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The impact of Algerian University graduates on Algeria's gross domestic product

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Abstract---This study aims to measure the number of university graduates in order to provide a meaningful representation of the state of higher education in Algeria during the study period. Using a simple linear model, the study examines both the concept and the objectives of higher education, alongside an analysis of the current reality of higher education. It also examines whether there is a relationship between the number of university graduates and gross domestic product (GDP). The results indicate a positive correlation between the two variables, suggesting that higher education plays a fundamental role in driving progress and direction, given its responsibility for training the workforce necessary for development in various sectors.

Keywords---Higher education, Higher education challenges, Gross domestic product, Simple linear model, Algeria.

JEL classification: F43; I25; C01

Introduction

The higher education sector has undergone significant and important expansion in recent years. The number of universities has increased, as has the demand for enrolment in colleges and specialist higher education institutions. The aim is to achieve educational democracy, equality of educational opportunity and the right

of access to advanced and high quality education for all qualified individuals who desire it.

Individuals are determined to spend many years in school education, partly because the benefits are greater and the chances of getting a job increase with educational attainment. For many, moving up the educational ladder is a means of social mobility. Similarly, countries and regions are keen to raise the average years of education of their populations, believing that this will increase productivity, improve the quality of jobs in the economy and boost economic growth.

Recognising the important role that education plays in achieving economic and social development, its impact can be positive and effective in promoting development and increasing productivity, or negative, potentially dragging society into backwardness and wasting both human and material resources.

Research problem

This paper addresses the reality and challenges of higher education and its role in economic growth in Algeria, which is one of the prominent issues that require attention. From this perspective, the main research question is formulated as follows:

- To what extent can higher education outcomes contribute to economic growth in Algeria?
In order to answer this main question, the following sub-questions need to be addressed
- What is the relationship between higher education outcomes and economic growth in Algeria?
- Have higher education outcomes influenced the increase in economic growth in Algeria?

Research hypotheses:

1. There is a significant relationship between the higher education sector and economic growth in Algeria.
2. The performance of the higher education sector has influenced the level of economic growth in Algeria.

Significance of the study:

The importance of this study lies in describing and analysing the state of higher education in Algeria and its contribution to the Gross Domestic Product (GDP). This is achieved through the increasing role of creativity and innovation in the generation of knowledge and the provision of new value-added products by creating appropriate conditions to exploit the existing potentials of the higher education sector in Algeria.

Aims of the study:

The main objectives to be achieved through this research include:

- Identifying the capabilities of the higher education sector in Algeria and highlighting its requirements for economic growth.
- Presenting key statistical indicators of the higher education sector through figures and data to provide a meaningful representation of the reality of higher education in Algeria.
- To analyse the resulting economic results and identify the shortcomings and imbalances in the sector.

Theoretical framework of the study:

An examination of the objectives of higher education, growth and employment policies:

The education system provides both quantitative and qualitative preparation for the labour market. Therefore, economic institutions find a demand for labour in the labour market. The degree of correspondence between the outputs of the education system and the labour market needs of the economy is one of the standards for measuring the level of development of the education system.

A- Definition of higher education:

The Global Declaration on Higher Education, adopted by the World Conference on Higher Education in 1998, defines higher education as: (Mayor, 1998)

All forms of study, training or research at the post-secondary level provided by universities or other educational institutions accredited as higher education institutions by the competent authorities of the State.

An analysis of the evolution of higher education institutions over the last thirty years shows that the main tasks of higher education have been and will continue to be linked to four main objectives (Días, 1998):

- To generate new knowledge (research function);
- To train highly qualified personnel (teaching function);
- Providing services to society;
- The ethical function, which includes social criticism.

B-Higher education and economic growth:

Interest in studying the relationship between education and economic growth began after the Second World War, especially after it became clear that, according to economic models, all output could not be attributed solely to physical factors of production such as labour and capital. Education was identified as one of the factors contributing to this phenomenon (Rahma, 2018):

- Education contributes to growth and is included under the term 'residual factor'.
- The impact of education helps to achieve an increase in national output, using statistical processing methods such as calculating the correlation between increased spending on education or an increase in years of schooling, or the workforce receiving additional education or improving the educational level of the workforce, on the one hand, and the productivity of educated workers, on the other.
- Factorial methods were used to calculate the role of each factor of production and to assess the role of the technological level of machinery and the skills, learning and training of workers in increasing output and hence welfare.
- The contribution of education to economic growth is well established.

In developing regions, including Arab countries, the task of conducting scientific research in various fields is entrusted to universities for two reasons (Al-Jadba, 2010):

1. Universities have the intellectual and human resources that can be used for economic development.
2. Universities are the only institutions through which research activities can be conducted in a disciplined manner, and they can also provide consultancy services to entities and individuals in the agricultural, industrial and commercial sectors.

A university graduate is better able to understand and recognise the needs for economic development than others and thus contributes positively to the elimination of economic backwardness.

The spread of university education eliminates many customs and traditions that hinder the process of economic development (Nadia, 1998, p. 1).

C- Specific objectives of higher education:

These are the objectives which, when achieved, contribute to the realisation of the general objectives. The specific objectives of higher education can be summarised as follows (Ben Sid Ahmed & Wahabi, 2018):

- Accessibility to knowledge: Acquiring the required knowledge easily and conveniently by mastering the necessary skills for knowledge acquisition.
- Scientific Thinking: Adopting a scientific approach to thinking.
- Development and innovation: The ability to develop, innovate and generate new ideas.
- Interpersonal Relationships: Treating others with kindness and respect.
- Objective Knowledge Management: The ability to handle knowledge and solve problems with objectivity and responsibility.

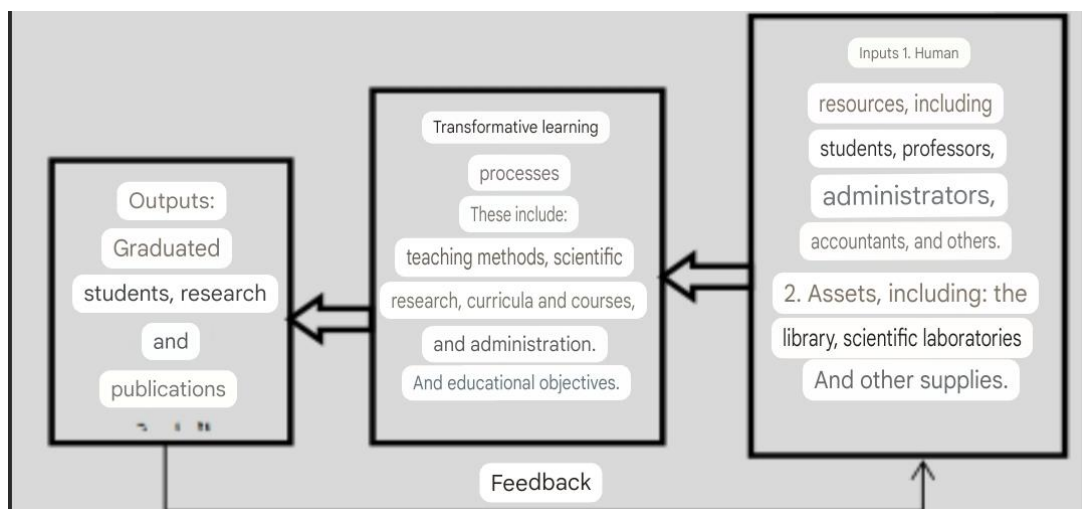


Figure 1: Illustration of the components of higher education.

Source: (Ben Sid Ahmed & Wahabi, 2018, p. 168).

D- Aims of the National Employment Policy:

The main objectives of the national employment policy include the following (Musette Cread, 2014, p. 12):

- To combat unemployment through an economic approach.
- To promote skilled labour in the short and medium term.
- Encourage initiative.
- Adapting training programmes and profiles to the needs of the labour market.
- Support productive investment to create employment opportunities.
- Setting up inter-sectoral coordination bodies.
- Modernising monitoring, control and evaluation.
- Improving and consolidating labour market mediation.
- Continue efforts to create two million jobs as part of the Presidency's "Horizon 2009" programme.
- Continue to increase youth employment and improve the employment rate after the preparatory period.

In order to achieve these objectives, the authorities have identified seven areas of intervention:

- Supporting the economic sector through job creation.
- Improving skills training (including on-the-job training to facilitate integration into the labour market).
- Promoting incentive policies for businesses to encourage job creation.
- Strengthen youth employment.
- Improve and modernise labour market administration.
- Monitoring and evaluation of labour market management mechanisms.
- Establishment of inter-sectoral coordination bodies.

2- The reality, challenges and ways of bridging the gap between educational outcomes and the labour market in Algeria:

Universities, as national educational institutions, face numerous external and internal challenges imposed by international realities and economic, social, political and scientific transformations, as well as the changing needs of the labour market.

A- The reality of higher education in Algeria:

Algeria's first university, the University of Algiers, was founded by the French in 1909 and remained the country's only university until 1962, with an enrolment of 500 students. After Algeria gained independence in 1962, significant changes were made to facilitate access to higher education for a greater number of Algerians. As of 2016, there were 112 higher education institutions, including 50 universities, 11 university centres, 20 national higher schools, 11 higher institutes, 12 preparatory schools and 4 integrated preparatory classes (two years of training in the national school).

Higher education is completely free for all programmes and is supported by the State, with institutions covering the entire Algerian territory. The number of enrolled students reached approximately 1.3 million in 2014 and is expected to increase to 2.5 million by 2025 (Samah, 2017).

Statistics show that the unemployment rate among graduates is increasing, which is attributed to the decline in employment policies and job offers for graduates, which is considered one of the main responsibilities of the state.

The reasons for the escalation of unemployment among graduates can be divided into two types (Al-Kahal, 2017):

- Related to the nature of higher education: This includes the rapid and unplanned expansion of higher education, coupled with a low degree of matching between university outputs and the needs of the labour market, both in terms of quality and quantity. The Algerian university produces about 120,000 graduates per year, most of them in the humanities.

- Related to the nature of local employment: This concerns the imbalance between the supply and demand mechanisms for skilled labour in the local market, as well as the mismatch between the skills available among graduates and the types of jobs offered by recruitment agencies in both the public and private sectors. In addition, there has been a decline in government employment policies for graduates, coinciding with the recent economic crisis in the country.

Although the government has implemented several mechanisms to address graduate unemployment, including the establishment of the Professional Integration Assistance Device (DAIP), which provides financial support to public and private companies to hire graduates, these solutions are seen by labour market observers as addressing symptoms rather than causes.

Achieving a balance between what Algerian universities offer and the needs of the labour market requires practical skills and good experience. This has led to the retraining of university graduates in line with job requirements, as degrees alone are not enough to secure employment. Even the Ministry of Higher Education is reluctant to acknowledge the true value of the certificates it issues.

Table 1: Illustrates the economic specialisations that employers intend to hire in the future (survey of employers)

Specialization	Count	Percentage
Accounting	340	71.6
Marketing	275	57.9
Finance	212	44.9
Administration	188	39.8
Commercial	162	34.1
Business Administration	133	28.0
Business Administration and International Economics	128	26.9
Automation Engineering	122	25.7
Economics	58	12.2
Agricultural and Environmental Economics	19	4.0

Source: (Nicolescu & Pun, 2009, p. 28)

Although graduates expressed their preferences in terms of economic fields and employers in terms of economic specialisations (in line with those offered by the HEI surveyed), there was some positive correspondence between the two. Economic specialisations such as finance, commerce and marketing are the main

fields sought by employers, which largely correspond to the preferences of graduates (finance and banking, commerce and professional services). However, the economic specialisation most sought after by employers, at 71.6%, is accounting, which can be associated with any type of organisation, regardless of economic sector (Nicolescu & Pun, 2009). This high demand for accountants may indicate a shortage of professionals in the field and represents a future opportunity for the development and expansion of higher education in accounting.

Labour market consequences of increased supply:

The consequences of labour market expansion due to higher education depend on the demand for graduates as well as the number of graduates. Starting from a point where supply and demand are in perfect equilibrium (in a competitive market), an increase in the supply of graduates - holding all other variables constant - should lead to a reduction in wage premia, as employers have a large pool of similarly qualified individuals from which to choose. To illustrate this, the following figure shows the labour market with two types of workers - graduates (G) and non-graduates (N) (Machin & McNally, 2007, p. 7).

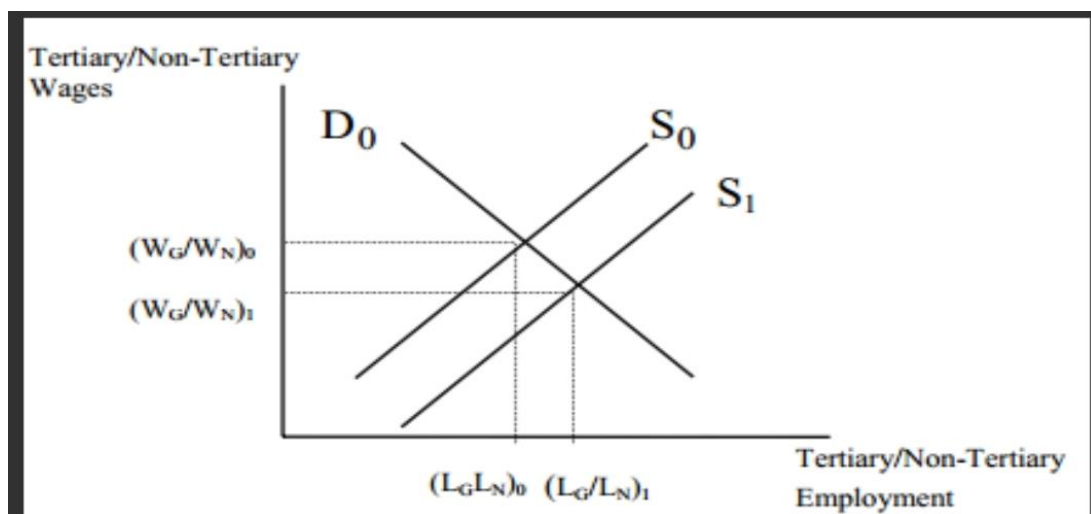


Figure 2: Illustration of the components of higher education.

Source: (Machin & McNally, 2007, p. 36)

The wages of graduates and non-graduates are determined by (W_g) and (W_n) , and their respective employment rates are (L_g) and (L_n) . In the standard economic model, we have an initial equilibrium at the intersection of the initial relative supply and demand curves, (D_0) and (S_0) , respectively, with the associated relative wages. $(W_g/W_n)_0$

The relative employment $(\frac{L_g}{L_n})$ is at $(\frac{L_g}{L_n})_0$. The clear implication of this model is that if there is an increase in the supply of higher education graduates, the supply curve shifts to the right from (S_0) to (S_1) . This leads to an increase in the relative employment rate to $(\frac{L_g}{L_n})_1$ and a decrease in

relative wages. Thus, the supply shock mitigates the relative wage of higher education graduates.

However, lower wages do not have to be the outcome if the demand for higher education graduates also rises. If, for any reason, employers demand more higher education graduates, the expansion may not lead to a decline in the wage premium received by graduates. In fact, if demand increases faster than supply, the wage premium could rise. This means that even though the number of graduates is increasing, the jobs at the graduate level are growing at a faster rate, thereby corresponding to a higher relative wage.

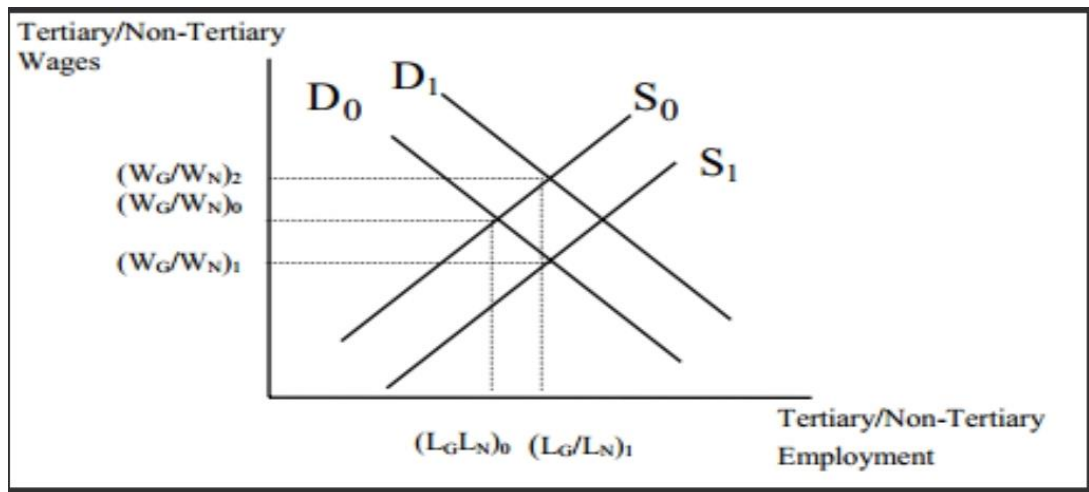


Figure 3: Illustrates the components of higher education.

Source: (Machin & McNally, 2007, p.37)

This is illustrated in the figure above by holding the relative supply curve constant (curve S_1) while allowing such a relative shift in demand by shifting the demand curve to the right (from D_0 to D_1). In this case, the relative shift in demand exceeds the shift in supply, resulting in an increase in the relative wage above the initial level to the relative wage level $(W_G/W_N)_2$. In this example, the relative wages and employment levels of tertiary graduates are higher after the expansion.

An intuitive way of thinking about this supply and demand approach is in terms of an economic model where the wages and employment of graduates and non-graduates are the result of a race between supply and demand. This means that the supply and demand curves change, and the question is which curve moves more. In the example in Figure 3, relative demand must have risen more than relative supply in order to generate higher wages and employment for skilled workers at the same time.

The simple supply and demand framework we have just established has been widely used in academic research on changing inequality in the labour market. Indeed, a substantial increase in the demand for graduates is the only way to

justify fixed (or rising) wage premiums in the face of the expansion of higher education.

Challenges facing higher education in the Arab world:

The obstacles and difficulties that hinder the development of higher education in the Arab world, especially in terms of funding, include the following (Omar, 2019):

- Private sector investment in higher education is viewed from a purely commercial perspective, focusing on profit without considering important variables such as quality, funding scientific research, and nurturing talent and excellence.
- The increasing demand for enrolment in public universities puts the state in a dilemma regarding the annual provision of educational places, which burdens it and may lead it to neglect its role, allowing private universities to take over without adhering to comprehensive standards of quality and educational excellence.
- Higher education has become very expensive, especially in terms of quality and standards.
- Arab countries spend much more on armaments than on education, training and scientific research.
- The total amount allocated to scientific research by all Arab countries does not exceed two billion dollars, which is about what Harvard and the University of Michigan spend on scientific research alone.

This is seen as a crucial factor in supporting the knowledge economy and meeting its conditions and requirements. Scientific research requires substantial material and financial resources, experienced and highly qualified researchers and scientists, prudent and effective management with a clear strategic vision, as well as industries and development projects that align themselves with the research project, fund it and use it to improve their performance and results. Most importantly, a research environment and community that values science, knowledge and scientific inquiry is essential.

Planning, management and coordination: It is important to note that scientific research is a culture, behaviour and civilisation that society, especially decision-makers, must embrace in all its segments.

-The gap between decision-making and scientific research in the Arab world:

One of the most important issues is the gap between decision-making and scientific research in the Arab world.

-Brain drain:

The phenomenon of brain drain is evident as outstanding graduates from Arab universities often receive scholarships to continue their studies in foreign universities. Often, they excel there and receive additional scholarships and benefits that provide incentives for stability in those countries.

The motivating factors of competition, quality, excellence and distinction that research in the West provides are usually absent in their home countries. As a result, they prefer to stay in Western countries, resulting in a significant loss for Arab countries, which lose many of their outstanding researchers, scholars and thinkers every year. Arab countries cultivate talent while their Western counterparts reap the benefits. This brain drain is a significant loss as Arab

countries lose the elite graduates from their universities - those who should be leading the way in creativity, innovation, invention and knowledge production.

-The gap between university output and the labour market:

The unemployment rate in the Arab world is estimated at 15%, meaning that thousands of graduates complete their studies but find themselves unemployed. Some end up in jobs far removed from their field of study and qualifications. This situation leads young people to prefer alternatives to university education, such as freelance work, vocational training, early work or emigration.

The lack of accumulated scientific and knowledge production in Arab universities has made them dependent on foreign knowledge products that carry indirect ideological influences. Such over-dependence in all aspects can, over time, lead to the erosion of national and cultural identity, especially in the current wave of globalisation.

The reality of higher education and scientific research in the Arab world requires radical reforms and structural and cognitive measures. This requires a strong will to change mindsets, improve management and significantly increase budgetary support, as well as the need to open up funding opportunities to the private sector.

Systematic and organised coordination: between the Ministry of Higher Education, the Ministry of Education and the labour market is essential. Regular studies and surveys should be conducted to identify needs and develop strategies to meet them.

C- Ways to bridge the gap between educational outcomes and the labour market:

The state seeks to establish channels between educational outputs and job positions to achieve economic development by implementing the following measures (Al-Bahwash, 2005, p. 5):

- **Encouraging entrepreneurship:** Encouraging entrepreneurship among youth and creating as many small projects as possible as a step to support the plan and strategy of the Ministry of Labour, Employment and Social Security in combating unemployment and increasing the spirit of employment.

- **Pre-employment contracts:** the provision of pre-employment contracts for this group as a mechanism to support their professional integration, including better support for university graduates through training, rehabilitation and skills development activities during the integration period.

- **Economic transition:** Algeria is undergoing a major economic transition from a command economy to a market economy, with major implications for the economy and society. In this context, several measures have been taken to improve macroeconomic balances, restructure public institutions and encourage private sector investment. This phase is characterised by the development of the private sector, which requires an efficient workforce, where the quality of human resources plays a crucial role for companies in a competitive environment.

- **New university system:** The introduction of a new system in Algerian universities will increase the demand for skilled and professional labour and establish a stable relationship between academic performance and labour input.

Methodology and procedure:

In this paper, we will attempt to investigate whether there is a relationship between the number of graduates from Algerian universities and economic growth in Algeria. This will be done using an econometric study to analyse the quantitative relationship between the two variables.

A- Description of the variables:

We will use a model with two variables where the dependent variable will be denoted as:

- GDP: Gross Domestic Product (Office National des Statistiques, 2019).
- Independent variable: $(NGAU)$: Number of graduates from Algerian universities (Yang, 2019).

The model has the following mathematical form

$$GDP = F(NGAU).....1$$

For the purposes of this study, we used a simple linear regression model to determine the nature of economic growth as follows:

$$GDP_t = \alpha + \beta_1 NGAU_t + \varepsilon_t(2)$$

(t) represents time, specifically the year $(t = 1,n)$, with the number of observations being $(n = 25)$.

$$\varepsilon_t$$

The random error term in the equation is assumed to be normally distributed with mean zero and constant variance.

Data presentation:

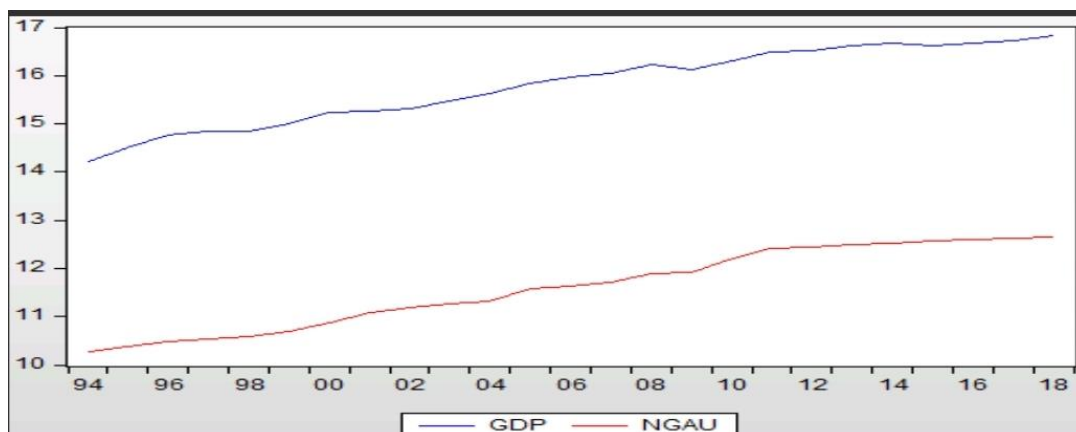


Figure 4 shows the evolution of the linear relationship between tertiary graduates and gross domestic product (GDP)

Source: Prepared by the researcher using Eviews10.

From this graph we can see that both variables move in a similar direction, indicating a linear relationship between the number of university graduates and economic growth. In order to verify the assumption of a relationship between the two variables, we will draw a scatterplot for GDP and the number of graduates from Algerian universities (NGAU). This will allow us to determine whether the relationship is linear or non-linear and to infer the nature of the relationship as either inverse or direct.

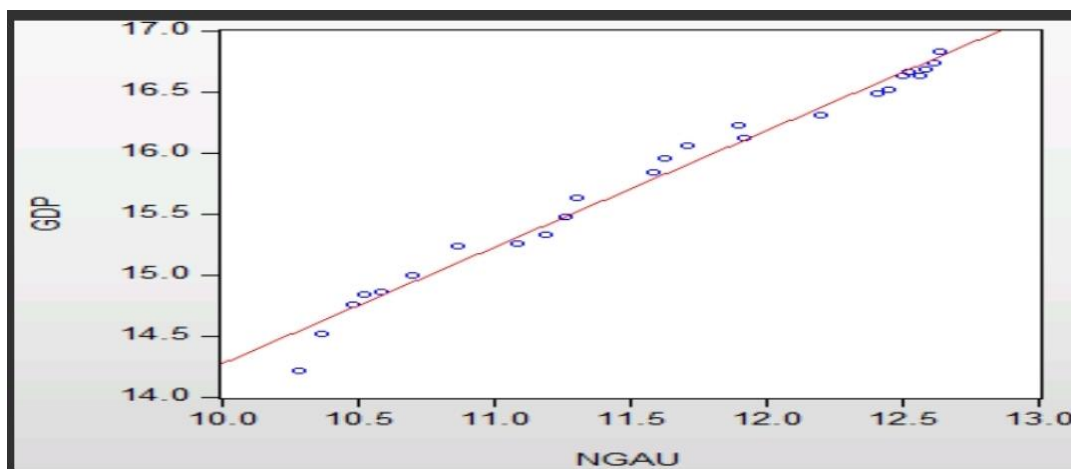


Figure 5: Illustration of the scatterplot between university graduates and GDP:
Source: Prepared by the researcher using EvIEWS10.

From this figure we can see a relationship between GDP and NGAU, where a linear relationship can be seen, with points scattered around the line. This suggests that the relationship between GDP and the number of graduates can be considered linear.

Descriptive statistics of the data:

Table 2: Shows the statistical package for the data on the number of tertiary graduates and GDP

	Gross Domestic Product (GDP)	Number of university graduates
Mean	15.78983	11.59882
Median	15.95732	11.63454
Maximum	16.82411	12.64508
	14.21254	10.28674
Std.dev	0.794246	0.824646
Skewness	-0.360784	-0.153177
Kurtosis	1.854159	1.585416
Jarque-Bera	1.910011	2.182188
Probability	0.384810	0.335849
Sum	394.7458	289.9705
Observation	25	25

Source: Prepared by the researcher using EvIEWS10.

The average GDP of the sample studied from 1994 to 2018 was 15.78983, with a median of 15.95732. The highest average GDP value was 16.82411, while the lowest was 14.21254. The standard deviation of GDP was 0.794246, and the coefficient of skewness was negative at -0.360784, indicating that the frequency distribution curve is left-skewed, with a kurtosis of 1.854159, as shown in the table above.

The average number of graduates in the study period from 1994 to 2018 was 11.59882, with a median of 11.63454. The highest average number of graduates was 12.64508 and the lowest was 10.28674. The standard deviation was 0.824646, while the coefficient of skewness was -0.153177, a negative value indicating that the frequency distribution curve is slightly skewed to the left, with a kurtosis of 1.585416, as shown in the table.

The Jarque-Bera test was used to check how closely the data followed a normal distribution using the Eviews10 statistical software package. The decision rule for accepting the null hypothesis that the data follow a normal distribution is that the p-value of the test is greater than 0.05. The table shows that all the variables examined follow a normal distribution, with p-values ranging from 0.384810 to 0.335849, both greater than 0.05. Therefore, there is no problem with the normal distribution.

Estimation of the regression model and evaluation of the results:

The simple linear regression model was used to estimate the standard model for measuring the impact of the number of university graduates on GDP according to the following equation:

$$GDP_t = \alpha + \beta_1 NGAU_t + \epsilon_t$$

Variables	Coefficient	T- statistics	Std error	Prob
NGAU	0.954614	35.81443	0.026654	0.0000
C	4.717432	15.22197	0.309910	0.0000
R-squared	0.982385	Mean dependent var		15.78983
Adjusted R-squared	0.981619	S.D dependent var		0.794246
S.E. of regression	0.107682	Akaike info criterion		-1.54265
Sum squared resid	0.266695	Schwarz criterion		-1.445140
Log likelihood		Hannan-Quinn criter.		-1.542650
F-statistic				0.653216
Prob(F-statistic)				
	21.28312			
	1282.673			
	0.000000			

Source: Prepared by the researcher using Eviews10.

Evaluation of the model according to economic criteria:

The coefficient for the variable “number of university graduates” is positive at 0.954614, indicating a direct relationship between this variable and Gross Domestic Product (GDP). The p-value of 0.0000 is less than 0.05, indicating statistical significance at the 1% level.

The constant term is positive at 4.717432, representing the value of GDP when the independent variable (number of university graduates) is zero. This means that GDP is positively affected by the number of graduates with 100% confidence; as the number of graduates increases, so does GDP.

The correlation coefficient shows a positive relationship between GDP and the independent variable, with a (R^2) value of 0.98.

The adjusted (R^2) value of 0.981619 indicates that 98% of the changes in GDP are explained by changes in the independent variable (number of graduates), while other factors account for the remaining 2%.

The F-statistic value of 1282.673 with a p-value of 0.000000 is less than 0.05, indicating the significance of the regression and the importance of the effect of the independent variable on the dependent variable.

Conclusion

After studying all these aspects and delving into their content, several findings have been reached, along with some recommendations, as follows:

A- Findings:

- University graduates can understand and recognise the needs of economic development more than others, thus enabling them to make a positive contribution to the elimination of economic backwardness.
- Quality education and improved skills of the workforce help to create conditions conducive to high productivity and economic growth.
- The introduction of the new system in Algerian universities aims to increase the demand for specialised and skilled labour and to establish a stable relationship between educational output and labour input.
- Graduate individuals capable of creativity, innovation and applying what they have learned in their university studies.
- The model studied shows that an increase in higher education output is accompanied by an increase in economic growth, indicating a direct relationship between the number of university graduates and GDP, such that GDP is positively affected by the number of university graduates.

B- Recommendations:

- Open the door to the private sector: Allow the private sector to manage universities alongside the public sector.
- Continuous evaluation of teachers and administrators: Implement a continuous evaluation approach for teachers and administrators to foster a culture of competitiveness and credibility in universities.
- Stability for the Common Good: Ensure stability in higher education for the benefit of society.
- Quality of education: Upholding the principle of quality education for universities and the productivity of research institutions.

- Increase budget allocations: Increase the budget allocated for training, capacity building, international cooperation, scientific research and technological development, while ensuring effective management of this budget to enhance its objectives.
- Improve evaluation methods: Improve individual evaluation methods and promote collective encouragement.
- Collaboration between managers and researchers: Facilitate collaboration between managers, teams, researchers and universities to strengthen links with industry.
- Model reward and promotion systems: Develop a compensation and promotion model and patent pricing based on the size of each research institution or university.
- Improving the legal and regulatory framework: Improve the legal and regulatory texts governing researchers, universities and research institutions in Algeria.

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Appendices:**Appendix No. (01): Least squares estimation of the model equation**

- Dependent variable: GDP
- Method: Least squares
- Date: 19.02.23
- Time: 18:34
- Sample: 1994 - 2018
- Observations included: 25

Variables	Coefficient	Std error	T- statistics	Prob
NGAU	0.954614	0.026654	35.81443	0.0000
C	4.717432	0.309910	15.22197	0.0000
R-squared	0.982385	Mean		15.78983
Adjusted R-squared	0.981619	dependent var		0.794246
S.E. of	0.107682	S.D.		-1.542650
regression	0.266695	dependent var		-1.445140
Sum squared	21.28312	Akaike info		-1.515605
resid	1282.673	criterion		0.653216
Log likelihood	0.000000	Schwarz		
F-statistic		criterion		
Prob(F-statistic)		Hannan-Quinn criter.		
		Durbin-Watson stat		