Investment in education and economic growth : ARDL Model

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Abstract:

The study aimed to measure the impact of investment in education on economic growth in Algeria through some indicators of the education sector during the period from 1970 to 2016 in the long term, where many studies confirm a strong positive relationship between education and economic growth and that economic growth occurs from During the development of human resources, especially through the provision of some basic needs and effectively such as investment in the education sector through achieving high rates of economic growth, and therefore the study focuses on the estimation using time series of statistical data for Algeria over the period 1970 - 2016 The number of students in primary and secondary education as well as the number of students in universities with the economic growth rates expressed in the GDP, using the ARDL model.

Keywords: investment in education, education spending, economic growth, support, ARDL model

Jel Classification Codes : I20,I21,I23,I25,I22.

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1. INTRODUCTION

-(Mehta,1995,p54) considers human capital as "the combination of knowledge, skills and abilities of people living in a country (Adams, 2002, p. 36)." Human capital is also meant as expenditures on the process of preparing people for the performance of jobs through areas that contribute to the physical and mental construction of the child and from childhood to the age of work, including spending on health, nutrition, training and education and assesses human capital in terms of additional income generated by this investment Its economic viability is then judged by comparing the rate of return on human investment with the average cost of human capital building (Nannan, Bo, Jong, & Storm, 2015, pp. 164-173). UNDP also defined it as all that increases the productivity of workers and employees through the cognitive and technical skills they gain through science and experience (Sostaine & Tagne, 2009).

Human capital is also an important factor in economic development, but the process of preparing this capital requires an efficient and effective educational and training system in order to prepare the latter to enter the labor market and contribute to the creation of wealth, and in this sense, the effectiveness of the education system It is not related to the size of its outputs or the structures and facilities equipped for it, as it is measured by the extent of its ability to provide the labor market with trained, qualified and specialized labor according to the requirements of this market. Here, the role of theoretical analysis in the early and contemporary economists emphasizes the close relationship between human capital and the labor market, where it shows the importance of education for the national economy, because of the role of education in increasing growth rates and economic development, as well as the

pressure on education spending On the state budget, research in Western countries has highlighted the contribution of education to economic growth rates and the calculation of economic returns both on the individual and at the community level (Cristiane, 2013).

One of the most important of these researches is the work of the economists shultz and dension individually to prove that education contributes directly to increasing national income, by raising the efficiency and productivity of the human element, as shultz emphasized spending on education is a kind of good investment. He believes that investment in education is of equal importance to other material investments. Spending on education is an indirect measure of human capital stock that contributes to increasing the volume of educational stock represented by the number of students enrolled in the stages of education and improve their quality, which enhances the efficiency of the workforce. Which Attached to the economic benefit of investment in education, as the World Bank showed great interest in the issue of education, and the impact in raising the level of the human element in developing countries (Sancho, 1994).

Considering the basic building blocks on which the development of any country is based, Algeria has since its independence sought to reform education and develop the educational system in order to raise the friendly and successful response to the various negative aspects facing this field. In the early years Algeria was running its educational institutions in the manner left by France From 1969, however, a new reform of education was introduced.

As a result of this reform increased the number of students, the number of teachers in primary education in 2012 by 3451588 pupils compared to 1851416 in 1970, also increased the number of teachers in intermediate education from 190900 in 1970 to 29.8 million students, while secondary education has also witnessed a remarkable development The number of teachers increased from 34,988 in 1970 to 1,199,000 in 2010, while the number of students in higher education rose significantly to reach 1138,600 in 2012 compared to 34,988 in 1970. "Spending on education has increased and the number of educational institutions has increased. (Jach & Izabelle, 2014)

The problem of whether this increase in the number of pupils and students and the increase in spending on education has an impact on the economic growth in Algeria. To further understand the aspects of this issue, we have raised the problem about the nature of the relationship between investment in education and economic growth in Algeria.

Thus, this research aims to show the theoretical relationship between investment in education and economic growth and study the impact of human capital on economic growth through the evolution of the budget of spending on education and support directed to the higher education sector, the development of enrolment in universities, the number of students in primary and Secondary education in Algeria during the period 1970 to 2016.

2. Empirical studies and country models of the relationship between investment in education and economic growth

In a study about the rapid expansion of Hong Kong's higher education sector into both self-funded government for (A Tik, Wai-Yin Wong,2016) Higher education in Hong Kong generated high competition by examining how institutions are quality and quality and

increasing their competitiveness. This study examines the relationship between educational and institutional, so that the quality of teaching and student satisfaction. Quantitative research was conducted to test these hypotheses through the use of a questionnaire. The policy of higher education for students enrolled in post-secondary programs offered by the government with high funding is based on the selection of the quality of educational institutions in Hong Kong. The analysis results show that the quality of teaching adopted in higher education has a positive and significant impact on students by rapidly expanding the role of the state in this field and improving the quality of institutions. Institutional, which has a positive and significant effect on student satisfaction, while not considered the effect of mediation in the trade marks of the institution only partial mediation between teaching quality and student satisfaction. The study also contributes to the discussion of higher education and student progress in terms of corporate brand visions, student satisfaction and quality of teaching in Hong Kong.

The study of (Nannan, Bo, Jong, & Storm, 2015, p. 28)This study aimed at the impact of inequality in educational attainment on economic growth during the period 1990-2010 in China. By identifying the strong nonlinear relationship between educational inequality and economic growth in Chinese provinces and finding In particular, the results of the study showed that inequality is more important to economic performance than educational attainment in the economically less developed western region. To limited Social resources for investment and education, education policies that create a more equitable distribution of educational resources and promote higher growth, especially in less developed regions.

Study of (Goirand, 2014, pp. 69-86) where new features emerged in the social and educational field, including the process of coordinating educational policies in Toulouse, so that this study aims to reveal the details of this new activity and analyze the process of integrating individuals into the local social and educational system. Human resources become part of this process by building a professional activity in traditional social work.

The aim here is to analyze the integration process between the new social actors in the local system such as the administration, especially the process of structuring its work and its interaction with other sectors of social and educational intervention. To this end, this study is based on the study of the implementation of the success of the educational system in the city of Toulouse during the period 2006-2009.

One of the findings of this study is that despite the critical situation that has always been a barrier to educational and professional policy in the city of Toulouse and the budding of those means and resources from social and educational institutions, the capacity remains limited especially that the method of social intervention The “traditional” social work system still lacks mobilization. Social situations must therefore be addressed. It is possible to preserve the sustainability of the system that depends on the stability and success of educational policy, formalize local inter-agency partnerships, and define the role and duties. Competence of each. Away from the areas of intervention that strengthen this device in the social and educational field.

(S Al Majali ,2011,p60) on Gender Indicators in the Education Sector, This study aimed to build gender indicators in the fields of education in Jordan, identify the reality of gender mainstreaming in the Ministry of Education in all its authorities, and identify gender gaps In various fields of education.

A study showed that there is a gender gap in the net enrollment ratios in the secondary stage in the gender gap in favor of female students that the problem of enrollment persists at that stage in both sexes. This difference between the sexes decreased during that period.

A study of Professor (Y. Abdul Rahman, 2010) in Yemen under the title of the impact of the outputs of the technical education and vocational training in industry applied study on the industrial sector in the governorates of Aden and Taiz Republic of Yemen. Both professional and private. In addition, researchers and interested students benefit from this type of study. The study also relied on a questionnaire addressed to the managers of the researched factories.

Also study (S. Rizk ,2009,p97) on the indicators of quality in Palestinian university education, where these studies address the subject of interest of many educators and those responsible for education institutions in general, and institutions of higher education in particular, where this study aimed to determine the concept of quality educational institution, and then determine the criteria The study concluded that it is necessary to develop a set of tools to detect the quality of educational institutions.

The study of (Sostaine & Tagne, 2009)in Cameroon on the growth of public expenditure and its impact on the development of the state of the education sector, which examined the factors behind the evolution of public spending in Cameroon and its effects on the well-being of individuals. More specifically, the purpose of the work is to analyze the main determinants of growth In public spending in Cameroon on the one hand, assess the impact of these expenditures in promoting the development of Cameroon through the education sector more on the other.

For (Mathodi, 2007)the study in the Republic of the Congo on the analysis of access to education, which examined that the vicissitudes of life sometimes authorize a range of options in terms of unmet needs in daily life, giving parents a commitment to priority. That is, meeting the most necessary needs at the expense of the educational needs of children, and this situation is often applied to the owners of the low standard of living of the majority of the population, which leads to achieve the desired development by all as a preliminary stage for the integrated growth of all members of society. At the end of the study, it was concluded that one of the biggest challenges facing the world is to achieve the highest educational level of the population because no country can achieve social development and economic growth without adequate population composition in terms of quality first and quantity secondly. Normal and even poorer countries.

OCDE (2001) study on the role of educational policy with reference to the study of welfare in some countries of the organization, and here the study included the original countries of the OECD, which are Germany, Austria, Belgium, Canada, Denmark, Spain, the United States, France, Greece, Ireland, Iceland, Italy, Luxembourg, Norway, the

Netherlands, Portugal, the United Kingdom, Sweden, Switzerland and Turkey The study found the contribution of human capital through education to economic growth and well-being through the care and development of human resources.

The study (Temple, 2000), on the impact of economic growth on education in the countries of the Organization for Economic Co-operation and Development (OCDE), which relied on the use of macroeconomic data to determine the relative impact of education in general and education economics in particular, where the study reached There is a positive impact and productivity benefits of education in the OECD countries, but these productivity benefits remain weak compared to the results of studies on the economics of education by other thinkers, also from the results of the study that public and private spending on educational institutions is about 6% Of text The gross domestic product (GDP) of the OIC Member States reduces the real opportunity cost of educational investments, or of spending and investing in the education sector, because it does not take into account the percentage of lost profits. In general, it should be clear that the provision of basic services such as education is a major commitment. By the member countries in the provision of human resources and the provision of social welfare because the latter contribute significantly to raise the rates of national income and per capita.

The study of (Barro ,1994,p23) confirms the previous results, which aimed to measure the impact of the increase in the number of students enrolled in the primary and secondary level, which directly reflects the amount of investment in education in increasing per capita real GDP in 98 countries 1985-1960 using cross-sectional data analysis to calculate the simple linear regression equation. It was found that the increase in the number of students by 10% leads to increase the per capita real GDP by 2%.

3. Model and study data

The study of the impact of state support to the social sectors in Algeria with reference to the education sector will be done through the interpretation of economic growth in Algeria, and the interpretation of spending on education and subsidies or subsidies allocated to the education sector in addition to the evolution of the number of students enrolled in universities, and these variables have been determined depending on Economic theory and previous studies taking into account the Algerian reality.

Theoretical and empirical studies have shown that the impact of state spending on the social sector is often different from economic growth. That is, the positive impact on social spending does not necessarily have to be the same on economic growth, and therefore the assessment results regarding the impact of social spending on social sectors on economic growth cannot be overlooked. This difference in impact from the point of view of many previous studies, led us to estimate the model is to know the impact of investment in education on the economic growth in Algeria in the long term.

The economic growth variable is the dependent variable in the applied study, while the other variables are independent. In theory and previous studies, causality may work in both directions. As for the estimation method, we have relied on ARDL to study the long term relationship. The ARDL method allows us to study the long-term relationship taking into

account the effect of slowing values of independent and dependent variables on the current values of the dependent variable. The application of co-integration technology to analyze long-term growth is to test whether the dependent variable and independent variables follow a common long-term trend.

3.1. Study variables

The data related to the variables of the study are the economic growth rates expressed in the GDP ratios, in addition to spending on education, supporting the education sector and the development of enrollment in universities in addition to the development of the number of pupils at the primary and secondary levels. These variables are taken in logarithm to make them homogeneous with other variables, which are rates and ratios. The quantitative data of the study are annual time series for Algeria, extended over the period (1970-2016).
The model variables and their sources are summarized in the following table:

Study data coding table

Source Series	The name of the string	String Code
World Bank Database	GDP	**TPIBG**
World Bank Database	GDP per capita	**TPIBH**
ONS	Expenditure on primary and secondary education	**Educpsf**
ONS	Support to the education sector	**subv**
ONS	Evolution of the number of students enrolled in the university	**etud**
ONS	The development of the number of pupils at the primary and secondary levels	**elev**

As for the crude product variable is a dependent variable, the rest of the other variables are independent variables, which are the expenditure on education, support allocated to education, the development of the number of students enrolled in the university and the number of students, as these variables are the variables used in the study are variables Independent model used in the interpretation of economic growth.

3.2. .Economic measurement of the impact of some education indicators on economic growth in Algeria

The impact of education indicators on long-term economic growth will be determined by estimating a standard model that explains economic growth by the following independent variables: expenditure on education, subsidies for education, the number of students enrolled in the university and the number of pupils.

$$PIB = f\ (\ \mathbf{subv},\ \mathbf{etud},\ ,\mathbf{Educpsf},\mathbf{elev}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

To estimate the aforementioned long-term relationship, we will use the Auto Regressive Distributive Lags (ARDL) model developed by (Pesaran, Shin, & Smith, 2001) . This model is considered as an alternative to known common integration tests, so this test developed by Pesaran et al (2001) is distinct from the rest of the tests because it does not require that all time series be of the same degree I (0) or I (1). The only requirement for the application of this test is that the degree of integrity of any of the variables is not I (2). Also,

ARDL can be applied if the sample size is small, unlike most conventional co-integration tests that require that the sample size be large in order for the results to be more efficient.
The ARDL model enables us to separate the short-term and long-term effects. Through this methodology, we can determine the integral relationship of dependent and independent variables in the long and short term in the same equation, as well as the magnitude of the effect of each independent variable on the dependent variable. Also in this methodology we can estimate the parameters of independent variables in the short and long term. Its estimated short- and long-term parameters are more consistent than those in other methods such as Angel-Grainger (1987), Johansen (1988) and the Johansen-Gesells Method (1990). To determine the length of distributed slows, AIK and SC are usually used, where the length of the low AIK and SC values is selected.
The ARDL model for equation (1) is written as follows:

$$\Delta PIB_t = a_0 + \sum_{j=1}^{P_1} \beta_j \, \Delta \mathrm{PIB}_{t-j} + \sum_{j=0}^{p_2} \vartheta_j \, \Delta \mathrm{subv}_{t-j} + \sum_{j=0}^{p_3} \delta_j \, \Delta \mathrm{EDUCPSF}_{t-j} + \sum_{j=0}^{p_4} \lambda_j \, \Delta \mathrm{etud}_{t-j} + \sum_{j=0}^{p_5} \lambda_j \, \Delta \mathrm{elev}_{t-j} + \pi_1 PIB_{t-1} + \pi_2 subv_{t-1} + \pi_3 EDUCPSF_{t-1} + \pi_4 etud_{t-1} + \pi_5 elev_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Model (1) shows that economic growth can be explained by its decelerating values and the decelerating values of independent variables.
The first step of the ARDL methodology is to test a co-integration relationship, so that co-integration according to Pesaran and al (2001) in ARDL models is based on testing the following hypothesis:

$$\begin{cases} H_0 : & \pi_1 = \pi_2 = \pi_3 = \pi_4 = \pi_5 = 0 . \\ H_1 : & \pi_1 \neq 0, \pi_2 \neq 0, \pi_3 \neq 0, \pi_4 \neq 0, \pi_5 \neq 0. \end{cases}$$

The test statistic is F-statistics (Wald test), and the resolution is as follows: If the value of F-stat is greater than the upper limit of critical values, we reject the null hypothesis that there is no common integral relationship. If F-stat is below the minimum critical values, we accept the null hypothesis that there is no co-integration relationship. If the calculated value of the F statistic falls between the upper limit and the minimum critical values proposed by Pesaran and al (2001), then we cannot decide.

The minimum value assumes that all variables are static in their original values (in their level), meaning that they are integrated from the zero order I (0). The value of the upper limit assumes that the variables are static in the first differences of their values, in the sense that they are integrated from the correct one order I (1).

The second step is to estimate the parameters of the model in the short and long term. This is after making sure that there is a common integration relationship between the variables of the study.

Before estimating the equation, the statistical characteristics of the variables should be studied, in particular the study of stability. The goal is to detect the relationship in the long

term and to avoid the false estimates that may result if the series used in the estimation are unstable.

The unit root of the model variables was tested by the Augmented Dickey Fuller Test. For the degree of delay, it was determined based on the lowest value of the Akayek and Schwarz parameters (max p = 4) The following table:

Table (02): The degree of integration of time series

Variables	**elev**	**Etud**	**Subv**	**educpsf**	**Tpibg**
Degree of integration	**I (1)**	**I (1)**	**I (1)**	**I (1)**	**I (0)**

Source: Prepared by the researchers depending on Eviews 10

If the critical value (according to 1996 Mackinnon) at a significant 5% is greater than the calculated value of the Dicky Fuller test (ADF) (in absolute terms), this means accepting the null hypothesis, ie the variable contains the unit root, and therefore the chain is unstable. If the calculated value of the Dicky Fuller test is greater than the critical value, the series is stable.

By making the first differences on the unstable time series, we get stable time series.

After confirming the condition of applying the ARDL methodology, which is the degree of integration of time series of study variables through unit root test, so that the degree of integration of all variables is integrated by class I (1), except the series of internal crude product rate pib which is stable in level I (0). We will experience a common integration relationship.

The ARDL form of the equation is written as follows:

$$\Delta PIB_t = a_0 + \sum_{j=1}^{P_1} \beta_j \, \Delta \mathrm{PIB}_{t-j} + \sum_{j=0}^{p_2} \vartheta_j \, \Delta \mathrm{subv}_{t-j} + \sum_{j=0}^{p_3} \delta_j \, \Delta \mathrm{EDUCPSF}_{t-j} + \sum_{j=0}^{p_4} \lambda_j \, \Delta \mathrm{etud}_{t-j} + \sum_{j=0}^{p_5} \lambda_j \, \Delta \mathrm{elev}_{t-j} + \pi_1 PIB_{t-1} + \pi_2 subv_{t-1} + \pi_3 EDUCPSF_{t-1} + \pi_4 etud_{t-1} + \pi_5 elev_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

3.3. Test the relationship of joint integration using the Boundary Approach

Table (03): Boundary Tests

F-statistic =12.321654		
Critical values		
Upper limit	Bottom border	significatif levels
4.52	3.23	10%
5.01	4.56	5%
8.49	5.87	2.5%
10.06	5.13	1%

Source: Prepared by the researchers depending on Eviews 10

The table shows that F-stat is greater than the upper limit of the critical value at different degrees of significance (1%, 5%, 10%) and therefore reject the null hypothesis and accept the alternative hypothesis of a long-term equilibrium relationship.

3.4. Estimation of the ARDL Model

After confirming a long-term relationship between GDP and its determinants, we will estimate the parameters of this relationship according to the ARDL methodology. Depending on the standard (Schwarz Bayesian Criterion) deceleration intervals were determined, the model was shown

(1, 0, 3, 2, 4) is the optimal model.

The results of the assessment in the short and long term are shown in the following table:

Estimation of the self-regression model for distributed time gaps (1, 0, 3, 2, 4)

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Subv)	0.000006	0.000002	2.978761	0.0062
D(etud)	0.000009	0.000003	2.890351	0.0077
D(etud(-1))	-0.000023	0.000004	-5.361272	0.0000
D(etud(-2))	0.000026	0.000006	4.299228	0.0002
D(educ f)	0.000004	0.000002	2.355528	0.0263
D(educ f(-1))	-0.000005	0.000002	-2.990216	0.0060
D(elev)	-0.000017	0.000006	-3.027946	0.0055
D(elev(-1))	0.000031	0.000007	4.425273	0.0002
D(elev(-2))	-0.000038	0.000010	-3.896508	0.0006
D(elev(-3))	-0.000013	0.000005	-2.739826	0.0110
CointEq(-1)	-0.211797	0.041667	-5.083020	0.0000
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
subv	0.230000	0.000010	2.733625	0.0211
etud	-0.500000	0.000021	-2.856615	0.0043
Educ f	-0.170000	0.000005	-2.671113	0.0109
elev	0.209000	0.000058	3.077305	0.0039
C	-6.905590	5.126904	-16.429180	0.0000

Source: Prepared by the researchers depending on Eviews 10

$$y=6.90+(0.27\,subv - 0.59\,etud - 0.13\,educ\,f + 0.17\,elev)$$

After estimating the ARDL model, we found the negative impact of the number of students on economic growth. A 1% increase in the number of students enrolled in the university in Algeria leads to a 0.50% decrease in GDP. GDP by 0.17%

The effect of other variables on GDP was positive, with a 1% increase in subsidies allocated to the education sector and the development of the number of students enrolled, leading to an increase in GDP in the long run by 0.23% and 0.20%, respectively, and all variables including Its statistically significant at 5%.

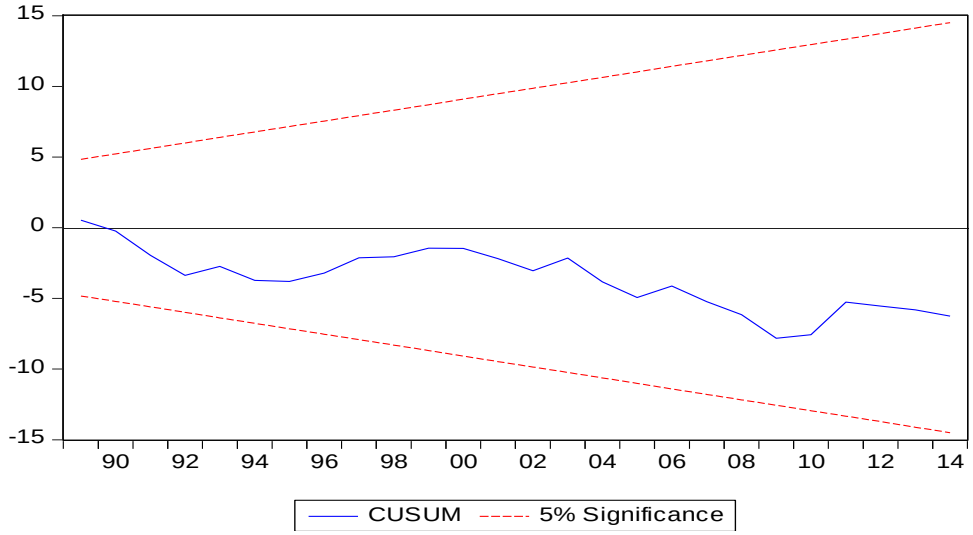
3.4. Test the stability of the model

The structural stability test for short- and long-term transactions will be conducted through two tests proposed by(Brown, Durbin, and Evans ,1975) the CUSUM cumulative test and the CUSUM of Squares cumulative test.

These two tests are one of the most important tests in this field because it shows two important things, namely, showing the existence of any structural change in the data, and the stability and consistency of long-term parameters with short-term parameters. Many studies have shown that such tests are always associated with the ARDL method.

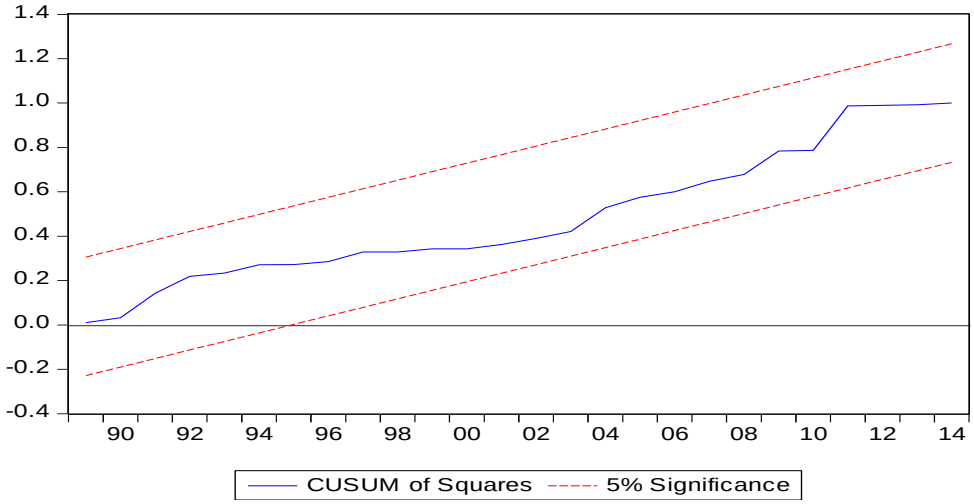
The structural stability of the estimated coefficients of the ARDL error correction formula is achieved if the CUSUM and CUSUM of Squares are within the critical limits at a significant level of 5%. Therefore, these parameters are unstable if the chart of the two tests is passed outside the critical limits at this level.

Figure (01): Test the cumulative sum of residual residues(CUSUM)



Source: Prepared by the researchers depending on Eviews 10

Figure (02): Test the cumulative sum of squares of residual residues(CUSUM of Squares)



Source: Prepared by the researchers depending on Eviews 10

Both models show that the model's estimated coefficients are structurally stable during the study period, because the CUSUM and CUSUM of Squares are within the critical limits of 5%.

4. RESULTS AND DISCUSSION

- There is a negative impact on the economic growth:So that education at this stage is a consumption and not an investment as the nature of training in this area has become

sensitive to the quantitative side only without taking into account or attention to the qualitative aspect.

In addition, this is due to the high unemployment rates among graduates of university degree holders also the absence of coordination between the local labor market and the Algerian universities, if there is a plan under which universities are provided with the educational cadres needed to the market so as to reduce the problem of unemployment, and the contribution of these Stage in economic growth.

- There is a positive impact of support directed to education on economic growth:This

is because support programs affect almost all strata of society, especially the target group that needs support to improve their educational level. In addition to the good guidance of the policy of social support to achieve the objectives of the social policy, which aims to a fair distribution of income among the categories of society within the framework of comprehensive education policy and compulsory and free education in Algeria in addition to the efforts made by the state, especially during the recent period by giving importance to the education sector and During the reforms undertaken by Algeria since the early nineties and took various measures to improve the quality of education and attention to the economies of education and knowledge economy.

5.Conclusion:

Through this paper, we have attempted to study the impact of investment in education on economic growth during the period 1970 to 2016.

After estimating the ARDL model, we found the negative impact of the number of students on economic growth.

The effect of other variables on GDP was positive, with a 1% increase in education spending and subsidies for education leading to an increase in GDP in the long run by 0.23% and 0.20%, respectively, and all variables, including constant It was statistically significant at 5%.

Despite the achievement of positive results on some indicators and quantitative indicators, Algeria still suffers from some deficits in the level of its educational policies and has not seriously eliminated some problems.

What we can say in the end that this study, which is presented, is a research open to the studies to come to open a wide scope for research in various aspects related to it and among the topics that we propose to develop and enrich this research are: Providing an approach to the quality of higher education policies Within the framework of good governance that establishes a society of freedom and transparency.

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