

The Impact of Demographic Factors on Unemployment Using Logistic Regression

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Abstract: *This study aims to build a standard model to identify the most important individual demographic factors that have an impact on increasing the probability of an individual leaving unemployment, using the logistical regression method that suits the classification of binary qualitative variables, using data obtained from the field study by means of a questionnaire distributed to 353 unemployed individuals , one of the most important results reached by the study is that the estimated logistical model, which includes individual demographic factors for the unemployed individuals, has a high classification efficiency estimated at 89.2%.*

Keywords: unemployment; demographic factor; logistic regression model.

JEL Classification Codes: J6, C2,

ملخص: تهدف هذه الدراسة إلى بناء نموذج قياسي لمعرفة أهم العوامل الديمغرافية التي لها تأثير في زيادة احتمال خروج الفرد من البطالة، باستخدام أسلوب الانحدار اللوجستي الذي يناسب تصنيف المتغيرات الثنائية النوعية، وذلك باستخدام بيانات تم الحصول عليها من واقع الدراسة الميدانية بواسطة استمارة استبيان تم توزيعها على 353 فرد عاطل عن العمل، ومن أهم ما توصلت إليه الدراسة من نتائج أن النموذج اللوجستي المقدّر والذي يضم عوامل فردية ديمغرافية للعاطلين عن العمل ذو كفاءة تصنيف عالية قدرت بـ 89.2%.

الكلمات المفتاحية : بطالة، عامل ديمغرافي، انحدار لوجستي.

1. Introduction:

Unemployment is a complex phenomenon that affects various sectors, including economic, social, and political ones. This issue arises from the increasing population growth in the country and the inability of different sectors to absorb this growth. Such an increase continues year after year due to the rise in the number of new entrants into labor markets. Rapid population growth leads to an increase in the working-age population, thereby affecting the supply and demand for labor. Consequently, this results in higher unemployment rates, which hinder development processes.

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Unemployed individuals form a heterogeneous group, allowing unemployment rates to be calculated in different ways using demographic factors that influence individuals. These factors yield varying results, such as calculating unemployment rates based on gender, age, the duration of unemployment, or the extent of their hardship despite advancements in education, training, and qualifications that should enable individuals to secure jobs. These results differ from the overall unemployment rate. Therefore, this research paper aims to study the characteristics of the sample population to identify the key demographic factors influencing individual unemployment.

From this, the research problem can be formulated as follows:

What are the key demographic factors influencing individual unemployment using logistic regression?

Based on this question, the following hypotheses have been formulated:

- There is a statistically significant effect of the variables "marital status" and "age" on the dependent variable, which is unemployment.
- Work experience is one of the most important factors contributing to securing employment.

1.2 Significance of the Study: The importance of this study lies in addressing the issue of unemployment and analyzing the characteristics of individuals in securing jobs. This is achieved by using the appropriate model logistic regression, which is well suited for binary qualitative data.

1.3 Study Objectives: The study aims to build a statistical model that helps identify the key demographic factors influencing the unemployed, using a standard model logistic regression. It also seeks to employ a binary outcome model to study the phenomenon of unemployment.

1.4 Study Methodology: The descriptive approach was utilized to describe the study's data using tables, which help reveal the general characteristics of the study's dataset. Additionally, the analytical method was applied to examine the key demographic factors influencing unemployed individuals through logistic regression.

1.5 Study Sample and Performance: The study sample included a group of unemployed individuals, approximately 353 persons. A questionnaire was used to collect their data, particularly the demographic variables relevant to the study. After collecting the data, it was described and analyzed using the Statistical Package for Social Sciences (SPSS).

1.6 Previous Studies: The study referenced literature, scientific research, and previous studies that addressed the research topic from various perspectives, including:

Study by Ghanem Adnan and El-DjaouniFarid Khalil (2011): Titled "Using Binary Logistic Regression Technique to Study the Main Economic and Social Determinants of Household Income Adequacy," the study concluded that variables such as the presence of university students, monthly income, homeownership, and family size affect the adequacy of

household income. However, variables like educational level, place of residence, and employment status were found to have no statistical significance.

Study by DjellitTahar (2016): Titled "An Econometric Study of the Determinants of Unemployment in Algeria (1980-2014)," this study aimed to identify the temporal factors influencing the unemployment rate in Algeria during the period 1980-2014 through an econometric model. The findings highlighted that economic growth rates, public spending, and oil prices are the main determinants of unemployment in Algeria. Fiscal policy was found to be more effective in mitigating unemployment compared to monetary policy, which had a weaker impact on unemployment rates.

Study by HimaliLokaPathiranage (2020): Titled "Determinants of Unemployment and Unemployment Duration," this paper aimed to identify the factors influencing unemployment and its duration in Sri Lanka. The study utilized a survey of 1,200 households in the Kalutara district. Key findings revealed that factors such as the living sector, gender, education level, and language constraints significantly impact unemployment. It was also found that the majority of the unemployed belong to the youth category, specifically the age group of 15–29 years. Unemployment rates were shown to decrease with age but rise among the educated population. The study highlighted that long-term unemployment in Sri Lanka is primarily attributed to prolonged job searching.

2. Unemployment Indicators in Algeria

2.1 Definition of Unemployment: Unemployment is a term that has been widely used since ancient times. Although it is believed to be a subject that has undergone extensive scientific research and deep analysis, it remains a significant issue on both local and global scales.

Unemployment occurs in a situation in which there is an excess of job seeker (labour demand) in relation to the actual number of available job offers (labour supply).

According to the International Labour Organization's (ILO) definition adopted in 2003, the unemployed comprise all persons within the age limits specified for measuring the economically active population, who during the reference period were: who meets three criteria:

- Is without work.

- Is available to take up employment.

- Is actively seeking employment. (ILO, 2012, pp. 4-5)

In the European Union, an unemployed person is defined as someone who has not worked for at least one hour during a reference week, is available to work within two weeks (15 days), and has actively and continuously sought employment during the four weeks preceding the reference week (Chardon & Dominique, 2003, p. 68).

Furthermore, the National Office of Statistics defines an unemployed person as:

Being within the working age, between 16 and 60 years old, and without work during the survey period.

- Without work: Not engaging in any paid or unpaid work, even for one hour, during the survey period.
- Being available and ready to work during the survey period.
- Actively seeking employment: Taking specific steps to find a job, such as registering with an employment office.

Job Seekers Categorization According to the National Office of Statistics:

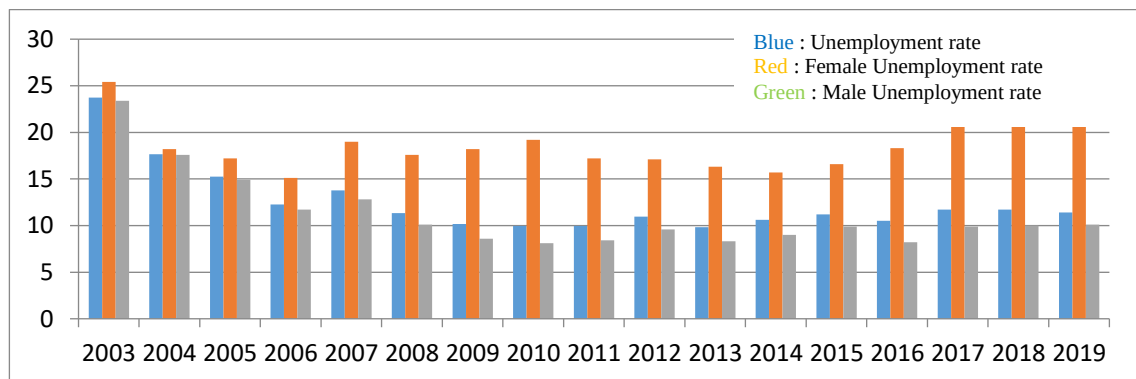
Job Seekers 1: Any person of working age (16–60 years) who previously worked but is unemployed during the survey period due to reasons such as dismissal, contract termination, resignation, etc., and is actively searching for work.

Job Seekers 2: Any person of working age (16–60 years) who has never worked before, is unemployed during the survey period, and is actively looking for a job (بن تركي، 2021، صفحة 17)

2.2 Development of Unemployment Rates in Algeria

The unemployment rate is one of the key indicators for measuring labor market performance, reflecting either balance or imbalances between labor supply and demand. It also highlights the country's ability to create new job opportunities or, conversely, its loss of jobs during periods of declining growth, often caused by various crises (جلال، 2017، صفحة 291)

Figure (1): Evolution of unemployment rates in Algeria



Source: Developed by the student based on data from the World Bank and the National Office of Statistics

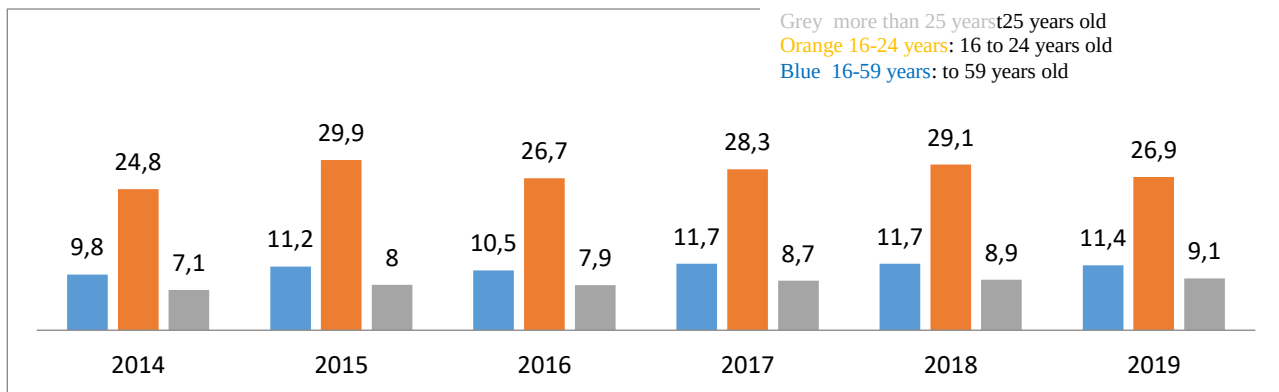
This figure illustrates the trend of unemployment rates in Algeria. It shows a sharp increase in the unemployment rate in 2003, reaching 25.4%, before declining to 10.17% in 2009. This decrease can be attributed to the rise in hydrocarbon prices. By 2013, the

unemployment rate was recorded at 9.83%. During this period, especially between 2011 and 2014, initiatives promoting entrepreneurship and the creation of new jobs were introduced. Support agencies played a significant role in generating over one million jobs, and government investment programs helped revitalize the national economy through development plans initiated in Algeria since 2001. However, in recent years, unemployment in Algeria has risen again due to the decline in oil prices, which led to reduced support for small and medium enterprises and a decrease in public sector employment (جليط، 2017، صفحة 6).

As we observe, the unemployment rate among women is higher compared to that of men, indicating a lack of equality among members of society in the labor market. The unemployment rate among women exceeds 20%, a notably high percentage compared to the unemployment rate among men, which ranges between 8% and 10%. This disparity becomes even more apparent when considering age as a criterion, as illustrated by Figure 02. Across all age groups, the unemployment rate for women surpasses that for men, and this gap widens significantly among the youth aged 16–24 years. For this age group, the unemployment rate for women was estimated at 51.3% in 2018, compared to 24.6% for men.

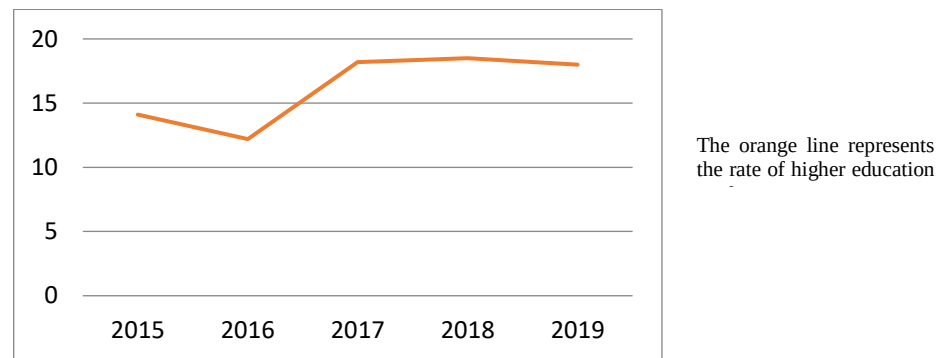
This increase is attributed to the graduation of university students and those trained in institutes entering the labor market for the first time. Additionally, economic institutions often require professional experience, which newcomers to the job market typically lack.

Figure (2): Evolution of the youth unemployment rate



Source: Developed by the student based on data from the National Office of Statistics.

It is also worth highlighting the unemployment of higher education graduates and its evolution in recent years. Human resource competence is one of the fundamental pillars of modern economies; however, Algeria has not effectively leveraged this resource due to a mismatch between the educational system and labor market needs. This misalignment reflects an emphasis on quantity over quality in education, as illustrated in the following figure.

Figure (3): The Unemployment Rate of Higher Education Graduates.

Source: Developed by the student based on data from the National Office of Statistics.

2.3 Characteristics of Unemployment in Algeria

The majority of unemployed individuals are in the youth category. As of May 2019, the unemployment rate for the 16–24 age group reached 26.9%. In contrast, the unemployment rate for those aged 25 and above was 9.1% during the same period, broken down to 6.8% for men and 17.8% for women.

The unemployment rate increases among the educated population, with the vast majority of the unemployed being graduates of universities and high schools. According to the National Office of Statistics, the distribution of unemployment rates based on educational qualifications recorded a total of 1,449,000 unemployed individuals, of which 663,000 were without any formal qualifications, representing 45.8% of the total unemployed. Among the unemployed, vocational training graduates accounted for 26.5%, while higher education graduates comprised 27.8%, equivalent to 402,000 individuals.

The unemployment rate among women is notably higher, with a rate of 20.4% compared to 9.1% among men. Furthermore, the National Office of Statistics reported that six out of ten unemployed individuals (62.9%) experience long-term unemployment, meaning they have been seeking work for a year or longer.

Unemployment is particularly concentrated among newcomers to the labor market who lack experience. However, unemployment rates drop significantly among skilled and trained technical labor, highly qualified professionals with specialized training, and experienced individuals with higher qualifications (ONS, 2019).

3. Practical Framework

3.1 Characteristics of the Sample:

This section examines the key demographic factors influencing individual unemployment.

Table (1): Represents the dependent variable.

	Yes	No
Frequency	43	310
Percentage	12.2	87.8

Source: Developed by the researcher based on SPSS software.

Table (2): Represents unemployment distribution by gender.

	Male	Female
Percentage (Gender)	52.7	47.3
Yes	21	22
No	165	154

Source: Prepared by the researcher using SPSS software.

The study sample consists of 52.7% males, out of which 165 individuals are unemployed. Additionally, 154 individuals from the female category are unemployed.

Table (3): Represents the correlation between qualifications obtained and age.

Degree	15– 20 years old	20– 25 years old	25– 30 years old	30– 35 years old	35– 40 years old	40– 45 years old	45– 50 years old	50– 60 years old and more
Without a degree	5	8	11	9	5	9	0	3
Vocational training degree	0	8	7	10	14	10	4	1
University degree	0	41	73	58	43	24	7	1

Source: Developed by the researcher based on the outputs of the SPSS program

The majority of unemployed individuals fall within the youth age groups of 25–30 years and 30–35 years, with rates of 25.8% and 22.4%, respectively. These percentages are

significantly higher compared to other age categories, primarily due to graduates entering the labor market for the first time.

The study identified 303 individuals holding qualifications, of whom 247 are university graduates. Among these, 159 individuals have never been employed before.

Table (4): Marital status with social environment

	Single	Married	Divorced/Separated	Widowed
Town	150	127	18	3
Countryside	28	24	3	0

Source: Developed by the researcher using the SPSS program.

The characteristics of the study indicate that the number of single individuals residing in cities was estimated at 150 individuals, compared to the number of single individuals residing in rural areas, which was estimated at only 28 individuals, according to the study sample

Table (5): Preference in Securing Employment.

	Paid work	Job	Self-employed	Doesn't matter
Frequency	19	193	75	66
Percentage	5.4	54.7	21.12	18.7

Source: Developed by the researcher using the SPSS program.

The majority of unemployed individuals prefer obtaining a formal job, with their percentage estimated at 54.7% compared to others.

Table (6): Unemployed Individuals and the Duration of Job Searching

	Less than a year	12 to 23 months	24 months or more	Refusal to disclose
Yes	38	23	42	38
No	45	23	101	43
Total	23	46	143	81

Source: Prepared by the researcher based on the output of the SPSS program

The majority of unemployed individuals have experienced unemployment for more than 24 months and lack work experience. Their number is estimated at 101 individuals. However, they are actively searching for employment and are ready to work.

Table (7): The relationship between the unemployment variable and demographic factors

Dependent variable (unemployment)	Yes	No
Gender		
Male	21	165
Female	22	145
Age		
15-20 years old	0	5
20-25 years old	2	55
25-30 years	7	84
30-35 years	8	71
35-40 years	13	49
40-45 years	8	35
45-50 years	4	7
50-55 years	0	2
55-60 years	1	1
60+ years old	0	1
Marital status		
Single	18	160
Married	22	129
Divorced/Separated	1	20
Widowed	2	1
Social environment		
Town	37	261
Countryside	6	49
Obtained degree		
Without a degree	4	46
Vocational training degree	9	47
University degree	30	217
Duration of job searching		
Less than a year	10	73
12-23 months	3	43
24 months or more	6	137
Refusal to disclose	24	57

Preference in Employment		
Paid work	0	19
Job	25	168
Self-employed	14	61
Doesn't matter	4	62
Experience		
Yes	32	109
No	11	201
Preparing for work		
Yes	29	292
No	14	18
Searching for work		
Yes	20	261
No	23	49

Source: Developed by the researcher using the SPSS program.

Unemployment affects various segments of society, especially the youth and those of legal age, whose ages range between 35-30 and 40-35 years old (81 and 71 individuals in the study sample, respectively). 35 years (81 and 71 individuals according to the study sample, respectively), the number of people ready and looking for work was estimated at 292 and 261 unemployed individuals according to the studied sample, and there are 109 individuals with skills and experience (according to the study sample) that qualify them to occupy positions that suit their experience and specializations. However, they do not have a job, especially the category of university degree holders, which is the most unemployed group, as their number reached 217 individuals who were unable to obtain it, whether they entered the labor market for the first time or lost their positions under social or economic circumstances that forced them to lose their jobs.

3.2 Definition of the Logistic Regression Model:

Logistic regression is a statistical analysis method that describes the relationship between response (dependent) variables with two categories (dichotomus) and explanatory (independent) variables that are categorized or continuous. (marchegian baebae & setiawan, 2020, p. 12), In a logistic regression, the dependent variable only has two categories. Generally, the occurrence of the event is coded as 1 and its absence as 0. (antonio alves, dalson britto, enivaldo carvalho, & willber da, 2020, p. 2).

Logistic regression is employed to predict the probability of an event occurring, such as whether a person with certain demographic characteristics will obtain a job or not. It also explains how several independent variables influence the occurrence of the binary

observation of the dependent variable, which takes on two probabilistic values. The logistic regression equation is presented as follows: (kleinbaum & klein, 2002, p. 30)

$$y = \text{logit}(\text{odds}) = \log\left(\frac{p}{1-p}\right) = b_0 + b_1x_1 + \dots + b_nx_n \dots \dots \dots (1)$$

Y: the binary dependent variable

b_0 : Constant term

b : The logit value for the explanatory variables.

4. Logistic regression results:

In the following, we present the results of the model, which are a set of statistical tests that the researcher uses to investigate the suitability of the model in the case of dealing with binary response data for the unemployment variable, and these results consist of two parts, one part presents results that help us evaluate the model statistically to see how well it can explain the studied phenomenon, and one part presents results that help us interpret the relationship between the dependent variable and the explanatory variables.

4.1 Testing the efficiency of the model:

We will check the fit of the model as a whole by using the following measures:

✓ Maximum plausibility test: used to determine the statistical significance of the model, where the results of the model including only the fixed term are compared with the model including the explanatory variables.

We found that the test of maximum plausibility ratio that follows the χ^2 distribution for the significance of the difference between the two values of the logarithm of the weighting function for the logistic regression model with and without the independent variables for all models as follows:

Table (8): Maximum plausibility test

Step	Value of χ^2	Degrees of freedom	Significance
1	63.919	10	0.000

Source: Developed by the researcher based on the output of the SPSS program

From Table 08, we found that the chi-squared value was 63.919 at the degree of freedom 10 and the level of significance is less than 0.05, this explains that the model used is statistically significant and significant, and that the variables in the first step are important, influential and statistically significant in categorizing the unemployed.

✓ Testing the explanatory power of the model: Cox Snell R² and Nagelkerke R² are used to know the suitability of the proposed model for the study

data and this corresponds to the coefficient of determination R^2 in the multiple linear model, where the results of explaining the variables included in the model as shown in the following table:

Table (9): Matchmaking quality coefficients

Step	-2LOG L	Cox Snell R^2	Nagelkerke R^2
1	197.610	0.166	0.316

Source: Developed by the researcher based on the output of the SPSS program

We note from the table that the variables included in the model at step 1 explained about 31.6% using the first coefficient Nagelkerke R^2 , which indicates that the model has a somewhat average value in explaining the explained variables, but it is acceptable in such models, and the second coefficient Cox Snell R^2 , which represents the percentage of variance explained in the model, amounted to 16.6% of the variation in the dependent variable, and therefore the independent variables explained the dependent variable, but there are other variables affecting the dependent variable that did not enter the model.

✓ **Classification Efficiency Test:** It is considered one of the ways to check the quality of fit of the model, the results came as shown in the following table:

Table (10): Classification Efficiency

Step 1	Classification		Expected		Correct classification
			Yes	No	
	The viewer	Yes	11	32	25.6
		No	06	304	98.1
					89.2

Source: Developed by the researcher based on the output of the SPSS program

It is clear from the table that the sensitivity of the model in the first step, which is the percentage of correct predictions in the group of employed individuals, was 25.6%, and the accuracy of the model, which is the percentage of correct predictions in the group of unemployed individuals, was 98.1%.

When the inclusion of the predictor variables in the model achieved an overall correct classification ratio, which is the number of correct predictions on the total number of the study sample amounted to 89.2%, which is a high percentage considering the step 0 shown in the following table, which shows that the results of the analysis without any independent variables amounted to 87.8%, it can be seen an improvement in the correct classification achieved by the model.

Table (11): Classification table for Step 0

Step 0	Classification		Expected		Correct classification
			Yes	No	
	The viewer	Yes	0	43	0
		No	0	310	100
					87.8

Source: Developed by the researcher based on the output of the SPSS program

✓ Hosmer-Lemeshow Test for Model Fit: This test is utilized to evaluate how well the data aligns with the proposed model by testing the null hypothesis, which states that the proposed model is a good fit for the data. A significant result in this test would imply poor model fit, while a non-significant result indicates that the model fits the data well.

Table 12: Hosmer-Lemeshow Test for Model Fit

Step	X ²	Freedom degree	Significance
1	5.946	8	0.653

Source: Developed by the researcher based on the output of the SPSS program

It is clear from the table that (Sig=0.653>0.05), which means accepting the null hypothesis that the model fits the data well, and hence the overall significance of the model parameters.

4.2 Testing and interpreting the estimated model parameters:

After testing the fit of the model as a whole, each variable will be examined individually using the wald test, which confirms the significance of the estimated model coefficients and the effect of the independent variable on the dependent variable by accepting the null hypothesis that the logistic regression coefficient associated with the independent variables is equal to zero and follows the χ^2 distribution.

Table 13: Variables in the model

Variants	Coefficient B	WALD test	Sig	Exp (B)
Gender	0.679–	2.525	0.112	0.507
Age	0.287–	4.153	0.042	0.751

Social environment	0.022–	0.002	0.968	0.978
Marital status	0.716	4.109	0.043	2.046
Obtained degree	0.130–	0.191	0.662	0.878
Experience	1.796	16.366	0.000	6.027
Willingness to work	1.006–	3.460	0.063	0.366
Job search	1.249–	8.091	0.004	0.287
Searching duration	0.333–	3.304	0.069	0.717
Job Differentiation	0.186	0.574	0.449	1.204
Fixed	3.085	12.6	0.000	21.873

Source: Developed by the researcher based on the output of the SPSS program

It is clear from the above table that the following independent variables: Age, experience, job search, marital status and fixed income (statistically significant at the 5% level, while search duration and job readiness are statistically significant at the 10% level, while the rest of the variables have no significant effect, which shows the low importance of these variables in explaining the phenomenon under study.

- The results showed that there is a significant effect of age (sig=0.042), meaning that this variable is significant in explaining unemployment, the higher the age of the unemployed, the more likely they are to get a job (sig=0.042).

- The experience variable is a significant variable (sig=0.000), the odds ratio was estimated to be 6.027, meaning that individuals who have never worked are 6 times more likely to be unemployed than individuals with work experience.

- The job search variable has an odds ratio of 0.287, which means that job-seeking individuals have a better chance of getting a job than individuals who have not looked for a job.

- The marital status variable has an odds ratio of 2.046, this indicates that single individuals are more likely to be unemployed compared to other categories, so that 02 unemployed singles get a job compared to an unemployed individual from other categories.

- The willingness to work variable is a significant variable (sig=0.063), with an odds ratio of 0.366, which means that unemployed individuals are willing to enter the world of work compared to individuals who are unwilling and unwilling to get a job.

- The job search duration variable is significant at 10%, the odds ratio is 0.717, which means that individuals with a long job search duration are more likely to get a job than individuals with a short job search duration.

- From the results of the logistic regression, the equation for the demographic factors influencing whether individuals are unemployed or not was found as follows:

$$y = \log\left(\frac{p}{1-p}\right)$$

$$= 3.085 + 1.796\text{Experience} - 1.249\text{Job searching} - 0.287\text{Age}$$

$$+ 0.716 \text{ Marrital status} - 1.006 \text{ willingness for work}$$

$$- 0.333 \text{ searching duration} \dots \dots \dots (2)$$

5.Conclusion

The influx of large numbers into the labor market as a result of rapid population growth and the mismatch of employment requirements in the Algerian economy with the outputs of Algerian institutes and universities, which clearly contributed to increasing the pressures that lead to an increase in the number of unemployed, this research paper made an important contribution to highlighting the most important demographic variables explaining unemployment using binary logistic regression, and we obtained the following results: The classification efficiency was 89%, which is a high percentage indicating that the independent variables are efficient in representing the dependent variable:

- The classification efficiency was estimated at 89.2%, which is a high percentage indicating that the independent variables are efficient in representing the dependent variable.
- By presenting the model, we found that there are some variables that do not have a significant effect on the dependent variable, namely: Gender, degree obtained, social environment, preference in obtaining a job...
- The variables that had a significant effect on the dependent variable are - in order of importance -: Experience, job search, age, marital status, work readiness, and duration of job search.

Suggestions and Recommendations:

This study recommends:

- Conducting a study on the unemployment of university youth using advanced statistical methods.
- Study the formal and informal work of women in Algeria using binary qualitative models.
- Paying attention to specialized models in the study of qualitative variables and applying them in various fields.

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