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# Impact Of Determinants Of Expenditure On Higher Education In Rajasthan: The ARDL Approach

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**Abstract**

The study analytically examines the impact of determinants of government expenditure on higher education in Rajasthan by considering the time series data for the period 1980-2023. Autoregressive Distributed Lag (ARDL) Approach given by Toda and Yamamoto (1995) has been applied. Sources of data collected for the considered variables are EPWRF Indian Time Series and Economic Review of Rajasthan. Total expenditure on education has been used as dependent variable while Net State Domestic Product, Pupil Teacher Ratio, Number of Teachers and Total enrolment have been used as independent variables. ARDL bound test confirms the pre sence of the long-run relationship between the variables. Pupil Teacher Ratio and Net State Domestic Product show the positive significant effect on expenditure on higher education in the long run. Total Expenditure on higher education with lag 1 has been found significant in effecting the current total expenditure on higher education similarly current Net State Domestic Product and itself with lag 1 have the statistically significant impact on the total expenditure on higher education in short- run.

**KEYWORDS:** Higher Education, Government Expenditure, Autoregressive Distributive Lag Model, Rajasthan.

JEL Classification: I22, I25, I28.

## 1. Introduction

Education is the main determinant of economic growth in each country and is widely accepted as one of the main conditions to attain better social welfare. Investment in education means investing in human resources, which is the most important factors of the production function, and is directly related to the level of development of the country and the standard living. Education increases productivity and labor efficiency, and creates a qualified labor force that's able to lead the economy to a way of sustainable economic development (Zaman, 2008). Government expenditure on education leads more to the accumulation of human capital than to physical and social capital, and this contributes to economic growth (Dickens et al., 2006; Loening, 2004). The education expenditures can enhance to achieve better educational results and leads to contribution to human capital development. An investment in human capital enables each person to make a productive contribution to society. It becomes a crucial influencer of the economy's ability to achieve a high level of growth with high wages, low unemployment and a strong social unity. Hence, the effect of spending on education on economic growth is the key issues in economic literature. There are several models, like Solow (1956), Lucas (1988) and Romer (1990),

that pointed out the human capital result from expenditure on education as a driving force for economic growth. The social benefits of education are a powerful set of arguments in favor of public investment to achieve a social optimum (Harsha, 2004). That is why government expenditure on education as an investment is an economic problem that is well discussed nowadays.

Education is financed through both governmental and private resources. However, a major commitment from government is required in financing education because of the positive externalities related with it. The beneficial impact of education is not restricted to the individual alone but spills over to other members in the society, e g, there is well documented evidence of the beneficial impact of mother's education on health of her children, increased training enhances productivity of not only a single worker, but has a positive impact on his/her co-workers, etc. Thus, education is broadly considered as public good. It is also found that while considering the private returns to education, an individual does not take account of the980-se externalities. Hence, provision of education may be suboptimal when left only to market forces and government intervention is necessary to provide an optimum level of education (taking into account the private as well as the social benefits).

However, when we come to each step of education, it is not clear whether to differentiate it as public good or merit good. Elementary education is broadly accepted as public good. On the other hand, in case of higher education, it is found that while it is beneficial to the society, the private returns from higher education are more than social returns. Thus, it is generally advised that the burden of financing higher education should be shifted to private individuals. The liberalisation process feeds this line of thinking. This also gets reflected in our changing educational policies with greater emphasis on generation of additional resources through conventional and non-conventional measures. The national policy on education (NPE) (1986, 1992) as well as the recommendations made by the University Grant Commission (UGC) recognises the need for decreasing the role of government in education sector and increasing the role of private sector, particularly in higher education.

In case of higher education, the NPE clearly points out that the non-government sector can play an important role in funding higher education. Note, it is clearly stated in the document that "resources, to the extent possible, will be raised by mobilizing donations, asking the beneficiary communities to maintain school buildings and supplies of some consumables, raising fees at the higher levels of education and effecting some savings by the efficient use of facilities" (National Policy on Education 1986, p 35).

Similar measures, in terms of creating resources for higher education through non-government sources, have also been echoed by the UGC. The UGC was formally established in November 1956 as a statutory body of the government of India through an act for the coordination, determination and maintenance of university education standards in India. The UGC is the only grant giving agency in the nation, which has been vested with the dual responsibility of giving funds and that of coordination, determination and maintenance of institutions standards of higher education. The UGC, in these years has documented the need for bigger role of private sector in financing higher education [UGC 2003]. Private financing of higher education is advocated on the following terms: private returns on higher education far exceed the social returns; private sector benefits the most from higher education and public expenditure for higher education is not sufficient to take up the challenging task of exceeding and diversification of higher education system to meet the continuously growing demand. On one hand, it assures that providing better quality higher education is the key responsibility of the government and it will not withdraw from this responsibility. Also mentions that industrial houses may be encouraged to be partners with educational institutions directly for the human resource development dedicated to their interests. The portion which is remaining of this chapter elucidates how long these changing policies have triggered off changes in actual expenditure pattern of the government on education.

Salary of teachers, administrative staff, etc. are the expenditure on education which can be on recurring items or it can be on capital infrastructure such as school building, libraries, equipment, etc. Expenditure on recurring items comes under the revenue account, whereas that on non-recurring items constitutes the capital account.

## 2. Literature Review

Verbina and Chowdhury (2004) attempted to fill the gap in the literature and estimated the impact of determinants of education expenditures in the Russian Federation. The spatial and inflation-adjusted per capita expenditures on general education was measured as dependent variable. Panel data analysis had been taken and showed the result that revenue and the student-population ratio have a positive impact on education expenditures while the effect of population density was negative. Significant impact had been shown by the regional variables. The income and price elasticity of public education expenditures were estimated to be 0.57 and -0.18, respectively, a result comparable to studies from other countries. How fiscal institutions and the structure of the political process in Russia may affect the degree of resource allocation in the educational sector during the transition process are the results shown in the study.

Chakrabarti and Joglekar (2006) used a panel of 15 major states from India from year 1980-2000 and examined the patterns and changes in the allocation of government funds for education, particularly higher education, before and after the introduction of the new economic policies. Fixed Defect model and Fixed Defect GLS model was used in the study. Educational expenditure at the aggregate, elementary, secondary and higher levels significantly found enhanced by State real per capita income, with elasticity less than one. Moreover, contrary to general perceptions, education expenditure at all levels had been significantly lower after liberalization vis-à-vis the pre-economic reform era. Education expenditure in real per capita terms, Elementary education expenditure in real per capita terms, Secondary education expenditure in real per capita terms, Higher education expenditure in real per capita terms, Real per capita NSDP, proportion of population belonging to the following age groups are the different variables used in the study. This is particularly detrimental for the vulnerable sections of the population, i e, for females and backward social groups. Even after controlling for the economic reform process, privatization exerts a negative significant impact on expenditure on higher education found evident.

Sagarik (2014) investigated in Thailand the trends of education expenditure policy during the past few decades, as well as the recent allocation and education expenditure distribution and also focused on the development of the substance of education policy. Political connection with the education expenditure policy was also examined in the study. A landscape was provided by both the trends in education expenditure and the distribution across provinces in Thailand of the making of education expenditure policy. Even though the relative figure to gross domestic product (GDP) and to total public expenditure illustrated slightly more volatility, it was found evident that education expenditure in Thailand had increased significantly in the past few decades. The current distribution of education expenditure in Thailand was still somewhat uneven. In particular, a higher level of education expenditure should be allocated to the needy in the poor area.

Chatterji, Mohan and Dastidar (2015) used data on sixteen Indian states from 2001-2010, the paper tried to identify the determinants of per capita education expenditure of state governments in India. Dependent variable is per capita state expenditure on education. Models used are Random Effects model (REM) or Fixed Effects model (FEM). It was found that richer states spend more on education compared to the poorer states. A lower share of child population (0-14 years) was found to significantly enhance education expenditure at the state level. No evidence found in political factors such as political ideology of the ruling party and level of corruption affect education expenditure of state governments.

Yun and Yusoff (2017) analyzed the determinants of the public education expenditure in Malaysia from period 1982 to 2015. Study focused on addressing the existing research gaps within Malaysia context that failed to receive much attention in the past. Time series data within the Co- integration technique used in the model and the determinants of education expenditure would be modeled. Wagner's law used in determining Malaysia's public education expenditure, as implied by a positive relationship between economic growth and public education expenditure. Independent variables were real gross domestic product, unemployment rate, inflation rate, tax revenue, population and dependent variable of public education expenditure. However, the Keynesian Counter-Cylical Theory was contradicted by the finding of a positive relationship between the inflation rate and public education expenditure. Thus, concluding a less robust support to the Keynesian Counter-Cyclical Theory.

Real gross domestic product, inflation rate, unemployment rate, and younger population age less than 65 determined Malaysia's education expenditure and was proved.

Gadbade and Kokate (2021) the recent trend and composition of public expenditure on education incurred by both state and central governments was highlighted in the study and recent trends of total public expenditure on education, state-wise public expenditure on education in terms of total state expenditure and total GSDP was analyzed. It was founded that the percentage share of state government had been reduced and there was gradual increased in share of the central government, however on an average 77% of the education sector spending has come from the state government. The expenditure on education in terms as the percentage share of SGDP had reduced in most of the Indian states during the second phase (2000-01 to 2018-19) of the study period.

Haliru (2023) examined the determinants of government expenditure in Nigeria using a Time series data from (1986-2021). The method of analysis used are; descriptive and inferential statistics was employed; measure of location and measure dispersion was examined, the result shows that the data for analysis was stationary. Total Government Expenditure used as dependent variable whereas, Inflation, Population, Trade Openness and National Income used as independent variable. ARDL model, Cointegration was carried out. The result of ARDL showed that inflation and population had a long-run relationship with total government expenditure in Nigeria. The findings also, showed that national income and trade openness are statistically insignificant in influencing the total government expenditure in Nigeria. Post estimation test showed that the model has no evidence of serial correlation, heteroscedasticity and non-normality of residuals. The study suggested that inflation should be controlled all time to avoid incurring unwanted expenditure. Secondly, government should have the knowledge and needs of its population; through inclusive policies that will address both economic and social problems of its peoples.

## 3. Data, Variables and Methodology

This section introduces the data used in the analysis and provides a brief description of each variable and the sources of the data. The time-series data of Rajasthan for the period of 1981 to 2023. The data used in the study has all been sourced from the EPWRF. The dataset consists of the dependent variable which is total expenditure on education (LNTEXEU) and independent variables are Net state domestic product (LNNSDP), pupil teacher ratio (LNPTR), number of teachers (LNT), total enrollment (LNTENR).

Table 1: Variables – Definition, Specification and Data Source

| VARIABLE | DEFINATION | SPECIFICATION | EXPECTED & ALGEBRIC SIGN | DATA SOURCE |
|---|---|---|---|---|
| LNTEXEU | Total expenditure on education is the amount of total government's budget of a country allotted in different educational activities. | Dependent variable. | - | EPWRF |
| LNNSDP | Net State Domestic Product (NSDP) is the volume of all goods and | Independent variable. | Positive | EPWRF |

| | | | | |
|---|---|---|---|---|
| | services produced within the boundaries of the State during a given period of time after deducting the wear and tear or depreciation, accounted without duplication. | | | |
| LNPTR | Pupil Teacher Ratio is the number of students in a school in relation to the number of teachers available to teach them. | Independent variable. | Positive | EPWRF |
| LNT | It is a measure of the total number of teachers employed throughout the year. Here all teachers are counted equally, whether they are full or part time. | Independent variable. | Positive | EPWRF |
| LNTENR | Total enrolment in an education, regardless of age, termed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school year. | Independent variable. | Positive | EPWRF |

**Research Methodology**

Different aspects of research tools applied in the study have been described as below:

**Unit Root Test**

For testing the stationarity of the series unit root tests have been applied. Augmented Dicky Fuller (ADF) and PP tests have been applied as the unit root tests. LNTEXEU, LNNSDP, LNT, LNPTR and LNTENR are the variables for which unit root tests have been applied.

**Optimum lag length**

Time series models consider lagged values of the dependent and independent variables so selection of optimum lg length becomes the essential part of the times series models. Many different criteria are available for deciding the optimum lag length in the analysis. This study uses LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan- Quinn information criterion and decides the optimum lag length.

**ARDL Model**

As the choice of econometric modelling the ARDL model of Pesaran et al. (2001) has been employed. In comparison with other cointegration methods the ARDL cointegration approach has many advantages. Unlike other cointegration techniques, the ARDL does not impose a restrictive assumption that all the variables under study must be integrated of the same order.

In other words, the ARDL approach can be applied regardless of whether the underlying regressors are integrated of order I (1), order zero I (0) or are fractionally integrated. Secondly, the ARDL test is suitable even if the sample size is small while other cointegration techniques are sensitive to the size of the sample. Thirdly, the ARDL technique generally provides unbiased estimates of the long-run model and valid *t*-statistics even when some of the regressors are endogenous.

In formulating our ARDL empirical specifications, we firstly specify the model as below:

Model 1: TEXEU = f (NSDP, PTR, T, TENR)

Above models can be respecified in the log linear form as below:

Model 1: LnTEXEU = a+bLnNSDP+cLnPTR+dLnT+eLnTENR+e

On the basis of unit root test and optimum lag length, the ARDL model can now be specified as below:

$$\Delta LnTEXE;s;:S:S::SS:DD:U_t = \sum_{i=1}^{n} \phi_1 \Delta LnTEXEU_{t-i} + \sum_{i=1}^{n} \phi_2 \Delta LnNSDP_{t-i} + \sum_{i=1}^{n} \phi_2 \Delta LnPTR_{t-i} + \sum_{i=1}^{n} \phi_2 \Delta LnT_{t-i} + \sum_{i=1}^{n} \phi_2 \Delta LnTENR_{t-i} + \beta_1 LnTEXEU_{t-i} + \beta_2 LnNSDP_{t-i} + \beta_3 LnPTR_{t-i} + \beta_4 LnT_{t-i} + \beta_5 LnTENR_{t-i} + \varepsilon_t$$

The long run aspect of the ARDL model is expressed as given below:

$$LnTEXEU_t = \beta_0 + \beta_1 LnTEXEU_{t-i} + \beta_2 LnNSDP_{t-i+} \beta_3 LnPTR_{t-i} + \beta_4 LnT_{t-i} + \beta_5 LnTENR_{t-i} + \varepsilon_t$$

The short run aspect of the ARDL model is expressed as given below:

$$\Delta LnTEXEU_t = \phi_0 + \sum_{i=1}^{n} \phi_1 \Delta LnTEXEU_{t-i} + \sum_{i=1}^{n} \phi_2 \Delta LnNSDP_{t-i} + \sum_{i=1}^{n} \phi_3 \Delta LnPTR_{t-i} + \sum_{i=1}^{n} \phi_4 \Delta LnT_{t-i} + \phi_5 LnTENR + \gamma_1 ECT_{t-i} + u_t$$

Where $\varphi_i$'s are the short-run coefficients, $\beta i$'s are the long-run regression coefficients and ECT's are the error correction terms which measure the speed of adjustment back to steady-state equilibrium in the face of external shocks to the economy. The error correction terms are assumed to lie within an interval (0, −1) although the coefficient can be allowed to be lie between −1 and −2 as an exceptional case. Incidentally, significant negative error correction terms indicate long-run causality from the regressor to the regress and variable. However, it is

imperative that one tests for cointegration effect to his end, prior to estimating our ARDL models the study uses the bounds test for cointegration effects which tests the joint null hypothesis as:

H0: $\beta1=\beta2=\ldots=\beta i =0$

And this is tested against the alternative hypothesis of significant ARDL cointegration effects i.e.

H0: $\beta1\neq\beta2\neq\ldots\neq\beta i\neq0$

With an F-statistic the test is tested which is compared to the non-standard critical bound's values reported in Pesaran et al. (2001). The null hypothesis of no cointegration is rejected if the computed f statistic exceeds the critical upper bounds value. And the null hypothesis of no cointegration is not rejected if the computed φ-statistic falls below the critical lower bounds value. And the test is considered as being inconclusive if the computed F-statistic falls between the critical lower and upper bounds values.
To capture the objective of the study ARDL Co-integration Approach used. The study employed ARDL Co-integration analysis to explore the contribution of higher education development on economic growth. To estimate the short-run and the long-run analysis of this study ARDL method is used.

**Diagnostic Tests**

After estimated empirical ARDL model, on the estimated regressions the final stage of the empirical analysis is to perform diagnostic test. In particular, the Jarque-Bera test for residual normality, the Breusch-Godfrey LM test for serial correlation, the Breusch-Pagan-Godfrey test for heteroscedasticity as well as Ramsey's RESET test for specification error are conducted. To study the stability of the models the CUSUM and CUSUM of squares tests have been applied.

**Analysis of Results**

**DESCRIPTIVE STATISTICS**

Table 2 displays information about descriptive statistics regarding the variables of the study.

Table 2: Descriptive Statistics

| Variable | LNTEXEU | LNNSDP | LNPTR | LNT | LNTENR |
|---|---|---|---|---|---|
| **Mean** | 11.38825 | 16.80844 | 3.284313 | 0.551588 | 2.757484 |
| **Median** | 10.50794 | 16.70651 | 3.218876 | 0.546366 | 2.752252 |
| **Maximum** | 15.37298 | 18.04411 | 3.761200 | 0.719202 | 2.871502 |
| **Minimum** | 6.924308 | 15.53748 | 2.890372 | 0.420327 | 2.614747 |
| **Std. Dev.** | 2.713846 | 0.764513 | 0.246729 | 0.096952 | 0.068952 |
| **Skewness** | 0.061337 | 0.011660 | 0.313145 | 0.170926 | 0.105483 |
| **Kurtosis** | 1.488778 | 1.779535 | 1.782337 | 1.652498 | 1.883677 |
| **Jarque-Bera** | 4.118758 | 2.669723 | 3.359272 | 3.462621 | 2.312476 |
| **Probability** | 0.127533 | 0.263195 | 0.186442 | 0.177052 | 0.314668 |
| **Sum** | 489.6948 | 722.7631 | 141.2254 | 23.71827 | 118.5718 |
| **Sum Sq. Dev.** | 309.3284 | 24.54815 | 2.556766 | 0.394790 | 0.199684 |
| **Observations** | 43 | 43 | 43 | 43 | 43 |

**Source:** Author's Computation

It can be stated that all the variables are normally distributed and all of them are positively skewed. The average means has a positive mean value and all the variables have positive coefficient of kurtosis. This indicate that over the year, there has been increase toward some of the variables. Jarque-Bera value (4.118758) result showed that the data is stationary. Means its sufficient for research.

## CORRELATION MATRIX

Correlation coefficients existing between different pairs of the variables are displayed in Table 3 in a matrix form which states the degree of association among variables.

Table 3: Correlation Matrix

| | LNTEXEU | LNPTR | LNNSDP | LNTENR | LNT |
|---|---|---|---|---|---|
| **LNTEXEU** | 1 | 0.24842091... | 0.97599689... | 0.90303772... | -0.8715460... |
| **LNPTR** | 0.24842091... | 1 | 0.31216734... | 0.41943109... | -0.0972972... |
| **LNNSDP** | 0.97599689... | 0.31216734... | 1 | 0.90795786... | -0.9054469... |
| **LNTENR** | 0.90303772... | 0.41943109... | 0.90795786... | 1 | -0.7229934... |
| **LNT** | -0.8715460... | -0.0972972... | -0.9054469... | -0.7229934... | 1 |

**Source:** Author's Computation

Presence of a strong positive correlation coefficient can be easily noticed among the variables with the coefficients of correlation ranging approximately to -0.8 to 0.9 specifying high degree of positive association existing among all the variables. It makes the study interesting to carry out the time series analysis further to check and understand in depth the long run dynamics of the relationship of the variables.

Table 4: Unit Root Test

| Variable | ADF | | PP | |
|---|---|---|---|---|
| | **Level** | **First differences** | **Level** | **First differences** |

| | Intercept | Trend & Intercept | Intercept | Trend & Intercept | Intercept | Trend & Intercept | Intercept | Trend & Intercept |
|---|---|---|---|---|---|---|---|---|
| **LNTEXEU** | -0.871 (0.787) | -3.104 (0.118) | -6.332 (0.000) | -6.255 (0.000) | -0.773 (0.819) | -3.020 (0.139) | -12.879 (0.000) | -12.53 (0.000) |
| **LNNSDP** | -0.351 (0.908) | -3.880 (0.116) | -12.517 (0.000) | -12.360 (0.00) | -0.438 (0.892) | -4.955 (0.001) | -15.733 (0.000) | -15.535 (0.000) |
| **LNPTR** | -3.687 (0.007) | -3.880 (0.021) | -6.514 (0.000) | -6.491 (0.00) | -3.571 (0.010) | -3.852 (0.023) | -15.466 (0.000) | -14.992 (0.000) |
| **LNT** | -1.894 (0.331) | -3.940 (0.018) | -7.404 (0.000) | -7.331 (0.000) | -1.650 (0.448) | -3.436 (0.060) | -14.174 (0.000) | -15.489 (0.000) |
| **LNTENR** | -0.942 (0.764) | -3.415 (0.062) | -8.030 (0.000) | -7.975 (0.000) | -0.298 (0.916) | -3.314 (0.077) | -14.623 (0.000) | -19.277 (0.000) |
| | | | | | | | | |

**Source:** Author's Computation

The results of ADF and PP test as mentioned in table 4. State that all the variables are found to be non-stationary at level except LNPTR which is stationary at level. All the rest variables are found to be stationary at first difference i.e. no problem of unit root exist at first difference for these variables. As the order of integration of all the variables is a mix of I (0) and I (1), hence it is feasible to make use of ARDL approach for the time series analysis.

Optimum Lag Length

The decision regarding the appropriate number of lags to be consider must be taken before ARDL model estimation. The outcomes of the different criteria are displayed in Table5.Table 5: Optimum Lag Length Selection

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| **0** | 95.64894 | NA | 7.40e-09 | -4.532447 | -4.321337 | -4.456116 |
| **1** | 241.5325 | 248.0020 | 1.78e-11 | -10.57662 | -9.309965* | -10.11864* |
| **2** | 269.5538 | 40.63097* | 1.62e-11* | -10.72769* | -8.405483 | -9.888055 |
| **3** | 294.1092 | 29.46639 | 1.95e-11 | -10.70546 | -7.327699 | -9.484167 |

Note: * indicates lag order selected by the respective criterions

Since three of the six given criteria results namely LR test statistic, Final Prediction Error (FPE), and (AIC) Akaike Information criterion , consider 2 as the suitable lag length, hence for the current analysis, optimal lag length of 2 is finalised.

Table 6: Estimates of ARDL Model

| Variables | Model :(2,2,0,0,0) |
|---|---|

| | Coefficient | t statistic | Prob. |
|---|---|---|---|
| **Intercept** | -39.67 | -4.43 | 0.00 |
| **LNTEXEU(-1)** | 0.67 | 4.93 | 0.00 |
| **LNTEXEU(-2)** | -0.36 | -2.50 | 0.01 |
| **LNNSDP** | 3.38 | 3.62 | 0.00 |
| **LNNSDP(-1)** | 1.98 | 2.41 | 0.02 |
| **LNNSDP(-2)** | -2.69 | -3.03 | 0.00 |
| **LNPTR** | -1.04 | -3.03 | 0.00 |
| **LNTENR** | 1.63 | 0.54 | 0.59 |
| **LNT** | 2.65 | 1.29 | 0.20 |
| | | | |

**R -squared= 0.979**
**Adjusted R-squared = 0.974**
**F-statistic = 194.313**
**Prob(F-statistic) = 0.000**
**Akaike info criterion = 1.265**
**Schwarz criterion = 1.641**

**Source:** Author's Computation

Table 7: Bounds Test for Cointegration

| Model | Value of bound test (F) | Significance level | I (0) | I (1) |
|---|---|---|---|---|
| Model | F= 4.50<br>K= 4 | 10%<br>5%<br>2.5%<br>1% | 2.2<br>2.56<br>2.88<br>3.29 | 3.09<br>3.49<br>3.87<br>4.37 |
| | | | | |

ARDL Bounds test is performed next to check if any sort of long run association exists between total expenditure on education and the undertaken independent variables. Table 7. Presents the outcome of the test conducted. Presence of the long run relationship among the concerned variables is assured as the value of F statistic (4.50) surpasses the upper bound values at 1%, 2.5%, 5% and 10% level of significance leading to rejection of null hypothesis of no long run relationship. It confirms that the concerned independent variables are cointegrated with Total expenditure on education in the long run.

Table 8: Long-run ARDL estimates

| Long run variables Model | Coefficient | t value | p value |
|---|---|---|---|
| LNPTR | -1.51 | -3.13 | 0.003 |
| LNNSDP | 3.85 | 6.002 | 0.00 |
| LNT | 3.84 | 1.20 | 0.23 |
| LNTENR | 2.36 | 0.56 | 0.57 |

**Source:** Author's Computation

Having confirmed of the presence of a long run relationship existing between total expenditure on education and the independent variables, estimation of long and short run coefficients of the variables is carried out which provide details about the direction as well as the degree of association present between total expenditure on education and each of the independent variables. The results of long run coefficient estimation are shown under Table 8.

Three independent variables are found to have positive relationship. Pupil teacher ratio and Net state domestic product possess statistically significant association at 5% level of significance showing the impact of determinants of expenditure on higher education in Rajasthan and how essential is the Pupil Teacher Ratio and Net State Domestic Product with the continuous pace of development of the state. Total number of teachers and Total Enrollment is statistically insignificant.

Table 9: Short run ARDL Estimates

| **Short run variables** | **Coefficient** | **t value** | **p value** |
|---|---|---|---|
| D(LNTEXEU(-1)) | 0.36 | 2.86 | 0.007 |
| D(LNNSDP) | 3.38 | 5.13 | 0.00 |
| D(LNNSDP(-1)) | 2.69 | 4.73 | 0.00 |
| Cointeq -1 | -0.691 | -5.58 | 0.00 |
| | | | |
| **R- squared** | 0.544 | | |
| **Adjusted R- squared** | 0.507 | | |
| **F-statistic** | 4.500 | | |
| **Prob (F-statistic)** | 0.000 | | |
| **Akaike info criterion** | 1.021 | | |
| **Schwarz criterion** | 1.189 | | |

**Source:** Author's Computation

In Table 9. the negative and significant value of the Error Correction Term ensures the restoration of the long run equilibrium with the speed of adjustment being around 69.1%. In the short run total expenditure on education and net state domestic product seem to be quite effective which is reflected by the positive and statistically significant coefficient of the variable. The coefficient of R-squared shows there is 54% variation in total government expenditure are caused by the independent variable. While the coefficient of F-stat. shows the fitness of the model, the result showed that the model is fit means the regressors are efficient to influence the dependent variable or the model is fit.

Table 10: Diagnostic Tests

| **Test** | **T value** | **P value** | **Results** |
|---|---|---|---|
| **Jarque Bera test (normality test)** | 2.091222 | 0.351 | Residuals are normally distributed |
| **Breusch-Godfrey LM test** | 0.061921 | 0.940 | No serial correlation exists |
| **Breusch Pagan Godfrey (Heteroskedasticity)** | 0.913260 | 0.518 | No presence of heteroskedasticity |
| **Ramsey RESET test** | 0.956084 | 0.346 | No specification error |

**CUSUM test and CUSUM of Squares test**

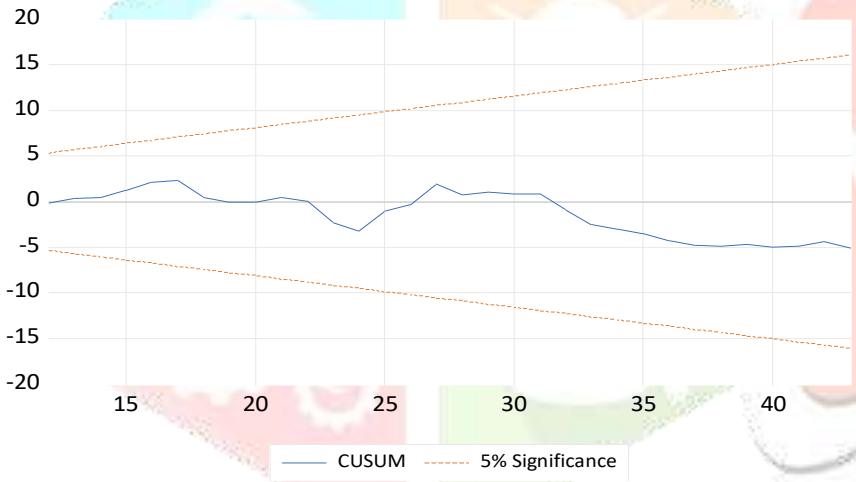
**Source:** Author's Computation

Table 10: displays the diagnostic tests of the ARDL model. JB Normality test of distribution of residuals states that residuals are normally distributed at 5% level of significance. The p- value is greater than 0.05 which means there is no autocorrelation in the residuals, as null hypothesis of presence of serial correlation in the residuals is rejected. Also, the residuals are homoscedastic that is there is no presence of heteroskedasticity. It is confirmed

that there is no specification bias in the model or that the model is free of specification errors as the p-value for Ramsey RESET test is also found to be greater than 0.05.

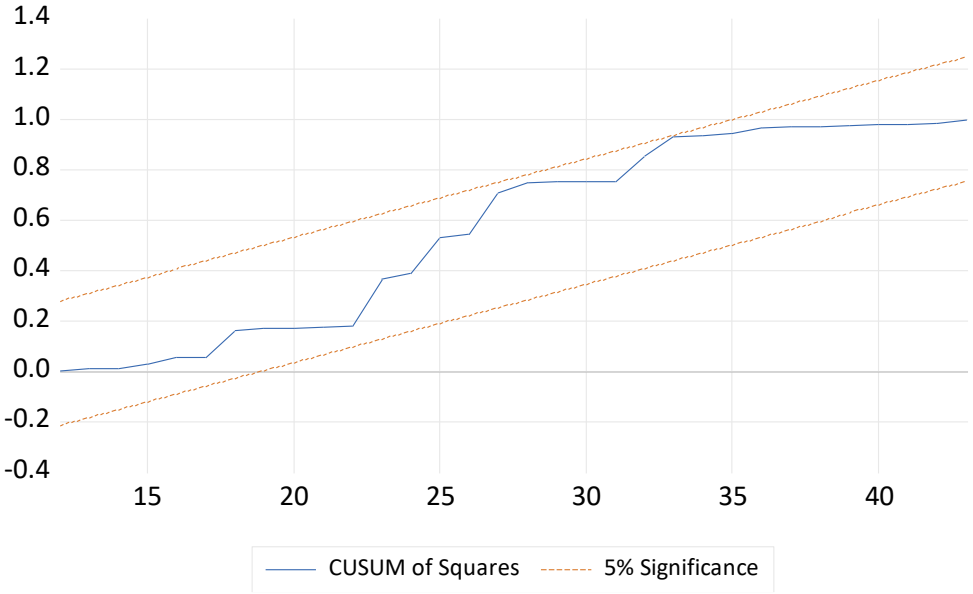
So, the results indicate that there is no problem relating to Jarque Bera, Breusch-Godfrey LM test, Breusch Pagan Godfrey, Ramsey RESET tests. Furthermore, it is indicated that no evidence of misspecification and instability during the period estimated by the models in Figures A and B of Cumulative Sum of Recursive Residual (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) tests. RAMSEY RESET test used to check any misspecification in the model. This model is correctly specified as both values of T-statistic and F-statistic need to be insignificant. As is evident from the above results in Table 9 that both these values are insignificant at a 5% level of significance. Moving onto the second diagnostic measure that is the recursive measure, the graph of CUSUM and CUSUMSQ are reported below: It is considered useful to check for model specifications to get significant results. For this many econometricians like Pesaran (1997), Brown (1975) has recommended the use of CUSUM and CUSUMSQ. In Figures 1and 2 CUSUM and CUSUMSQ both report stability at a 5% significance level. Overall, these diagnostics reinforce the validity of our short-run and long-run estimates. Our results about the functional form about its specification at a 5% level of significance is supported by the CUSUM graph given below. Based on the literature these figures also demonstrate the consistency of long-run and short-run estimations. Graphs are plotted via the sample size, two straight lines (red) show the critical value. Coefficients in the ARDL models are stable as long the CUSUM lies within them .

**Figure A:** CUSUM and CUMSUMSQ plots




**Source:** designed Using Eviews Version 13

**Figure B:** CUSUM and CUMSUMSQ plots for Model




**Source**: designed Using Eviews Version 13

## Conclusion

The time series analysis carried out focusses on examining the impact of the determinants of expenditure on higher education in Rajasthan considering time series data for the period 1980-2022. ARDL model approach has been utilized for the purpose of analysis. Total expenditure on education has been selected as being the dependent variable while the four independent variables being- Net state domestic product, pupil teacher ratio, number of teachers and total enrollment. The long run relationship is found to exist between variables and higher education as per the ARDL bound test.

Pupil Teacher Ratio and Net State Domestic Product possess statistically significant and Number of Teacher and Total Expenditure on higher education possess statistically insignificant showing the impact of determinants of expenditure on higher education in Rajasthan and how essential is the Pupil Teacher Ratio and Net State Domestic Product with the continuous pace of development of the state. In the short run Total expenditure on education and Net State Domestic Product seem to be quite effective which is reflected by the positive and statistically significant coefficient of the variable. The coefficient of R-squared shows there is 54% variation in total government expenditure are caused by the independent variable. While the coefficient of F-stat. shows the fitness of the model, the result showed that the model is fit means the regressors are efficient to influence the dependent variable or the model is fit.

Residuals are normally distributed at 5% level of significance as stated by the JB Normality test of distribution of residuals. There is no autocorrelation in the residuals which is meant by the Null hypothesis of presence of serial correlation in the residuals is rejected as the p- value is greater than 0.05. Also, the residuals are homoscedastic that is there is no presence of heteroskedasticity. It is confirmed that there is no specification bias in the model or that the model is free of specification errors as the p-value for Ramsey RESET test is also found to be greater than 0.05.

So, the results indicate that there is no problem relating to Jarque Bera, Breusch-Godfrey LM test, Breusch Pagan Godfrey, Ramsey RESET tests. Furthermore, no evidence of misspecification and instability during the period estimated by the models which indicated by Figures A and B of Cumulative Sum of Recursive Residual (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMQ) tests.

Therefore, the government is advised to invest more in higher educational institutes where practical and analytical knowledge of the students is improvised. The study is suggesting more research should be carried out with latest techniques of analysis based on the literature together with the expansion of sample size. So, that policy makers can be able to have an insight about what triggers government expenditure, so they can be able to make adjustment to translate into the current situation of the economy to a more dynamic standard.

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