

FINANCING OF HIGHER EDUCATION IN SAUDI ARABIA: AN ARDL MODEL

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ABSTRACT

This paper explores the connection between finance or government spending and higher education in Saudi Arabia. The main objective was to distinguish between the short-term and long-term effects of financing on higher education. This paper was based on secondary time series data from 2000 to 2021. The present study used econometric tools i.e, ADF and PP to assess stationarity, while ARDL and Bound tests were used to examine short- and long-term relationships. The findings indicate a positive and significant impact of public expenditure on higher education in Saudi Arabia. The study recommends that strategic investments in Saudi higher education will focus on quality education, research, faculty, and technology. The study also recommends that transparency, involvement from the private sector, scholarship programs, and flexible policies are necessary for the efficient growth of the country.

Keywords; Auto Regressive Distributed Lag; Augmented Dickey-Fuller; Financing; Higher Education;

1 INTRODUCTION

Saudi Arabia, a nation with a rich cultural heritage and a rapidly evolving economy, has witnessed significant developments in both its financial sector and higher education landscape. The financial system in Saudi Arabia has experienced robust growth in recent decades, driven by factors such as oil revenues, economic diversification efforts, and a proactive regulatory environment. The Saudi Arabian Monetary Authority (SAMA) plays a pivotal role in overseeing the financial sector, ensuring stability and fostering growth. The Kingdom's finances are closely tied to its oil resources, with oil exports historically serving as a major revenue source. However, recognizing the need for economic diversification, Saudi Arabia has implemented ambitious initiatives like Vision 2030. This strategic blueprint aims to reduce dependency on oil, stimulate non-oil sectors, and attract foreign investment. The Capital Market Authority (CMA) regulates the securities market, contributing to developing a dynamic financial ecosystem. The Saudi Stock Exchange (Tadawul) has also gained prominence as the largest market in the Middle East, reflecting the nation's economic vitality. Saudi Arabia has made substantial investments in Higher Education, recognizing its role in fostering human capital development and driving innovation. The Ministry of Education oversees the education sector, and universities like King Saud University and King Abdulaziz University are at the forefront of academic excellence. The country has witnessed a surge in the establishment of new universities and the expansion of existing ones. These institutions offer a diverse range of programs, from science and technology to humanities and social sciences. The goal is to equip students with the skills needed for a knowledge-based economy, aligning with the objectives of Vision 2030. The relationship between finance and Higher Education in Saudi Arabia is multifaceted. Financial stability and growth contribute significantly to the government's ability to allocate funds to the education sector. As the economy prospers, the government can allocate more resources to enhance the quality of education, fund research initiatives, and improve infrastructure in universities. Conversely, Higher Education plays a crucial role in the nation's economic development. A well-educated workforce is essential for diversifying the economy and reducing dependency on oil. The emphasis on science, technology, engineering, and mathematics (STEM) fields aligns with the evolving needs of the job market and contributes to innovation and competitiveness. Furthermore, the financial sector directly benefits from a well-educated workforce. Skilled professionals in finance, economics, and business contribute to the growth and sophistication of financial markets. Graduates from higher education institutions often play pivotal roles in shaping economic policies, managing financial institutions, and driving innovation in financial services. The paper is arranged into six sections: a literature review, data source and methodology, results and discussion, conclusion, and policy implications.

2 REVIEW OF LITERATURE

This section gives brief information on the status of Public expenditure and higher Education in Saudi Arabia as well as the relevant empirical studies of the variables.

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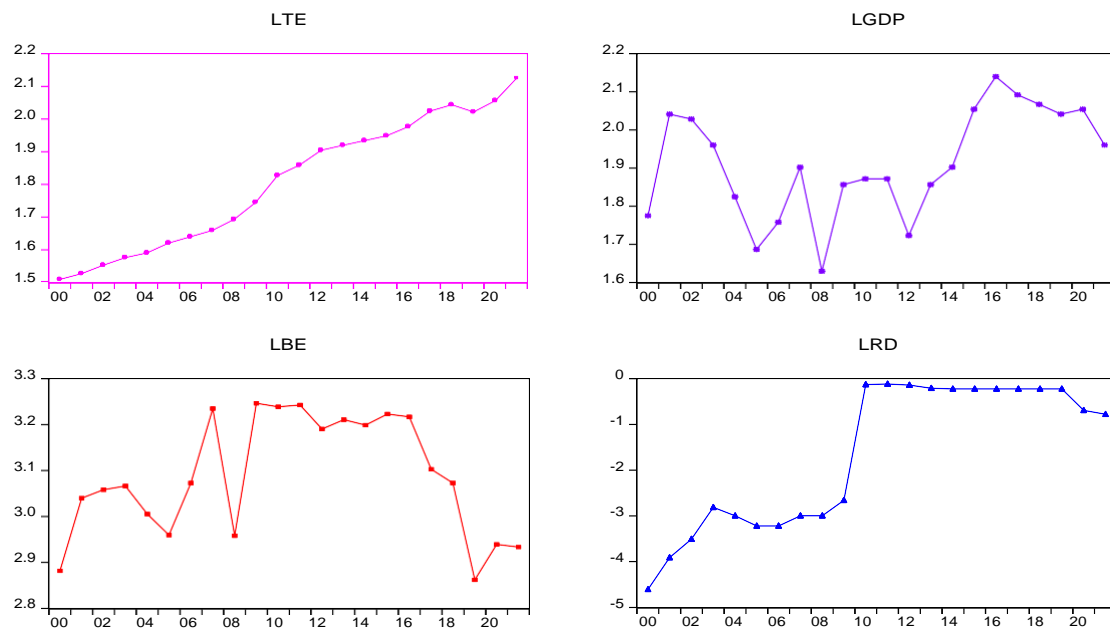
Denison (1697) was an early advocate of investing in education, recognizing its impact on growth and development by fostering activities to catch up with foreign technological progress (Barthelemy & Varoudakis, 1996). Human capital's significance for growth, highlighted by the internal growth approach emphasizing long-term returns to scale (Romer, 1986), has led governments to make substantial investments in education. While theoretical studies explored the financing-education relationship, empirical research using time series and panel data has yielded mixed results (Gylfason, 2000; Sylwester, 2000; Sylwester., 2002). Despite theoretical support for a positive correlation, empirical studies differ, with some indicating a positive impact (Gary, Kevin, and Robert, 1990) and others suggesting a negative relationship (Sylwester., 2002). Pilot studies like Barro (1991) suggest a strong positive link between education and economic growth. Liao et al. (2019) and Kobzev et al. (2018) argue for a positive connection, while Plabita (2019) emphasizes education's role in sustaining economic growth. However, conflicting studies, such as Griliches' findings, claim no significant relationship between education and economic growth, with disputes about data quality and measurement errors (Mehmet & Sevgi, 2014). Eric (2016) contends that merely adding more schooling without enhancing cognitive skills has limited systematic influence on growth. Inconsistencies are attributed to public sector human capital investment (Hirsch & Giovanni, 2009). Studies in Turkey (Kar, Nazlioglu, & Ağir, 2011) and Yılğör et al. (2012) assert significant mutual contributions of education and economic growth, supported by positive correlations between government expenditure on education and economic growth. Regional differences in growth rates within East and South Asia are linked to variations in educational progression (Anjum & Atiq, 2017). South Africa's economic growth is tied to increased government spending on education and improved trade openness (Akinwale & Grobler, 2019). Education, as a process fostering positive individual development, is highlighted by Zoran (2015). Karambakuwa et al. (2019) found an insignificant effect of human capital on economic growth in their study, even with added interactive terms representing government spending and direct foreign investment. Yet, increasing human capital may stimulate entrepreneurship and innovation, indirectly fostering economic development (Claude & Ralph, 2019). According to Akinwalea and Surujlalb (2021), Saudi Arabia experienced a substantial increase in R&D investment, rising from 0.01% of GDP in 2000-2009 to 0.884% in 2010, aligning with Vision 2030 goals. A \$1.6 billion investment in 2019 aimed to boost R&D at universities. While global competitiveness improved to 36th in 2019, business dynamism ranked low at 109th. The authors affirm that financing higher education is crucial for Saudi Arabia's economic development (Claude & Ralph, 2019).

3 DATA SOURCES AND METHODOLOGY

This study was based on secondary time series data collected from various public resources such as the Saudi Arabian Monetary Authority (SAMA) Annual Reports of Various Years, OECD, the UNESCO Institute for Statistics, and World Development Indicators (WDI). Additionally, the analysis carried out during this research was based on an annual time series of the Saudi economy from 2000 to 2021.

Table 1: Variable Names and Description

Variable Name	Log Form	Description (Proxy Variable)	Sources
TE	LNTE	Total Enrollment (In Million)	Saudi Arabian Monetary Authority (SAMA) Annual Reports of Various Years
GDP	LNGDP	As % of GDP	UNESCO Institute for Statistics and World Development Indicators (WDI)
BE	LNBE	As % of Total Budget Expenditure on Education	UNESCO Institute for Statistics and World Development Indicators (WDI)
RD	LRD	Gross Expenditure on R and D (As % of GDP)	World Bank, OECD, World Economic Forum, and UNESCO Institute for Statistics



Econometric Model:

This study's econometric model is as follows:

$$TE = \beta_0 + \beta_1 (GDP) + \beta_2 (BE) + \beta_3 (RD) + \mu \dots\dots 1$$

TE represents the Total enrolment,

GDP stands for gross domestic product in education,

BE represents Budgetary Expenditure on Education,

RD corresponds to the Research and Development of Higher Education.

In the regression model, β_0 signifies the intercept. β_1 , β_2 and β_3 are the coefficients associated with GDP, BE, and RD, respectively. The error term is represented by μ .

Autoregressive Distributed Lag Model:

The ARDL (Autoregressive Distributed Lag) technique has been utilized to explore the connection between public expenditure and Higher Education. Introduced by Pesaran et al. (1996), Pesaran and Shin (1999), and Pesaran et al. (2001), the ARDL bounds testing technique is versatile, necessitating that the variables in the model specification be integrated at order 0 or 1, denoted as I(0) or I(1). This approach is robust even with small sample sizes, offering reliable results. Variables in the model can be assigned different lag lengths to capture various dynamics. The ARDL equation takes the form:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \dots + \beta_q Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \dots + \alpha_k X_{t-k} + \varepsilon_t \dots\dots\dots 2$$

Notably, this technique has been recently employed by several researchers, reflecting its applicability and relevance in contemporary studies (Ansari et al., 2022; Ansari et al., 2022; Ansari et al., 2023; Ansari et al., 2023; Khan et al., 2023; Rashid, et, al., 2023; Amir, et, al., 2023). The unconstrained vector error model, on the other hand, is shown below.

$$\Delta TE_t = \gamma_0 + \sum_{i=1}^p \gamma_1 TE_{t-1} + \sum_{i=1}^p \gamma_2 GDP_{t-1} + \sum_{i=1}^p \gamma_3 BE_{t-1} + \sum_{i=1}^p \gamma_4 RD_{t-1} + \varepsilon_t \dots\dots\dots 3$$

The ARDL model, shown in Equation (3), demonstrates the long-run and short-run connection between the dependent and independent variables. The short-run coefficients of variables are γ_0 , γ_1 , γ_2 , γ_3 , and γ_4 , explanatory variables, whereas the long-run coefficients of variables, and t is the stochastic error, which includes all missing variables in the Equation.

Short-Run Relationship Error Correction Model

This approach determines the short-run relationship between the TE and other independent variables. The following is the short-run error correction equation:

$$\Delta TE_t = \theta_0 + \sum_{i=1}^p \theta_{1i} TE_{t-1} + \sum_{i=1}^p \theta_{2i} GDP_{t-1} + \sum_{i=1}^p \theta_{3i} BE_{t-1} + \sum_{i=1}^p \theta_{4i} RD_{t-1} + \lambda(ECM)_{t-i} + \mu_t \dots\dots\dots 4$$

(ECM-i) The ECM illustrates the short-run influence on the x and y variables and the adjustment rate.

$$\Delta Y_t = \eta + \delta t - i + \lambda(\text{ECMT} - I) + \mu t \dots \dots \dots 5$$

In the Equation, (δ) denotes the short-run effect, and (λ) denotes the adjustment speed. Table 6 displays the ECM findings.

4 RESULTS AND DISCUSSIONS

A concise understanding of the variables under investigation is crucial in empirical analysis. In this regard, the current study employed a RADAR chart to present the descriptive statistics of the variables visually. Figure 1 showcases the RADAR descriptive statistics: budgetary expenditure on Higher Education has the highest mean value, followed by the percentage of total GDP in Higher Education, the total enrollment ratio, and research and development. Examining the standard deviation, LBE (logarithm of BE) demonstrates better performance, followed by LGDP (logarithm of GDP), LTE (logarithm of TE), and LRD (logarithm of research and development). All the series under investigation exhibit negative skewness. Additionally, these series are characterized as platykurtic, as their kurtosis values are less than 3. In order to ensure accurate further analysis, it is essential to determine the order of integration of the series. Simple unit root tests and Zivot and Andrews' (ZA) stationarity tests were applied for this purpose. The result of the ADF and PP stationarity tests, presented in Table 2, reveals that all the series are non-stationary at this level. However, after taking the first difference, all the series become stationary, indicating that they are integrated of order 1 (I (1)). In order to recognize the potential impact of breaks in the series on conventional stationarity tests, the ZA unit test was employed to address this concern. Table 3 illustrates the ZA outcomes, indicating that all the series are non-stationary at this level.

Nevertheless, after making the first difference, all the series exhibit stationarity. After confirming that the series is of order 1, the study proceeded to the co-integration test. The Bounds test results in Table 4 reveal that the F-statistic (18.02) surpasses both the upper and lower critical values at 1%, 5%, and 10% significance levels. This implies that the failed null hypothesis of no co-integration provides evidence of a long-run association between LTE and Expenditure on Education (As % of GDP).

Table 1: Descriptive Statistics of Dependent and Independent Variable

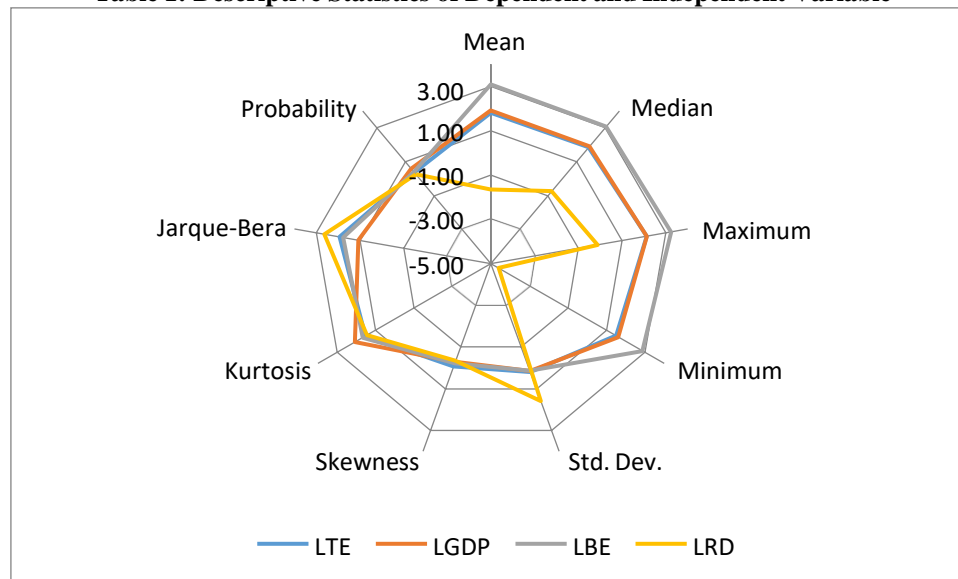


Figure 1. Descriptive Statistics.

Table 2 ADF and PP Tests

Variable	ADF		PP	
	Level	First Difference	Level	First Difference
LTE	6.06	-3.11	5.44	-2.79**
LGDP	0.14	-5.95	0.24	-6.13***
LBE	-0.21	-6.93	0.06	-7.25*
LRD	-2.43	-3.77	-2.42**	-3.76**

Note: ! Stands for the direction of causality. *, ** and *** stands for 1%, 5% and 10% level of significance.

Table 3 ZA Tests

Variable	Level		First Difference	
	t- Statistics	BD	t- Statistics	BD
LTE	-4.92*	2010	-2.97***	2013
LGDP	-4.34	2004	-4.65**	2006
LBE	-4.18*	2009	-5.37*	2016
LRD	-7.05	2010	-2.39**	2014

Note: ! Stands for the direction of causality. *, ** and *** stands for 1%, 5% and 10% level of significance..

Table 4 Bound Test

F statistics				18.02	
Co-integration				Yes	
10%		5%		1%	
2.01	3.01	2.45	3.68	3.42	4.84

Note: ! Stands for the direction of causality. *, ** and *** stands for 1%, 5% and 10% level of significance.

Table 4 presents the estimated ARDL bounds test for Saudi Arabia using Schwarz's information criterion (SBIC) to choose a suitable lag for the ARDL model with limited observations. The result for the bounds F-test for integration indicates that the three series are co-integrated at a 5% level for Saudi Arabia as the calculated F-value (18.02) is above the upper critical value (3.68) at 0.05 significant levels. The result of the bounds F-test reveals that the null hypothesis for no co-integration is rejected at the 5% level. The results of Saudi Arabia signify the existence of a long-run association among the three variables analyzed. The results of Equation (3) are presented in Table 5. The result for Saudi Arabia shows that the error correction term has the expected negative sign and is significant at a 1% level, which further analyzes the long-run association between the series. This further indicates that LGDP, LBE, and LTI have long-run causality towards Higher Education. The ECT value of -0.32 posits that any disequilibrium in the short run is corrected by 34% in achieving long-run equilibrium every year. In addition to this, the analysis of the short-run dynamics of Saudi Arabia also reveals that the preceding changes in LGDP, LBE, and LRD positively and significantly change the present LTE at 1% level with the corresponding coefficients of 0.28, 0.58, and 0.07 percent respectively. These results suggest that previous studies show that economic growth and R&D positively and significantly influence the economic growth in Saudi Arabia in the short run (Akinwale and Surujlal (2021). The short-run dynamics also indicate that the past changes in LBE and LRD positively and significantly affect the present LTE at 1% and 5% levels with the corresponding coefficients of 0.27 and 0.01 percent respectively.

Meanwhile, the coefficient value (-0.26) of the past changes in LGDP has a negative but significant influence on LTE. Also, these outcomes imply that previous changes in economic growth and R&D have a positive and significant influence on the present economic growth in South Africa in the short run. The outcomes of ARDL and ECM models for Saudi Arabia in many ways. Firstly, the models exhibit the existence of co-integration, and the long-run association was established. The outcomes are consistent with those of related studies (Bakari, 2019; Liu and Xia, 2018; Armeanu et al., 2018) and differ from others (Tuna et al., 2015). This implied that diversification from the natural resource endowments towards a knowledge-based economy is promising and significant for the long-run relation paper. The results of short-run dynamics also showed that R&D has a positive and significant effect on LTE, though the coefficient is slightly higher in LRD than in LBE. Similarly, studies such as Bakari et al. (2020) could not find any significant impact of innovation on economic growth. The results of the diagnostic tests, as displayed in Table 5, indicate that the residual of the models of Saudi Arabia is normally distributed and free from the presence of autocorrelation and heteroscedasticity.

Table 5 ARDL Long- and Short-outcomes

Long run Outcome					Short run Outcome			
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.28*	0.17	1.67	0.10	-0.26***	0.05	-4.70	0.00
BE	0.59*	0.25	-2.33	0.08	0.27***	0.04	5.63	0.00
RD	0.07**	0.02	3.28	0.03	0.01***	0.004	2.68	0.00
ECT(-1)					-0.34	0.006	5.29	0.00
R ²	0.92							
Adj R ²	0.87							
F-sta	9.18							
Pro(sta)	0.00							

Note: ! Stands for the direction of causality. *, ** and *** stands for 1%, 5% and 10% level of significance.

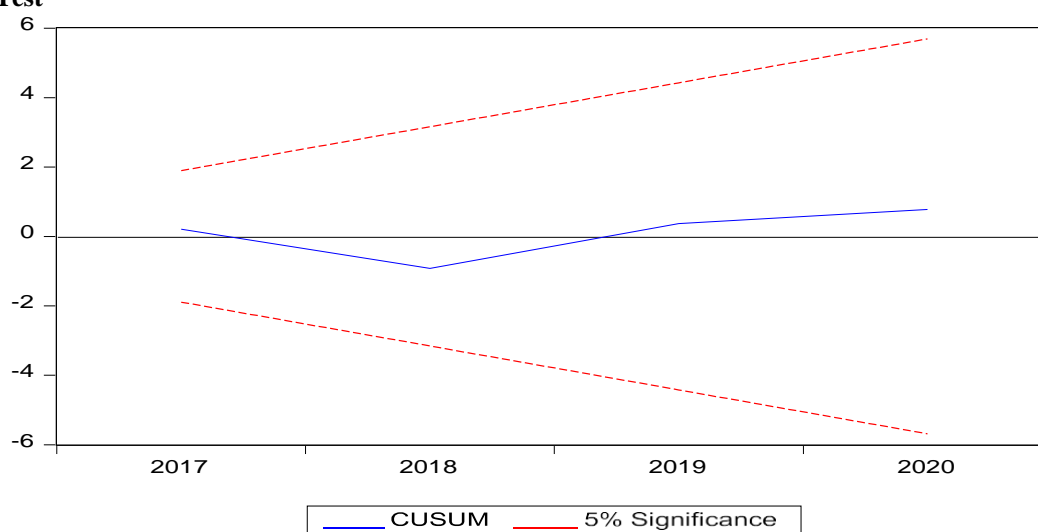
The Error Correction Term (ECT) is negative and significant, indicating that corrections made in previous periods can be rectified in succeeding periods. In addition, the study conducts several diagnostic tests, as shown in Table 6. The outcomes reveal the absence of heteroscedasticity and serial correlation in the model. Furthermore, there is no misspecification, as confirmed by the RESET test. The results of the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUM of Sq) in Figures 2 a and b indicate that the model is stable at a 5% significance level.

Table 6 Diagnostic Tests

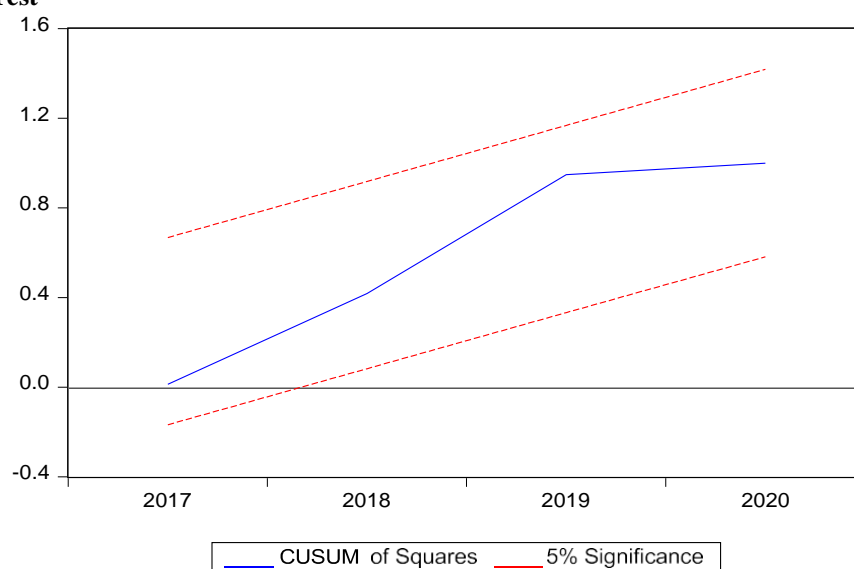
Test	Value	Probability
X ² ARCH	1.35	0.26
X ² RESET	1.78	0.32
X ² Normality	0.54	0.45
X ² LM	3.15	0.37

Note: ! Stands for the direction of causality. *, ** and *** stands for 1%, 5% and 10% level of significance.

CUSUM Test



CUSUM Square Test



5. CONCLUSIONS

This study investigated the connection between public spending and Higher Education in Saudi Arabia. We assessed the stationarity of public expenditure and Higher Education at both their levels and first differences, using the ARDL model and bound test. The bound test model indicated that the F-statistics were greater than the critical value, suggesting a long-term relationship between public expenditure and Higher Education. The ARDL model also showed that changes in LGDP corresponded to changes in LTE and similar relationships were observed with other variables. This implies that financing or public expenditure (LBE) has a positive influence on Higher Education in the long run. Examining the R-squared value, we found that approximately 92 percent of the impact on Higher Education can be explained by the model's goodness of fit. This research reveals that the variables we examined significantly affect Higher Education in Saudi Arabia.

6. POLICY IMPLICATIONS

We have studied this paper and suggest recommendations for funding higher Education in Saudi Arabia. In order to finance higher education effectively, it is recommended that the Saudi government should implement a comprehensive plan. This involves strategically allocating funds for long-term impact, emphasizing eco-friendly and energy-saving initiatives, prioritizing essential facilities such as labs and libraries, supporting educators with competitive salaries and research funds, ensuring transparency in financial matters, fostering collaborations with companies, enhancing accessibility through scholarships, and implementing regular evaluations to maintain efficiency and relevance in education.

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