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The impact of Foreign Direct Investment on labour in Algeria using the ARDL approach

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Abstract:
This study aims to measure the impact of foreign direct investment on employment in Algeria during the period 1990-2020 using the ARDL model, where we used the unemployment rate to express the employment index in addition to a set of variables that also directly affect employment in Algeria. The results obtained proved the existence of a significant impact of foreign direct investment on employment in Algeria, both in the short and long term, through the inverse and significant relationship that links the independent variable foreign direct investment and the dependent variable unemployment, which requires the need to find effective mechanisms to receive more foreign direct investment flows to mitigate the effects of the unemployment phenomenon in Algeria.
Keywords: *Foreign direct investment, employment, unemployment, ARDL methodology*

L'impact des investissements directs étrangers sur l'emploi en Algérie selon l'approche ARDL

Résumé :
Cette étude vise à mesurer l'impact des investissements directs étrangers sur l'emploi en Algérie au cours de la période 1990-2020 à l'aide du modèle ARDL, dans lequel nous avons utilisé le taux de chômage pour exprimer l'indice de l'emploi, en plus d'un ensemble de variables qui ont également une incidence directe sur l'emploi en Algérie. Les résultats obtenus ont prouvé l'existence d'un impact significatif des investissements directs étrangers sur l'emploi en Algérie, tant à court qu'à long terme, à travers la relation inverse et significative qui lie la variable indépendante « investissements directs étrangers » et la variable dépendante « chômage », ce qui nécessite de trouver des mécanismes efficaces pour attirer davantage de flux d'investissements directs étrangers afin d'atténuer les effets du phénomène du chômage en Algérie.

Mots clés *: Investissements directs étrangers, emploi, chômage, méthodologie ARDL*

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Introduction:

Studies related to investment have proven many important benefits of foreign direct investment on the economy of host countries, especially regarding increasing economic growth and creating more job opportunities. Given these benefits, governments of developing countries should place foreign direct investment among their priorities, allowing them to maximize these resulting benefits, by identifying the positive determinants that attract high inflows of foreign direct investment: "Foreign direct investment occurs when an investor resident in one country (the home country) acquires an asset in another country (the host country) with the intention of managing this asset" (N. H. Cung & Hung, 2020). This definition indicates that the beneficiaries of foreign direct investment are two parties, the home country and the host country, so that both parties expect to obtain benefits. The benefits that home countries receive when investing in other countries lie in:

First: Foreign direct investment allows home country companies to extend the life cycle of products that were manufactured and consumed in the local market. Second: It helps home country companies establish abundant and stable supplies of raw materials at low prices. Third: It improves the efficiency of the use of invested capital. Fourth: Through foreign direct investment, investors from the home country can achieve many fundamental objectives, such as expanding economic power and strengthening influence in international markets by opening expanded consumer markets, avoiding the trade protection barriers of host countries, reducing product costs, and increasing

competitiveness with goods and services imported from other countries (N. H. J. A. M. A. E. Cung, 2020).

The benefits received by host countries also lie in the positive effects of foreign direct investment not only in the home country but also in the host country. In the economic field, foreign direct investment complements investment capital, enhances economic growth and economic reform, changes the economic structure towards modernization, and strengthens exports of goods and services. In the field of technology, foreign direct investment contributes to the development of new techniques and methods through technology transfer, and significantly improves infrastructure. In foreign affairs, foreign direct investment aims to encourage the development of foreign relations towards multilateralism and diversification for the public good, strengthen standing in the international arena, and international economic development. In social fields, foreign direct investment contributes to increasing employment and income, reducing poverty, and developing human resources (C. H. NGUYEN, PHAM, TRAN, NGUYEN, & Business, 2021).

Given all the aforementioned benefits, countries and governments compete to attract foreign investments of all kinds. "Foreign direct investment flows have spread around the world as nearly all countries and regions around the world seek to attract a certain amount of foreign direct investment; the essence of the difference lies in quality and type" (N. H. Cung, Hua, & Economics, 2013). The benefits of foreign direct investment can include all fields and sectors in receiving countries, where foreign companies participate directly in daily operations in other countries. This means that they not only bring money with them but also

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technology, knowledge, and skills (C. H. J. T. J. o. A. F. Nguyen, Economics & Business, 2021). "Foreign direct investment flows usually come in the form of resource packages, such as capital, production technology, organizational and managerial skills, marketing knowledge, and the ability to access markets through multinational corporate networks" (Kumar, 2003). Motivations for foreign investment differ from one country to another, but "one of the basic motives behind foreign direct investment is companies' search for lower production costs" (Eckel, 2003).

Foreign direct investment has become an essential element in economic globalization and plays an important role in the economic development of developing countries, especially in Algeria, through creating more jobs and developing working skills. "The relationship between economic growth and foreign direct investment is interesting, as foreign direct investment plays a stimulating role in growth and therefore in development in emerging and developing countries (Chadlia, 2020), such as building infrastructure and developing a highly skilled labor force, which allows it to provide good output at the lowest possible costs, especially if local labor is relied upon, and encouraging openness to trade in terms of both export and import, and increasing GDP growth. The combination of all the previous factors will inevitably lead to creating more jobs and reducing the spread of various phenomena such as unemployment, poverty, and social ills.

Based on the above, we can formulate the following problem:

Do inflows of foreign direct investment affect unemployment rates in Algeria? And is this effect in the short term, the long term, or both?

We will try through this research paper to answer this question by examining the impact of foreign direct investment on the labor market in Algeria, where we expressed the labor market by the unemployment rate; which is the dependent variable, while foreign direct investment is considered an independent variable. We also expect a negative relationship, where an increase in foreign direct investment inflows leads to a reduction in unemployment and the creation of more jobs. A set of macroeconomic variables were also included in the first group, represented in: annual GDP growth rate, annual per capita GDP growth rate, domestic investment. In the second group, the following variables were adopted: trade openness and infrastructure represented in the number of mobile phone users in Algeria.

1. Previous Studies

- Study (Davies & Voy, 2009) entitled *The Effect of Foreign Direct Investment on Child Labor*, a case study on 145 countries with a total of 1995 observations using a panel model. The study concluded that there is a negative effect of foreign direct investment on child labor in the countries under study, taking into account GDP per capita as a control variable.
- Study (Chaudhuri & Banerjee, 2010): The research paper aims to study the impact of foreign direct investment in agriculture in the economy of developing countries, using a three-sector general equilibrium model with the inclusion of the unemployment variable between skilled and unskilled labor. The results concluded that foreign direct investment in agriculture not only improves

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national welfare but also alleviates the unemployment problem between both types of labor.

- Study (Schmerer & Finance, 2014): This paper focused on the relationship between foreign direct investment and unemployment by conducting an econometric study on OECD countries (19 countries) from 1982 to 2003 using the Generalized Method of Moments (GMM) on a panel model. The results concluded that there is a strong relationship between net foreign direct investment and low unemployment rates.
- Study (Boghean, State, & Finance, 2015) entitled: *The Relationship Between Foreign Direct Investment and Labor Productivity in EU Countries*, where this study was conducted on EU countries using data from 2001 to 2012. The study concluded that there is a strong link between foreign investment inflows and labor productivity for countries with high per capita income and national income, and the opposite for other countries. The researchers concluded that developed countries that seek to attract foreign direct investment are the ones that have a strong and significant relationship between foreign direct investment and labor productivity.
- Study (Dardour, 2022) entitled *The Effect of Foreign Direct Investment and Domestic Investment on the Unemployment Rate in Algeria During the Period 1950-2020 Using the VECM Model*. In this study, the researcher used foreign direct investment and domestic investment as independent variables, and the unemployment rate as a dependent variable during the period 1990-2020 using the VECM model. The study concluded that there is a negative and

insignificant relationship between foreign direct and domestic investment and the unemployment rate in both the long and short term.

2. Data:

To study the impact of foreign direct investment on the labor market in Algeria, the ARDL methodology was adopted through a time series extending from 1990-2022, where all data were collected from the World Bank database.

a. Dependent Variable: The labor market needs in Algeria were expressed through the unemployment rate, which was calculated as a percentage of the labor force. It is assumed that inflows of investments reduce the unemployment rate.

b. Independent Variables:

- **Foreign direct investment (FDI):** Considered the main variable in the study among the independent variables, it represents net inflows as a percentage of GDP. Foreign direct investment is considered a major driver of domestic investment by contributing to GDP growth and reducing unemployment through job creation.
- **Annual GDP growth rate:** Closely related to foreign direct investment. Most previous studies indicated the significant impact of foreign direct investment on annual growth rate, which may be reflected in this study. It is assumed that GDP growth has a negative effect on unemployment rates.
- **Annual per capita GDP growth rate:** A negative relationship is also assumed between it and the unemployment rate in Algeria.
- **Domestic investment:** Defined as gross capital formation, it is considered one of the most important

Received: 01/03/2025 **Acceptance:** 01/05/2025 **Publication** : 01/07/2025

factors the state relies on to absorb unemployment, especially among youth. It is taken as a percentage of GDP.

- **Trade openness:** It is net exports minus imports, measured as a share of GDP. Net exports may contribute to increased labor productivity and alleviating unemployment.

Control Variables:

- **Number of mobile phone users:** Expressed as the number of mobile phone users (per 100 people), this variable reflects the level of infrastructure development in the country under study.
- A dummy variable was added for the years Algeria was affected by the COVID-19 pandemic: 2019, 2020, and 2021.

The following table includes all the study variables:

Table (1): Study Variables

Variable type	Variable name	Variable code
Dependent	Unemployment rate	UNMP
Independent	Foreign direct investment	FDI
Independent	Domestic investment	INVL
Independent	Trade openness	COM
Independent	Annual GDP growth rate	GDP
Independent	Annual per capita GDP growth rate	GDPP
Independent	Number of mobile phone users	MOB
Independent	Dummy variable	DUM

Source: Prepared by the researchers.

3. Study Model:

To study the short- and long-term effects of foreign direct investment on unemployment using the above-mentioned variables, the model takes the following mathematical form: UNMP=f(FDI,COM,INVL,MOB,GDP,GDPP,DUM)UNMP = f(FDI, COM, INVL, MOB, GDP, GDPP, DUM)UNMP=f(FDI,COM,INVL,MOB,GDP,GDPP,DUM)

4. Stationarity Test:

To determine the degree of integration of the basic variables and avoid the problem of spurious estimation in the model, we conduct a stationarity (unit root) test as a first step in the analysis using the Augmented Dickey-Fuller (ADF) test, which includes additional lags of the dependent variable in order to eliminate autocorrelation or spurious correlation, where lag length is determined in the case of constant, trend, or without them (GHEDABNA, 2019). By adopting the Phillips-Perron test, the results obtained were as follows:

Table (2): Stationarity Test Results Using PP Test

Series	At Level			First Difference		
	With Constant	With Constant and Trend	Without Constant and Without Trend	With Constant	With Constant and Trend	Without Constant and Without Trend
	T-value	Probability	Stationarity	T-value	Probability	Stationarity

Received: **01/03/2025** **Acceptance: 01/05/2025** **Publication** : **01/07/2025**

Series	**At Level**			**First Difference**		
UNMP	-0.92	0.77	No	-2.13	0.51	No
COM	-1.75	0.40	No	-1.53	0.80	No
FDI	-2.54	0.12	No	-2.25	0.45	No
GDP	-3.95	0.00	***	-3.88	0.02	**
GDPP	-3.59	0.01	**	-3.52	0.05	*
INVL	-1.34	0.60	No	-1.16	0.90	No
MOB	-0.57	0.86	No	-1.69	0.73	No

After First Difference

Series	**T-value**	**Probability**	**Stationarity**	**T-value**	**Probability**	**Stationarity**	**T-value**	**Probability**	**Stationarity**
D(UNMP)	-3.94	0.00	***	-3.90	0.02	**	-3.97	0.00	***
D(COM)	-5.01	0.00	***	-4.88	0.00	***	-5.09	0.00	***
D(FDI)	-7.78	0.00	***	-12.00	0.00	***	-7.94	0.00	***
D(GDP)	-10.18	0.00	***	-11.27	0.00	***	-10.32	0.00	***
D(GDPP)	-9.72	0.00	***	-10.25	0.00	***	-9.84	0.00	***
D(INVL)	-4.55	0.00	***	-4.51	0.00	***	-4.64	0.00	***
D(MOB)	-3.40	0.02	**	-3.34	0.07	*	-2.80	0.00	***

*Significant at 10%, **significant at 5%, ***significant at 1%*
Source: Prepared by the researchers using Eviews 12 software.

After studying the stationarity of the model variables through the unit root test, we found that all the study variables are stationary at first difference, except for the GDP growth rate and the per capita GDP growth rate, which

are stationary at level. Since the study variables are a mixture between I(0) and I(1), it requires us to rely on the ARDL methodology, which is considered the best for dealing with this type of models.

Cointegration Test and Bounds Methodology

The test relies on the F-STAT statistic, where the decision is made regarding the existence or non-existence of a cointegration relationship after comparing the F-STAT with the tabulated critical value. If the F-statistic is less than the critical value for which the variables are stationary at degree I(0), we accept the null hypothesis of no cointegration relationship. If the F-statistic is greater than the critical value for which the variables are stationary at degree I(1), we reject the null hypothesis and accept the alternative hypothesis of the existence of a cointegration relationship. However, if the F-statistic lies between the upper and lower bounds of the critical value, no decision can be made.

Table (3): Test of the Existence of Cointegration

Bounds Test for the Existence of Cointegration

Null Hypothesis: No Cointegration

N = 31, K = 7

Calculated Value F-STATISTIC: F = 15.05

Significance Level	**I(0)**	**I(1)**
10%	1.92	2.89
5%	2.17	3.21
1%	2.73	3.90

Source: Prepared by the researchers using Eviews 12 software.

From the results of the table above, we note that the calculated value F = 15.05 is greater than the critical values

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2.89, 3.21, 3.90 at the significance levels of 10%, 5%, and 1%, respectively. Therefore, we accept the alternative hypothesis of the existence of a cointegration relationship in the long run. Thus, the variables (FDI, COM, GDP, GDPP, MOD, INRL) explain the unemployment rate in the long term.

Short- and Long-Run Estimation and Error Correction Term

Table (4): Estimation Results in the Short and Long Run

Selected Model: ARDL(1, 0, 2, 1, 2, 2, 2, 2)

Sample: 1990 2022

Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic
C	0.722135	0.089299	8.086735
UNMP(-1)*	-0.776001	0.144487	-5.370730
COM**	-0.168694	0.059506	-2.834892
FDI(-1)	-0.061279	0.009977	-6.141718
INVL(-1)	-0.147319	0.063559	-2.317828
MOB(-1)	-0.000334	0.000202	-1.653259
GDPP(-1)	0.164462	0.024764	6.641274
GDP(-1)	-0.180539	0.026471	-6.820305
DUM(-1)	-0.206901	0.028052	-7.375694
D(FDI)	-0.028865	0.004702	-6.139389
D(FDI(-1))	0.023277	0.005354	4.347727
D(INVL)	-0.217604	0.074475	-2.921855
D(MOB)	-0.000735	0.000482	-1.525400
D(MOB(-1))	-0.001861	0.000415	-4.486717
D(GDPP)	-0.085764	0.045779	-1.873413
D(GDPP(-1))	-0.063216	0.045692	-1.383529
D(GDP)	0.085638	0.045505	1.881945
D(GDP(-1))	0.071302	0.045284	1.574570
D(DUM)	-0.049844	0.011144	-4.472954
D(DUM(-1))	0.153245	0.019673	7.789639

R-squared	0.996148	Mean dependent var	0.179195
Adjusted R-squared	0.989493	S.D. dependent var	0.077691
S.E. of regression	0.007963	Akaike info criterion	-6.573672
Sum squared resid	0.000698	Schwarz criterion	-5.648519
Log likelihood	121.8919	Hannan-Quinn criter.	-6.272095
F-statistic	149.7016	Durbin-Watson stat	2.558437
Prob(F-statistic)	0.000000		

Long term

Variable	Coefficient	Std. Error	t-Statistic
COMP	-0.217389	0.097063	-2.239657
FDIP	-0.078967	0.013268	-5.951705
INVLP	-0.189843	0.088205	-2.152307
MOBILE	-0.000431	0.000201	-2.142542
GDPPP	0.211935	0.035144	6.030434
GDPP	-0.232653	0.039291	-5.921321
DUM	-0.266624	0.056150	-4.748435
C	0.930585	0.135917	6.846729

EC = UNIMPP - (-0.2174*COMP -0.0790*FDIP -0.1898*INVLP -0.0004 *MOBILE + 0.2119*GDPPP -0.2327*GDPP -0.2666*DUM + 0.9306)

Source: Prepared by the researchers using Eviews 12.

Short run:

The results obtained from Table (4) indicate the significance of the study variables (COM, FDI, INVL), meaning that the aforementioned variables affect employment rates, and their signs are negative, which is consistent with economic theory; as an increase in these variables leads to a decrease in unemployment rates through the creation of new job opportunities. As for the variables (MOB, GDPP, GDP), they are not

Received: **01/03/2025** **Acceptance: 01/05/2025** **Publication** : **01/07/2025**
significant at the 5% level, which confirms that these variables do not affect the unemployment rate in the short run.

The result also shows that R2=0.9961R^2 = 0.9961R2=0.9961, meaning that the explanatory variables explain 99.61% of the dependent variable.

Long run:

The results obtained indicate that Foreign Direct Investment (FDI) is significant, meaning that it affects employment rates in the long run, and its sign is negative, which is consistent with economic theory, as a 1% increase in the rate of FDI leads to a 7.9% decrease in unemployment rates. This result indicates the strong effect of FDI on the labor market in Algeria, especially in the long run.

Regarding trade openness (COM), it is significant and negative, which proves the importance of foreign trade, as a 1% increase in foreign trade leads to a 21.74% decrease in the unemployment rate. This confirms the importance of foreign trade for Algeria, especially in the field of imports, given that Algeria's economy largely depends on imports. As for the annual growth rate of GDP, it is significant and negative, which is consistent with economic theory; that is, the increase in GDP leads to increased productivity and, consequently, to limiting unemployment by creating more job opportunities. A 1% increase in GDP leads to a 23.26% decrease in unemployment rates.

The results show that the annual growth rate of GDP per capita (GDPP) is significant, but its sign is positive, which contradicts economic theory, as a 1% increase in the growth rate leads to a 21.19% increase in unemployment rates. The explanation for this phenomenon is the lack of compatibility

between GDP growth rates and demographic growth rates, which is confirmed by examining the GDPP variable, which shows clear fluctuations between increase and decrease. **Domestic investment (INVL):** The results obtained show that domestic investment is not significant in the long run, whereas it was significant in the short run. This is due to the weak productivity of the Algerian economy, as it largely relies on a rentier economy and imports.

As for the control variable represented by mobile phone users, it is not significant, meaning that the percentage of mobile phone use in Algeria does not affect unemployment rates.

Error Correction Model (ECM):

From the results of Table (4), we note that the value U(−1)=−0.776U(-1) = -0.776U(−1)=−0.776, which is negative and significant (Prob: 0.00%). Since the coefficient is significant and the condition of negativity is satisfied, the error correction model is statistically acceptable, as deviations are corrected at a rate of 77.6% within a period of 1/0.776=1.281/0.776 = 1.281/0.776=1.28 years, i.e., 1 year, 3 months, and 10 days.

Model Quality Test:

Before determining the model's suitability for long-run correction and its reliability for forecasting in both the long and short run, it is necessary to verify the quality of its performance and its freedom from defects by conducting a series of tests. From Table (4), we observe that the Jarque-Bera coefficient JB=0.73JB = 0.73JB=0.73, with a probability value prob=0.6927prob = 0.6927prob=0.6927, which is

Received: 01/03/2025 **Acceptance:** 01/05/2025 **Publication** : 01/07/2025

greater than 5%. This means that the residuals of the model follow the normal distribution.

As for the autocorrelation test of the residuals, the LM test results show that F=1.28F = 1.28F=1.28 with a probability of 0.3234, which is greater than 5%, indicating that the residuals are independently distributed. To verify the homoscedasticity of the errors, we tested using the **Breusch-Pagan-Godfrey** test, which showed the following result: F=0.9627F = 0.9627F=0.9627 with a probability of 0.5496, which is greater than 0.05. This means we accept the null hypothesis that there is no problem of heteroskedasticity in the residuals.

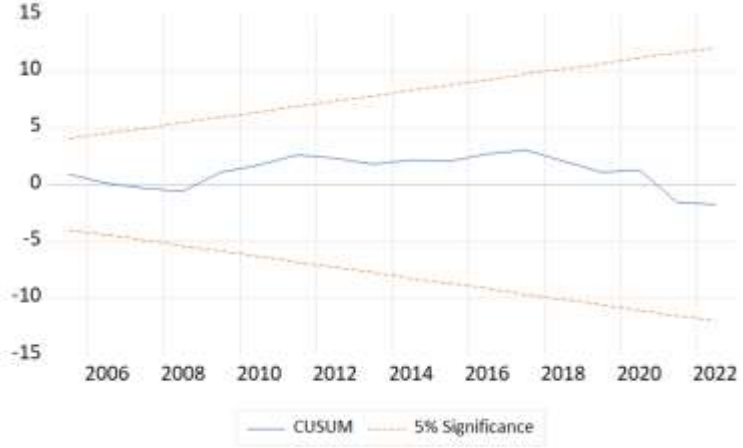
We also tested multicollinearity between the explanatory variables using **Klein's test** (Bourbonnais, 2018): Ry2<r2R^2_y < r^2Ry2<r2

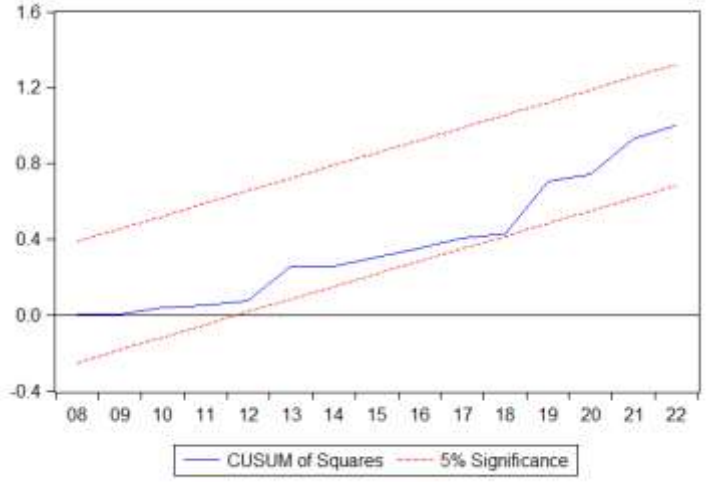
From the correlation matrix between the explanatory variables of the model, we find that the highest value is 0.9945, which represents the correlation between GDP growth rate and GDP per capita growth rate. This is less than R2=0.996R^2 = 0.996R2=0.996. Therefore, the model does not suffer from multicollinearity between the explanatory variables.

Structural Stability Test of the Model:

We tested the structural stability of the model using the **CUSUM** and **CUSUM of Squares** tests, and we obtained the results shown in the figure below:

Figure (01): Results of the structural stability test of the model





Source: Prepared by the researchers based on Eviews 12.

Received: **01/03/2025** **Acceptance: 01/05/2025** **Publication** : **01/07/2025**

From the above graph, we note that the central line lies within the boundary area at the 5% significance level in both tests. Therefore, it can be said that there is consistency in the model between the short-run and long-run results, meaning that the study model is structurally stable.

Conclusion:

Through this study, the effect of Foreign Direct Investment (FDI) on employment in Algeria was tested using the ARDL (Autoregressive Distributed Lag) model during the period (1990–2022). We expressed the employment variable by the unemployment rate. The preliminary stationarity tests allowed the use of this model, as all study variables were stationary either at level or at first difference. It was also found that the model is predictable after conducting the model quality tests.

The results obtained showed a strong effect of FDI on the employment rate in Algeria, with an inverse relationship between investment and unemployment, which is consistent with economic theory. A 1% increase in FDI leads to a 2.88% decrease in the unemployment rate in the short run, while in the long run an increase in FDI leads to a 7.9% reduction in unemployment rates, through the creation of both direct and indirect jobs.

It should also be noted that the effect of FDI is not independent of other factors, conditions, and variables, which were included in this study as important variables that, along with FDI, contribute to reducing unemployment rates and creating more jobs. The results clearly show the

impact of GDP on the economy in general and on employment in particular: a 1% increase in per capita GDP leads to a reduction in the unemployment rate by 8.57% in the short run and 21.19% in the long run. The important role of foreign trade in Algeria is also highlighted through the movement of exports and imports, as a 1% increase in trade openness reduces the unemployment rate in the long run by 21.73% and in the short run by 16.86%.

Accordingly, and in order to ensure a strong economy that guarantees permanent jobs for all segments of society, it is necessary to focus on creating a suitable environment to attract foreign investments and remove all obstacles to the movement of capital, especially with regard to customs duties on investments, whether material or in-kind. This requires reviewing all agreements concluded, whether with Arab or European countries, in addition to working on developing infrastructure, establishing the principles of governance, and reducing manifestations of corruption and bureaucracy to ensure a healthy climate capable of attracting more foreign capital and companies that contribute effectively to reducing the spread of unemployment and creating more jobs.

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Appendices

Appendix No. 01: Stationarity Test

UNIT ROOT TEST RESULTS TABLE (PP)
Null Hypothesis: the variable has a unit root

At Level

		UNIMPP	COMP	FDIP	GDPP	GDPPP	INVLP	MOBILE
With Constant	t-Statistic	-0.9217	-1.7480	-2.5387	-3.9501	-3.5902	-1.3386	-0.5677
	Prob.	***0.7681***	***0.3980***	***0.1162***	***0.0048***	***0.0117***	***0.5993***	***0.8642***
		n0	n0	n0	***	**	n0	n0
With Constant & Trend	t-Statistic	-2.1298	-1.5287	-2.2536	-3.8794	-3.5180	-1.1619	-1.6945
	Prob.	***0.5105***	***0.7982***	***0.4457***	***0.0249***	***0.0543***	***0.9015***	***0.7303***
		n0	n0	n0	**	*	n0	n0
Without Constant & Trend	t-Statistic	-0.7561	0.1898	-1.3649	-2.1475	-3.4094	-0.1039	0.6430
	Prob.	***0.3809***	***0.7348***	***0.1565***	***0.0325***	***0.0013***	***0.6402***	***0.8500***
		n0	n0	n0	**	***	n0	n0

At First Difference

		d(UNIMPP)	d(COMP)	d(FDIP)	d(GDPP)	d(GDPPP)	d(INVLP)	d(MOBILE)
With Constant	t-Statistic	-3.9394	-5.0123	-7.7875	-10.1766	-9.7202	-4.5466	-3.3982
	Prob.	***0.0050***	***0.0003***	***0.0000***	***0.0000***	***0.0000***	***0.0010***	***0.0188***
		***	***	***	***	***	***	**
With Constant & Trend	t-Statistic	-3.8951	-4.8767	-12.0080	-11.2681	-10.2495	-4.5104	-3.3361
	Prob.	***0.0244***	***0.0024***	***0.0000***	***0.0000***	***0.0000***	***0.0058***	***0.0792***
		**	***	***	***	***	***	*
Without Constant & Trend	t-Statistic	-3.9665	-5.0916	-7.9371	-10.3285	-9.8434	-4.6446	-2.8017
	Prob.	***0.0003***	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0067***
		***	***	***	***	***	***	***

Notes:
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

This Result is The Out-Put of Program Has Developed By:

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Appendix 02

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	15.05024	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
Actual Sample Size	31		Finite Sample: n=35	
		10%	2.196	3.37
		5%	2.597	3.907
		1%	3.599	5.23
			Finite Sample: n=30	
		10%	2.277	3.498
		5%	2.73	4.163
		1%	3.864	5.694

Appendix 03 results of estimations in the long and short terms

ARDL Long Run Form and Bounds Test
Dependent Variable: D(UNIMPP)
Selected Model: ARDL(1, 0, 2, 1, 2, 2, 2, 2)
Case 2: Restricted Constant and No Trend
Date: 07/28/24 Time: 20:37
Sample: 1990 2022
Included observations: 31

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.722135	0.089299	8.086735	0.0000
UNIMPP(-1)*	-0.776001	0.144487	-5.370730	0.0002
COMP**	-0.168694	0.059506	-2.834892	0.0162
FDIP(-1)	-0.061279	0.009977	-6.141718	0.0001
INVLP(-1)	-0.147319	0.063559	-2.317828	0.0407
MOBILE(-1)	-0.000334	0.000202	-1.653259	0.1265
GDPPP(-1)	0.164462	0.024764	6.641274	0.0000
GDPP(-1)	-0.180539	0.026471	-6.820305	0.0000
DUM(-1)	-0.206901	0.028052	-7.375694	0.0000
D(FDIP)	-0.028865	0.004702	-6.139389	0.0001
D(FDIP(-1))	0.023277	0.005354	4.347727	0.0012
D(INVLP)	-0.217604	0.074475	-2.921855	0.0139
D(MOBILE)	-0.000735	0.000482	-1.525400	0.1554
D(MOBILE(-1))	-0.001861	0.000415	-4.486717	0.0009
D(GDPPP)	-0.085764	0.045779	-1.873413	0.0878
D(GDPPP(-1))	-0.063216	0.045692	-1.383529	0.1939
D(GDPP)	0.085638	0.045505	1.881945	0.0866
D(GDPP(-1))	0.071302	0.045284	1.574570	0.1437
D(DUM)	-0.049844	0.011144	-4.472954	0.0009
D(DUM(-1))	0.153245	0.019673	7.789639	0.0000

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COMP	-0.217389	0.097063	-2.239657	0.0467
FDIP	-0.078967	0.013268	-5.951705	0.0001
INVLP	-0.189843	0.088205	-2.152307	0.0544
MOBILE	-0.000431	0.000201	-2.142542	0.0554
GDPPP	0.211935	0.035144	6.030434	0.0001
GDPP	-0.232653	0.039291	-5.921321	0.0001
DUM	-0.266624	0.056150	-4.748435	0.0006
C	0.930585	0.135917	6.846729	0.0000

EC = UNIMPP - (-0.2174*COMP -0.0790*FDIP -0.1898*INVLP -0.0004 *MOBILE + 0.2119*GDPPP -0.2327*GDPP -0.2666*DUM + 0.9306)

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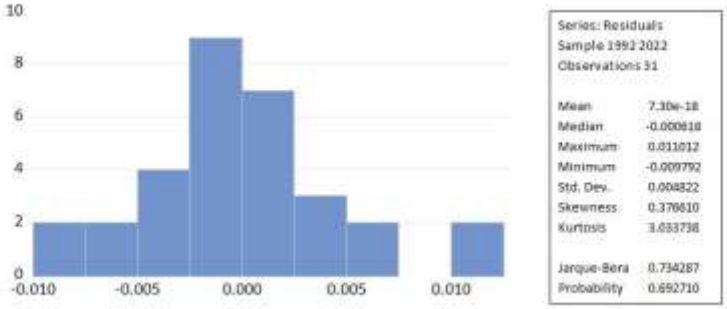
Appendix 04

Results of estng the pattern or model quality



Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.962793	Prob. F(19,11)	0.5469
Obs*R-squared	19.35902	Prob. Chi-Square(19)	0.4340
Scaled explained SS	2.478622	Prob. Chi-Square(19)	1.0000