impact of education expenditure on GDP, highlighting its critical role in promoting economic growth. Causality analysis indicates a unidirectional relationship from education expenditure to economic growth, while diagnostic tests confirm model stability and absence of structural breaks, heteroskedasticity, and autocorrelation. The findings underscore the importance of sustained investment in education for enhancing human capital and driving economic development in South Africa. This study contributes to the literature by providing country-specific evidence on the education–growth nexus, addressing previous research gaps related to short- and long-run dynamics, and informing evidence-based policy interventions to maximize the economic returns of education spending.

Keywords: Government Education Expenditure; Economic Growth; Human Capital Theory; ARDL Bounds Test; South Africa; Granger Causality; Cobb-Douglas Production Function.

1. INTRODUCTION

Education is widely acknowledged as a key component of sustainable economic development, promoting human capital formation, the creation of human capital, productivity growth, and long-term competitiveness [1]. Globally, governments continue to prioritise investment in education as a strategic lever for economic transformation, given its role in fostering innovation, reducing inequality, and improving labour market outcomes [2]. South Africa is no different; the government's dedication to enhancing human capital development is demonstrated by the fact that education continuously receives the highest share of public spending. As per the National Treasury [3], education is responsible for roughly 21% of the nation's non-interest budgetary allocations and 5% of the country's GDP.

Over the past two decades, South Africa's education spending trajectory has demonstrated significant increases. Allocations to the Department of Basic Education rose from R28.5 billion in 2021/22 to a projected R31.4 billion in 2024/25, representing an average annual increase of 3.3% [4]. Similarly, overall education spending increased by R80 billion over five years, from R169 billion in 2009–10 to R249 billion in 2013–14 [5]. The amount spent on education as a percentage of GDP also fluctuated, falling by 0.22% in 2016 before rising by 15.03% in 2020 [6].

Government funding for education has increased despite short-term financial limitations, such as the 2021 budget address that announced cuts to cultural and educational programs. R408.2 billion was set aside for education in the fiscal year 2021–2022, and public expenditures accounted for 18.42% of all government spending in 2021 and 6.84% of GDP in 2020 [6]. These numbers highlight how the country prioritises education's role as a central development strategy.

Given the vital role of education in driving socioeconomic progress, public education expenditure continues to be a topic of great interest to academics and policymakers remains a subject of intense interest among scholars and policymakers [7]; [8]. However, while international evidence confirms the significance of education spending in promoting economic growth, the empirical nexus is not always consistent, particularly across various institutional and cultural contexts [9]; [10]. In South Africa, there is a paucity of empirical research on this relationship, leaving important gaps in understanding the extent to which education expenditure translates into economic growth.

Considering this, the current study examines the connection between South Africa's economic growth and government spending on education. In particular, the study looks at both short- and long-term dynamics, assesses causality between the variables, and provides fresh data to support policy discussions about how education spending supports equitable and sustainable economic growth.

2. LITERATURE REVIEW

Theoretical Literature Review

The link between public education spending and economic growth is grounded in human capital theory [11]; [12], which views education as an investment that enhances productivity and long-term growth. From an endogenous growth perspective, education fosters innovation, technological progress, and knowledge accumulation [13]; [14]. Higher public expenditure improves access, quality, and equity in education, thus expanding the skilled labor force and boosting economic performance [15]; [1]. However, the growth effects of education spending depend on factors such as allocation efficiency, governance, and absorptive capacity [16]. Thus, while theory highlights education as a catalyst for growth, outcomes vary across contexts depending on how effectively resources are utilized.

3. EMPIRICAL LITERATURE REVIEW

Empirical Evidence: Global Context

The relationship between economic growth and education spending has been the subject of numerous studies, with varying degrees of success. According to certain research, there is a significant positive correlation, highlighting the contribution of education to the development of human capital and growth [17]; [18]. Others, however, contend that the effect depends on institutional quality, overall socioeconomic circumstances, and the effectiveness of educational institutions [2]; [10]. [9], for instance, contend that although funding for education boosts growth in many developing nations, the extent of the effect is frequently constrained by ineffective resource allocation and inadequate institutional frameworks.

Evidence from South Africa

Compared to other emerging countries, there is comparatively little empirical research on education spending and growth in South Africa. Existing studies indicate that while the government invests a considerable part of its budget in education, the returns concerning better learning outcomes, skills development, and labour market productivity have been limited [19]; [20]. The relationship is further complicated by structural issues, including inequality, inefficient use of resources, and skill mismatches in the labor market [21]. This implies that South Africa's educational spending may have a very different effect on economic growth than the rest of the world.

Research Gaps and Contribution

While the nexus between education spending and economic growth has been extensively studied globally, South Africa remains underexplored, despite allocating a relatively high share of GDP to education. Existing studies frequently focus on static correlations, often neglecting dynamic interactions and short- versus long-run causal linkages that can reveal how education investment translates into economic growth over time. Moreover, prior research tends to overlook factors such as spending efficiency, governance quality, and absorptive capacity, which may mediate the impact of education expenditure.

This study addresses these gaps by employing advanced econometric techniques to capture both short and long-term effects of public education spending on South African economic growth. Its novel contribution lies in providing country-specific evidence on the effectiveness of education expenditure in promoting growth, offering new insights into the mechanisms through which public investment in education influences economic outcomes.

Theoretical Framework

The study's theoretical foundation is grounded in human capital theory, which postulates that investments in education enhance the productivity, skills, and capabilities of the labor force, thereby promoting economic growth [11]; [12]. Education increases the efficiency of workers, facilitates innovation, and encourages knowledge spillovers, forming the basis for sustainable development [13]; [14].

From a Keynesian perspective, public expenditure on education functions as a fiscal stimulus that enhances aggregate demand, thereby fostering both short- and long-term economic growth [22, 23]. In contrast, neo-classical growth theory cautions that excessive government spending may crowd out private investment and constrain growth, unless resources are allocated efficiently [24, 25].

The study also considers insights from the Ricardian Equivalence Hypothesis, which suggests that government spending financed by debt may not affect growth if households anticipate future taxes and adjust their consumption accordingly [26]. Meanwhile, Wagner's Law argues that economic growth drives public expenditure, including education spending, suggesting a bidirectional relationship [27]. By integrating these perspectives, this study conceptualizes education spending as both a driver and a potential economic growth outcome, highlighting the importance of efficiency, allocation, and absorptive capacity.

The Empirical Model

Drawing from [28] and [29], the study employs the modified Cobb-Douglas function. The model is specified as follows:

$$GDP_t = f(GFCF, L, EDEXP, Poverty) \dots\dots\dots (1)$$

The equation can be rewritten as follows:

$$L_GDP_t = \beta_0 + \beta_1 L_GFCF_t + \beta_2 L_Labour_t + \beta_3 L_EDEXP_t + \beta_4 L_Poverty_t + \varepsilon_t \dots\dots\dots (2)$$

Where, GDP_t represents GDP economic growth, $GFCF_t$ is gross fixed capital formation, which represents capital. L_Labour_t is the workforce, measured by labour force, $EDEXP_t$ is the proxy for government education expenditure and $Poverty_t$ is the rate of poverty (all for period t).

A Priori Assumption

$\beta_1, \beta_2, \beta_3$, and $\beta_4 > 0$, implying that GDP positively correlates with government fixed capital expenditure, labour, government education expenditure, and poverty rate.

Note: All the variables are in logarithmic form (represented by L).

Estimation Techniques

The study employs the Autoregressive Distributed Lag (ARDL) bounds testing approach to examine both long-run and short-run dynamics between government education expenditure and economic growth. Stationarity was tested using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods.

Granger causality tests were conducted to identify the direction of causality: bidirectional if both variables affect each other, or unidirectional if only one variable influences the other. Model reliability was ensured through diagnostic tests for heteroskedasticity, autocorrelation, and functional form misspecification.

using Ramsey's RESET. Structural breaks were assessed via CUSUM, CUSUMQ, and Chow breakpoint tests to verify coefficient stability.

Data

Annual time series data from 1994 to 2021 were sourced from the South African Reserve Bank, IMF, and World Bank Development Indicators. EViews software was used for analysis, enabling ARDL estimation, causality testing, and diagnostic assessments.

4. EMPIRICAL RESULTS

4.1 Stationarity Tests

Before estimation, unit root tests were conducted to ensure variables were integrated of the same order and to prevent spurious regression results. Using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, all variables were non-stationary at levels but became stationary after first differencing, except GDP, which was stationary at levels under the PP test. These results justified the employment of the ARDL bounds testing approach (Ruiters & Charteris, 2020).

Table 1. Stationarity Test

		Augmented Dickey-Fuller test			Phillips-Perron test		
Order of integration	Variable	Test statistic	P-value	Implication	Test statistic	P-value	Implication
Level	L_GDP	-2.960749	0.521	Non-Stationary	-4.555950	0.0013	Stationary
1 st difference	L_GDP	-4.931468	0.0027	Stationary	-4.936712	0.0027	Stationary
Level	L_EDEXP	-2.023272	0.2757	Non-Stationary	-2.399992	0.1511	Non-Stationary
1st difference	L_EDEXP	-4.050524	0.0045	Stationary	-4.041426	0.0046	Stationary
Level	L_LABOUR	-2.037960	0.2699	Non-Stationary	-1.911063	0.3225	Non-Stationary
1st difference	L_LABOUR	-6.233955	0.0000	Stationary	-6.330234	0.0000	Stationary
Level	L_GFCF	-2.260518	0.1912	Non-Stationary	-2.260518	0.1912	Non-Stationary
1st difference	L_GFCF	-5.844957	0.0001	Stationary	-6.031491	0.0000	Stationary
Level	L_POVERTY	-2.844434	0.0684	Non-Stationary	-1.164064	0.6747	Non-Stationary
1st difference	L_POVERTY	-2.816870	0.0697	Stationary	-2.834064	0.0673	Stationary

Sources: EViews and Author's compilation

4.2 ARDL Bounds Test and Long and Short Run Relationship

The bounds test revealed that the calculated F-statistic exceeded the upper bound critical value, indicating that a significant long-run relationship between GDP, education expenditure, capital formation, labour, and poverty exists.

Long-run estimates showed that government education expenditure and gross fixed capital formation positively influence economic growth. The error correction term was negative and statistically significant, suggesting that deviations from long-run equilibrium adjust by approximately 3.6% annually. Similarly, short-run dynamics results show a positive nexus between education expenditure and capital formation on GDP, respectively, while labour and poverty are statistically insignificant.

4.3 Autoregressive Distributed lag (ARDL) Bounds test Approach Results

Table 2. Long-run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,930271	0,261619	3,555825	0,0019
L_GDP(-1)*	-0,036102	0,009915	-3,641009	0,0015
L_EDEXP***	-0,374882	0,111536	-3,361083	0,0030
L_LABOUR**	-0,005345	0,070386	-0,075937	0,9402
L_GFCF**	-0,215359	0,124718	-1,726775	0,0989
L_POVERTY**	0,004547	0,026492	0,171633	0,8654

Source: Eviews and Author's compilation

Table 3. ARDL Bound Test

F-Bounds Test	Null Hypothesis: No levels relationship			
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8,454950	10%	2,45	3,52
k	4	5%	2,86	4,01
		2,5%	3,25	4,49
		1%	3,74	5,06
Actual Sample Size	27	Finite Sample: n=35		
		10%	2,696	3,898
		5%	3,276	4,63
		1%	4,59	6,368

Source: Eviews and Author's work

Table 4. ARDL Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.930271	0.125633		0.0000
CointEq(-1)*	-0.036102	7.404703		0.0000
		0.005089	-7.094159	
R-squared	0,668114	Mean dependent var		0,039089
Adjusted R-squared	0,654839	S.D. dependent var		0,014339
S.E. of regression	0,008424	Akaike info criterion		-6,644195
Sum squared resid	0,001774	Schwarz criterion		-6,548207
Log likelihood	91,69663	Hannan-Quinn criter.		-6,615653
F-statistic	50,32709	Durbin-Watson stat		2,660633
Prob(F-statistic)	0,000000			

Source: Own Compilation

4.4 Granger Causality

Granger causality analysis revealed unidirectional causality from education expenditure to GDP, confirming that increases in public education investment drive economic growth. Additionally, GDP was found to Granger-cause labour, while no causal relationships were detected between GDP and capital formation or poverty. These findings highlight the pivotal role of education spending in shaping economic performance in South Africa.

Table 5. Granger causality tests

Null Hypothesis:	Obs	F-Statistic	Prob.
L_EDEXP does not Granger Cause L_GDP	26	4,58890	0,0222
L_GDP does not Granger Cause L_EDEXP		0,80533	0,4603
L_LABOUR does not Granger Cause L_GDP	26	0,15910	0,8539
L_GDP does not Granger Cause L_LABOUR		12,1917	0,0003
L_GFCF does not Granger Cause L_GDP	26	0,64793	0,5333
L_GDP does not Granger Cause L_GFCF		1,69566	0,2076
L_POVERTY does not Granger Cause L_GDP	26	3,06233	0,0681
L_GDP does not Granger Cause L_POVERTY		1,55443	0,2347
L_LABOUR does not Granger Cause L_EDEXP	26	0,11909	0,8883
L_EDEXP does not Granger Cause L_LABOUR		3,81246	0,0387
L_GFCF does not Granger Cause L_EDEXP	26	0,03749	0,9633

L_EDEXP does not Granger Cause L_GFCF		0,49553	0,6162
L_POVERTY does not Granger Cause L_EDEXP	26	0,61569	0,5497
L_EDEXP does not Granger Cause L_POVERTY		0,55186	0,5840
L_GFCF does not Granger Cause L_LABOUR	26	2,16953	0,1392
L_LABOUR does not Granger Cause L_GFCF		0,55148	0,5842
L_POVERTY does not Granger Cause L_LABOUR	26	2,11368	0,1458
L_LABOUR does not Granger Cause L_POVERTY		0,65754	0,5285
L_POVERTY does not Granger Cause L_GFCF	26	0,09169	0,9128
L_GFCF does not Granger Cause L_POVERTY		0,45363	0,6414

Source: Eviews and Author's compilation

4.5 Model Diagnostics and Stability

Residual diagnostics confirmed the robustness of the model. Tests showed no autocorrelation, homoscedastic residuals, and normal distribution of errors. The Ramsey RESET test indicated correct model specification, while CUSUM, CUSUMSQ, and Chow breakpoint tests confirmed stability of the model coefficients over time, with no structural breaks detected.

Overall, the empirical results suggest that government education expenditure is a key driver of both short-run and long-run economic growth in South Africa. The model is statistically sound, stable, and suitable for policy analysis regarding public education investment.

4.4.1 Misspecification Tests

Table 6. Serial Correlation Test

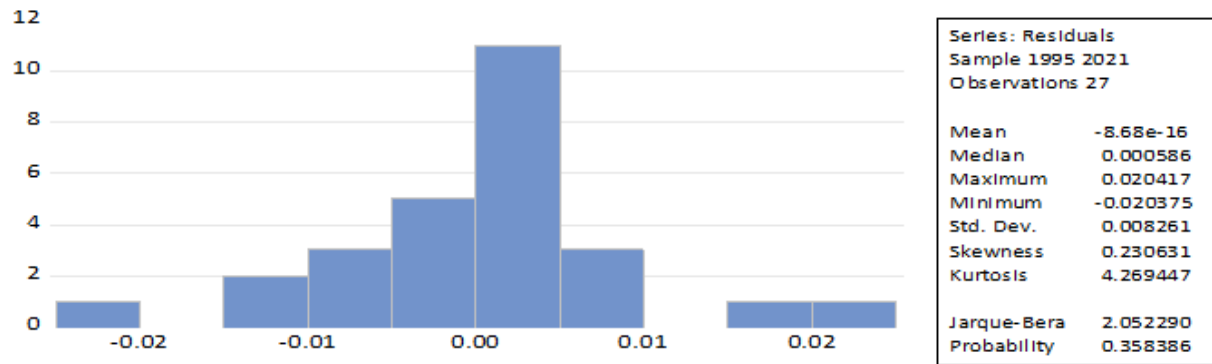
Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 8 lags			
F-statistic	2,19127	Prob. F(8,13)	0,1005
Obs*R-squared	15,50317	Prob. Chi-Square (8)	0,0501

Source: Eviews and Author's compilation

Table 7. Heteroscedasticity Test: Breusch-Pagan-Godfrey

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	1,939502	Prob. F(5,21)	0,1303
Obs*R-squared	8,529447	Prob. Chi-Square(5)	0,1294
Scaled explained SS	8,434828	Prob. Chi-Square(5)	0,1338

Source: Eviews and Author's compilation



Source: EViews and Author's compilation

FIGURE 1
RESIDUAL NORMALITY TEST

Stability test

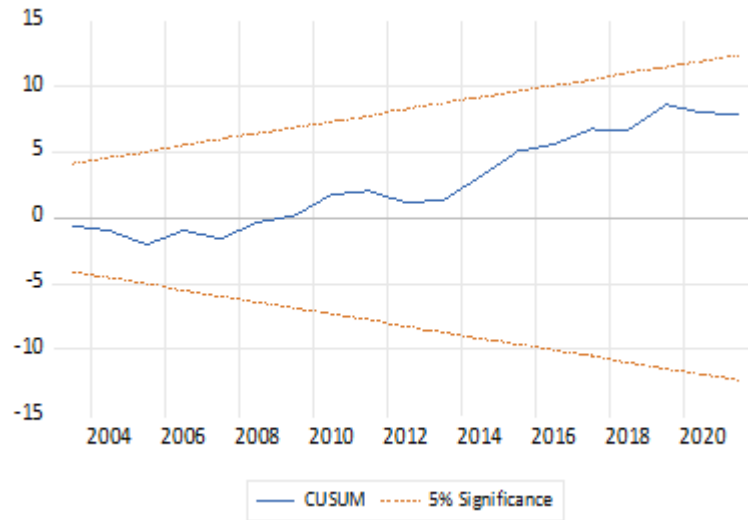
Table 8. Ramsey Reset Test

Ramsey RESET Test Equation: UNTITLED Omitted Variables: Squares of fitted values Specification: L_GDAP L_GDP(-1) L_EDEXP L_LABOUR L_GFCF L_POVERTY C			
	Value	df	Probability
t-statistic	0,64530 2	20	0,5261
F-statistic	0,41641 5	(1, 20)	0,5261
Likelihood ratio	0,55638 8	1	0,4557

Source: Eviews and Author's compilation

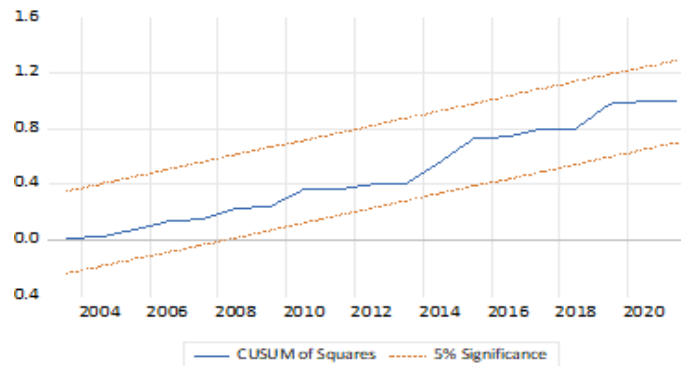
Testing for Structural Breaks

Cumulative Sum of Residuals (CUSUM) test and Cumulative Sum of Squares (CUSUMQ) test



Source: EViews and Author's compilation

FIGURE 2
CUSUM TEST OF STABILITY



Source: EViews and Author's compilation

FIGURE 3
CUSUMQ TEST OF STABILITY

Table 9. Chow Breakpoint Test

Chow Breakpoint Test: 2015		
Null Hypothesis: No breaks at specified breakpoints Varying regressors: All equation variables		
Equation Sample: 1994 2021		
F-statistic 2.203077 Prob. F (7,14)	0.0988	
Log Likelihood ratio 20.79475 Prob. Chi-Square (7)	0.0041	
Wald Test 15.42154 Prob. Chi-Square (7)	0.0310	

Source: EViews and Author's compilation

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