

The Impact of Foreign Direct Investment on Economic Growth: Empirical Evidence from Algeria (1990-2021)**Driss Amira ^{1♦}, Ouahrani Abdelkrim ²**¹ Ain Temouchent University (Algeria), amira.driss@univ-temouchent.edu.dz² Ain Temouchent University (Algeria), abdelkrim.ouahrani@yahoo.fr**Received:** 12/12/2022**Accepted:** 27/04/2023**Published:** 20/05/2023**Abstract:**

This study aims to investigate the impact of foreign direct investment on economic growth in Algeria, based on annual data covering the period (1990-2021). To do this, we use the Autoregressive Distributed Lag (ARDL) co-integration framework, including five variables, which are Gross Domestic Product growth rate (GDPG), foreign direct investment (FDI), gross fixed capital formation (GFCF), inflation as measured by the price index (CP), and the official exchange rate (EXR). The results show the existence of a long-term co-integration relationship between the variables, and a negative statistically significant impact of foreign direct impact of investment on the economic growth rate in Algeria, as a result of the most of these investments being directed towards the extractive sector.

Keywords: foreign direct investment, GDP growth, ARDL, Algeria.**JEL Classification:** O33, C22, O4, N1

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1. Introduction:

The investigation into the factors that increase or hinder economic growth has been one of the central debates amongst theoretical and empirical growth researchers. It is regarded as fundamental requisite to economic development. There for Countries try to formulate, reformulate, changing and improving several policies in order to achieve the real growth. In fact the objective of every sovereign nation like Algeria is to promote economic growth and economic development but the challenge is, what determine economic growth? This question has been a challenging topic in all over the world. Many theoretical and empirical researches have been conducted to seek to understand this issue for the purpose of assisting governments in the formulation of plans and policies that can sufficiently bring economic growth and so economic development.

Meny empirical researches prove that a Strong performance of financial sector has a direct positive impact on economic growth since the efficiency of almost all macroeconomic variables such as foreign direct investment. This prompted many countries, especially developing countries, to search for foreign direct investment as one of the most important strategic tools that could contribute to reviving the local economy, which increased intense competition in attracting and stimulating foreign direct investment all over the world.

In Algeria where the financial sector is not strong enough, resulted to the very small contribution of the foreign direct investment on the economic growth of a nation, prompting her to carry out several radical economic and financial reforms; On the conditions for the exercise of economic and financial activity by the government and economic operators, in addition to the fiscal rules that aim to rationalize the tax and make it more simplified and transparent, as well as providing total and partial exemptions to attract foreign direct investment.

The fact that foreign direct investment is an important and vital element in economic life through its contribution to the revival of the economic and investment sector, this study came to examine the ability of the Algerian economy to attract foreign direct investment and its contribution to raising the rate of economic growth, through the following main question

Have Foreign Direct Investment real effect on Algerian Economic Growth during 1990-2021 ?

2. Literature Review:

Several empirical studies have been conducted to explain how economic growth can be attributed to Foreign Direct Investment; where most researchers focused on developing countries which looked at the effective role that Foreign Direct Investment plays in the economic life, as follow:

(Benanaya & Bakdi, 2017): This paper provides new approach to testing for the existence of a relationship between foreign direct investment (FDI) and economic growth in Algeria Using the Autoregressive Distributed Lag (ARDL) co-integration framework, based on annual data covering the period of 1980-2014. In order to verify the relationship between Foreign Direct Investment and economic growth in Algeria ; The results suggest that FDI have a positive impact on economic growth in the long-run. Proving that FDI can be deemed to be catalysts for economic growth in Algeria where an increase in one unite in

FDI leads to increase by 5% in GDP.

(Cherakrak & Gaham, 2020): The aim of this study is to analyze the Impact of foreign direct investment on economic growth in Algeria over the period 1990-2018 Using the Auto regressive Distributed Lag (ARDL). The study shows that in the short and long run, FDI has a significant negative effect on growth in Algeria. This means that foreign direct investment has a negative effect on the economic growth of Algeria. The study also found that local capital and imports have a positive effect on the economic growth in Algeria.

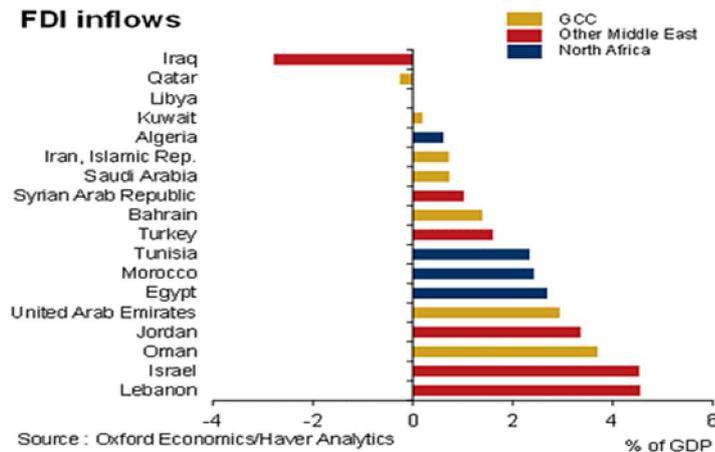
(Sarker & Khan, 2020): This study conducted an empirical analysis of the nexus between FDI and GDP in Bangladesh. To explore the relationship between the two variables, FDI and GDP this study used data series included annual data (in millions of U.S. dollar) for both FDI and GDP covering the period from 1972 to 2017. Using augmented ARDL bounds testing approach. The empirical results suggested that there was a long-run relationship between GDP and FDI in Bangladesh. In addition, the error correction model and Granger causality results indicated the presence of a unidirectional causality running from GDP to FDI. Therefore, the findings of this study have some crucial policy implications. The findings of the presence of short-run and long-run relationships and the causality running from GDP (economic growth) to FDI advocate for placing greater emphasis on policies that are appropriate to maintain a steady growth rate of GDP.

(Chaouachi & Balsalobre Lorente, 2022): This paper aiming to validate the existence of an N-shaped environmental Kuznets curve (EKC) relationship between the ecological footprint and economic growth in Algeria during the period 1975–2014. The proposed empirical model includes as additional explanatory variables the foreign direct investment (FDI) and the electricity consumption. Through the ARDL econometric approach, In the long run, the empirical results confirmed that the N-shaped EKC in Algeria is valid; reveals that FDI contributes to reducing the negative impact of fossil sources in the energy mix in Algeria through the transition to a cleaner energy mix pattern. These empirical results evidence the necessity of establishing suitable policies after the gold decade of the FDI in Algeria, being required to advance in this line to come-back to ascending levels of FDI after the financial crisis of 2008 and the current COVID-19 crisis. In this sense, policymakers should consider the advantages of FDI for promoting clean foreign investment, necessary for reaching a transition to sustainable development in Algeria.

3. The performance of foreign direct investment in Algeria:

Considering that foreign direct investment is an essential pillar of growth and diversification strategies in all developing countries, as it is a source of financing and a transmitter of knowledge, it has made the countries of the Middle East and North Africa region struggle to attract foreign direct investment. This can be seen in the following figure

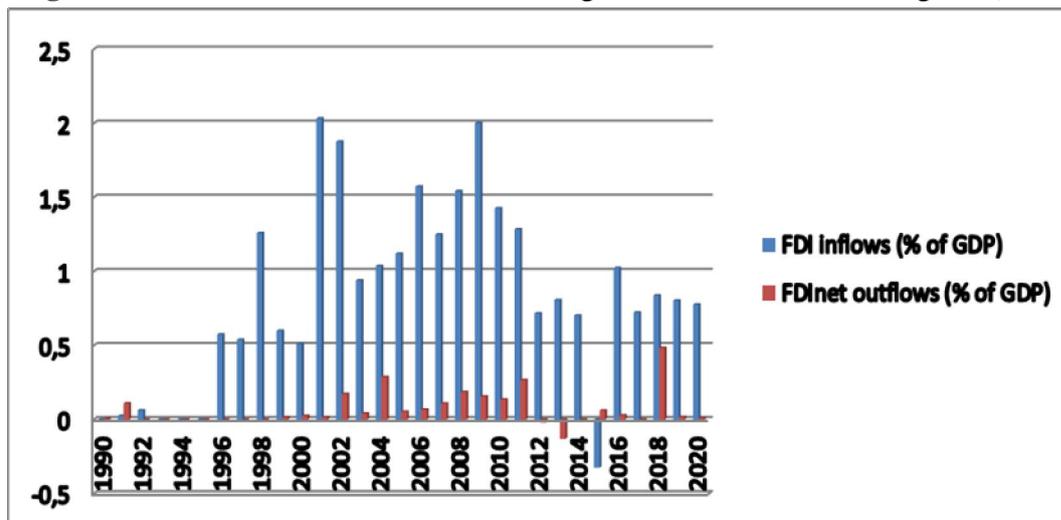
Figure 1. The inflows of foreign direct investment to MENA countries (2020):



Source: (Oxfordeconomics.com.)

Algeria is one of the developing countries that are working hard to improve its investment climate, and attracting foreign investments is one of its development plans. The following figure shows the percentage of foreign investment inflows and outflows during the period (1990-2020):

Figure 2. The inflows and outflows of foreign direct investment to Algeria (1990-2020):



Source: prepared by the Authors.

Economic reforms led to an improvement in the investment climate, but they were not sufficient. This is shown by the above curve, where it appears that the rate of FDI/GDP inflows experienced many fluctuations, recording the largest rate in 2009, estimated at 2%.

After that, it declined due to the severe crisis in 2015 as a result of the decline in oil rates, to rise again, reaching 0.78% in 2020, but it is always insufficient.

On the other hand, outflows of FDI can be considered null, where 2018 reached 0.48% as the largest value.

4. Methodology and Model Specification:

4.1 Data and Variables:

To estimate the impact of Foreign Direct Investment on economic growth in the Algerian economy, after reviewing many empirical literature (Falki, 2009) (Shaikh & Shaikh, 2012) we used an Autoregressive Distributed Lag (ARDL) co-integration framework, based on annual data covering the period of 1990-2021, including five key macroeconomic variables :

- Growth rate of gross domestic product (GDPG);
- foreign direct investment (FDI);
- gross fixed capital formation (GFCF);
- inflation rate measured by the price index (CP) that will allow us to monitor the evolution of the price level;
- the official exchange rate (EXR).

The variables and the period of analysis obtained from the World Bank.

4.2 Model Selection:

Recently, A large number of studies have used an alternative cointegration technique determine the long-term relationships between variables; known as the 'Autoregressive Distributed Lag (ARDL)' bound test, introduced by Pesaran and Shin (1996); Pesaran and Pesaran (1997); Pesaran and Smith (1998) and Pesaran et al. (2001)

The ARDL "Auto Regressive Distributed Lag/ARDL" modeling is a combination between AR autoregressive models (the models where among the explanatory variables we find past values of the variable to be explained), and stepped delay models or distributed lag DL (the models whose explanatory variables are: X_t and its past values). (Benyakoub & Es-salmani, 2021, p. 4). This model has three main features:

- The first, is that the ARDL test can be applied if the sample size is small, unlike most conventional co-integration tests that require that the sample size be large in order for the results to be more efficient is relatively more efficient in the case of small and finite sample data sizes. (Hakima, Adem, & Abbes, 2020, p. 45).

- The second, that approach can be applicable if running variables have ambiguous order of integration i.e. purely $I(0)$, purely $I(1)$ or $I(0) / I(1)$ which is not acceptable in traditional approaches. However, it requires that the dependent variable is of $I(1)$ in levels and none of the explanatory variables is $I(2)$ or higher). (Fatukasi, Olorunleke, Olajide, & Alimi, 2015)

- Finally, with the ARDL approach it is possible that different variables have different optimal numbers of lags (Pahlavan, Wilson, & Worthington, 2005, p. 8), and by applying the ARDL technique we obtain unbiased estimates of the long-run model. (Belloumi, 2013, p. 10)

The ARDL model takes a sufficient number of time lags to obtain the best set of data from the general frame model, and it also gives the best results for the parameters in the long run, as it enables us to separate the effects of the short-term from the long-term, as it enables to determine the integrity of the dependent variable and the independent variables in the long and short run in the same equation, in addition to determining the size of the effect of each of the independent variables on the dependent variable. The methodology used is

summarized in the following steps:

1. Order of Stationary of Series;
2. ARDL Model Estimation;
3. Bound Test;
4. Diagnostic Tests;
5. Parameters Stability Test.

5. Results analysis:

5.1 Order of Stationary of Series:

Many econometric studies (Stock & Watson, 1988) (C & Plosse, 1982) (J, 1991) (Yule, 1926) prove that time series of macroeconomic variables unstable resulting problem of Spurious Regression, this is shown by the misleading results obtained where R2 values are high even in the absence of a real relationship between the variables, and be sure of the stability of variables The study based on the Unit Root Test by using test (ADF) Augmented

Variables	Lag	ADF						Decision
		Intercept		Trend and Intercept		None		
		Level	1 st deff	level	1 st deff	level	1 st deff	
FDI	7	0.2110	***0.0000	0.2072	***0.0000	0.1931	** 0.0000	I(1)
GDP G	7	0.2274	***0.0000	0.1831	*** 0.0000	0.0516	*** 0.0000	I(1)
CP	7	0.4506	***0.0001	0.6903	***0.0004	0.1368	*** 0.0000	I(1)
EXR	7	0.8495	0.0058**	0.0575	**0.0306	0.9995	***0.0042	I(1)
GFCF	7	0.1644	***0.0000	0.2404	***0.0000	0.4442	***0.0000	I(1)

Dickey Fuller to test the stability of the time series so the null hypothesis is to contain the variable of time series the unit root (it is not stable) and we judge this hypothesis by observing the value of probability less than (0.05), it means that the calculated value of the statistic (ADF) bigger than the tabular value, which means refused the null hypothesis existence of unit root and stability of time series variables.

Table 1: ADF Unit Root Tests for variables

***, **, * Significant at levels 1%, 5%, 10%, successively.

Source: prepared by the Authors.

From the results obtained in the Table 1, shows that all economic variables except are not stationary at level, where the absolute values was less than the critical value for all variables which requires accepting the null hypothesis on the existence of a unit root, but after taking first difference all the variables has become stable (stationary) at the abstract level 5%, in other words, all variables are integrated of order I(1).

According to (Mamta, 2004), which sees that the (ADF) test is not able to distinguish well the statics of time series, so the Philips–Perron test will be conducted, which is characterized by its ability to give strong estimates in the case of series that have a series correlation and non-constant variance.

Table 2. PP Unit Root Tests for variables

Variables	PP						Decision
	Intercept		Trend and Intercept		None		
	Level	1 st deff	level	1 st deff	Level	1 st deff	
FDI	0.1934	***0.0000	0.2082	***0.0000	0.2671	** 0.0000	I(1)
GDP G	***0048.0	//	**0.0246	//	**0.0322	//	I(1)
CP	0.4697	***0.0001	0.6732	***0.0002	0.1354	*** 0.000	I(1)
EXR	0.8229	0.0063***	0.7364	***0.0334	***0.9957	***0.0057	I(1)
GFCF	**0.0128	//	0.0582	***0.0000	***0.0048	//	I(1)

***, **, * Significant at levels 1%, 5%, 10%, successively.

Source: prepared by the Authors.

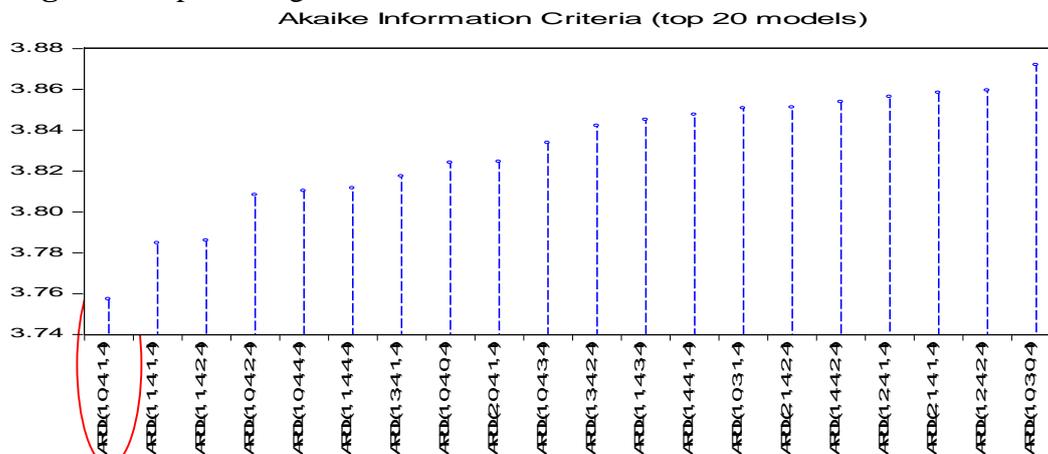
From the results obtained in the Table 2, shows that all economic variables except GDP growth and Gross Fixed Capital Formation are not stationary at level, where the probability was greater than (0.05), which requires accepting the null hypothesis on the existence of a unit root, but after taking first difference all the variables has become stable (stationary) at the abstract level 5%, in other words, all variables are integrated of order I(1), except GDP growth and Gross Fixed Capital Formation are stationary at level, where the probability was less than (0.05) which integrated of order I(0).

Through the obtained results and considering that the variables are integrated at I (0) and I (1), and considering that all the variables are not integrated at the second degree I (2), the null hypothesis that the variables are not integrated can be rejected. Therefore, an autoregressive lag time lag (ARDL) model will be used.

5.2 ARDL Model Estimation:

The appropriate lag order of variables should be determined before proceeding to the ARDL bounds testing approach to cointegration (Fatukasi, Olorunleke, Olajide, & Alimi, 2015). To visualize the optimal ARDL model, we extract the optimal lag graph according to the Akaike information criteria (AIC). The model that offers the smallest AIC value will be the best. In this case, ARDL (1 ,0,4,1,4) is the best.

Figure 2: Optimal lags



Source: prepared by the Authors.

Table 3. Unrestricted ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDPG (-1)	-0.159188	0.264986	-0.600742	0.5592
FDI	-2.80E-09	8.00E-10	-3.495519	0.0044
GFCF	0.217597	0.084198	2.584354	0.0239
GFCF (-1)	0.340862	0.082818	4.115799	0.0014
GFCF (-2)	0.264414	0.078911	3.350780	0.0058
GFCF (-3)	0.158111	0.074255	2.129291	0.0546
GFCF (-4)	0.112023	0.075702	1.479796	0.1647
CPI	0.060114	0.091310	0.658348	0.5227
CPI (-1)	0.125035	0.092800	1.347358	0.2028
EXR	-0.258322	0.088402	-2.922145	0.0128
EXR (-1)	0.379786	0.116561	3.258258	0.0069
EXR (-2)	-0.170354	0.098448	-1.730401	0.1092
EXR (-3)	0.165240	0.096570	1.711095	0.1128
EXR (-4)	-0.147696	0.067460	-2.189381	0.0491
C	2.359469	2.874659	0.820782	0.4278
Prob(F-statistic) 0.005920 Adjusted R-squared 0.659145 Durbin-Watson stat 2.966586				

Source: prepared by the Authors.

Table.3 reports the results of the unrestricted ARDL model. The adjusted R-squared is 0.659145 which implies that 66% of the GDP change is explained by independent variables, where the value of Fisher's probability value was 0.005920, which is less than 0.05 ; definitely rejects the null hypothesis that all regressors have zero coefficients for all cases.

5.3 Bound Test:

Bounds approach testing the existence of a long-run level relationship between a dependent variable and a set of regressors, The proposed tests are based on standard F- and t-statistics used to test the significance of the lagged levels of the variables in a first-difference regression. Two sets of asymptotic critical values are provided: one set assuming that all the regressors are I(1) and another set assuming they are all I(0). These two sets of critical values provide a band covering all possible classifications of the regressors into I(0), I(1) or mutually cointegrated Accordingly, various bounds testing procedures are proposed. This is a particularly relevant application as there is considerable doubt concerning the order of integration of variables. (Pesaran, Shin, & Smith, 1999, p. 1).

The bounds test for cointegration involves the comparison of f-statistics against the upper bound critical values I(1), and the lower bound critical values I(0), which are extracted from pesaran and pesaran 1997. To check for the cointegration by applying bound test using (1 ,0,4,1,4) model specification, the calculated f-statistic when export volume is the dependent variable $f=5.984325$ is higher than the upper bound critical value at the 5% significance level (tabelle4). This suggests that the null hypothesis of no cointegration cannot be accepted and that there exists cointegration relationship between variables.

(Seema & Nayaran, 2004, p. 106). Therefore, there is a long-run relationship between the GDPg and (FDI, CPI, GFCF, and EXR).

Table 4. ARDL Bounds Test

<i>Test Statistic</i>	<i>Value</i>	
F-Statistic	5.984325	
<i>Critical Value Bounds</i>		
Significance	I(0) Bounds	I(1) Bounds
10%	3.52	2.45
5%	4.01	2.86
2.5%	4.49	3.25
1%	5.06	3.74

Source: prepared by the Authors.

5.4 Diagnostic Tests:

Before estimating the long-run and short-run parameters, it is necessary to check for diagnostic tests to avoid the misleading conclusion. These test is performed to evaluate the robustness of our ARDL model the *no serial correlation* for no suffering from serial correlation. The results of diagnostic tests are reported in table 5. Also, Figure02 improve that there is no serial correlation.

Table 5. Diagnostic Tests

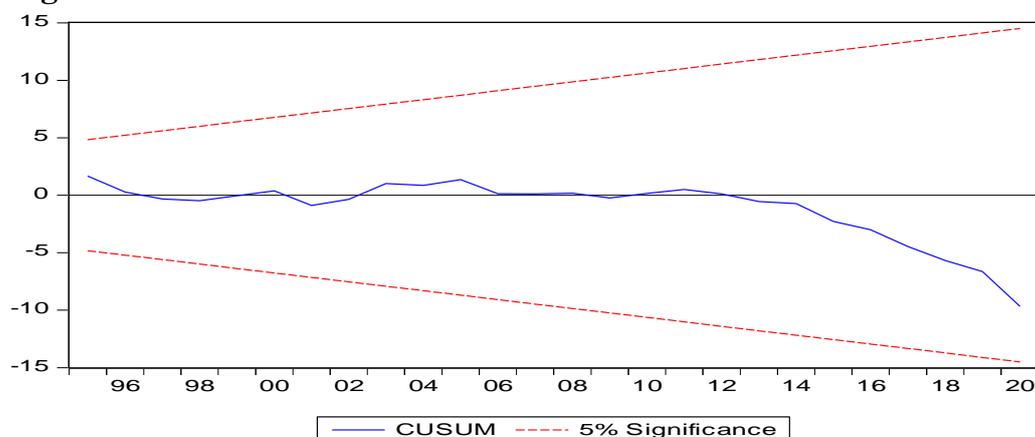
Test F	statistics (p-values)	Results
<i>Serial Correlation: Breusch-Godfrey LM Test</i>	2.272059 0.4503	<i>No serial correlation</i>

Source: prepared by the Authors.

5.5 Parameters Stability Test:

After making sure that there is no correlation between the residuals, it is also necessary to check the stability of the model because, the existence of a co-integration relationship between the variables does not necessarily mean that the estimated coefficients are stable.

Figure 4: CUSUM tests



Source: prepared by the Authors.

Through what was estimated in the above figure (3), and since the CUSUM line (the continuous line) is located between the two dashed lines or the confidence limits, the model is characterized by stability over time at a significant level of 5%, which confirms that the estimated parameters are stable throughout the study period, which allows for the next step.

Long –Run and Short-Run Dynamics:

In macroeconomics study, we give more importance to the long-run effects than those of the short-run. For this reason, we give a huge value in our study to the long-run relationship interpretation (Taallah & Chine, 2020, p. 7). The bound test finds long-run relationship between the GDPG and (FDI, GFCF, CPI and EXR). Therefore, long-run parameters are estimated and presented in Table 7.

Table 6. Short Run Dynamic

Variables	Coefficient
D (FDI)	-0.000000 0.0044
D(GFCF)	-0.112023 0.1647
D(CPI)	0.060114 0.5227
D(EXR)	0.147696 0.0491
CointEq(-1)	-1.159188 0.0009

Source: prepared by the Authors.

The results of the short-run model (presented in table 6) show that the error correction coefficient CointEq (-1) is negative and significant at 5% level, so there is an error correction mechanism. The CointEq coefficient -1.159188 implies that deviations from the long-term growth rate in GDP are corrected by 1.16% (that mean the speed of adjustment is 11.6 %). where (FDI) have a negative and significant effect on economic growth in the short run, and (GFCF) have a negative and no-significant effect on economic growth in the short run. In parallel, (CPI) have a positive and no-significant effect on economic growth in the short run, and (EXR) have a positive and no-significant effect on economic growth in the short run.

Table 7. Long Run Dynamic

Cointeq = GDPG - (-0.0000*FDI + 0.9429 *GFCF + 0.1597*CP -0.0270*EXR + 2.0354)	
Variables	Coefficient
FDI	-0.000000 0.0009
GFCF	0.942907 0.0003
CPI	0.159723 0.0925
EXR	-0.027042 0.2111

Source: prepared by the Authors.

On the other hand, this correction rate expresses the speed of adjustment towards equilibrium, in the sense that the growth rate of output takes approximately 4 years to reach its equilibrium value after the impact of any shock in the system (the model) as a result of the change in the independent variables. From the results shown in Table (06) according to the reference of the estimated parameters, it is noted that there is a positive and statistically significant effect of gross fixed capital formation on the rate of economic growth in the long run, while foreign direct investment notes that

there is a negative, non-existent effect on economic growth in the long run, However, the effect was weak and the resilience was low.

5.6 The Ramsey RESET Test:

In statistics, the Ramsey Regression Equation Specification Error Test (RESET) test is a general specification test for the linear regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is misspecified in the sense that the data generating process might be better approximated by a polynomial or another non-linear functional form.

Table 8. Ramsey (RESET) test

	<i>Vlue</i>	<i>df</i>	<i>Prob</i>
<i>t-statistic</i>	0.378013	11	0.7126
<i>F-statistic</i>	0.142893	(1, 11)	0.7126

Source: prepared by the Authors.

Table 8 showed that the probability of the F test is greater than 5%, which proves the validity and appropriateness of the functional form used in the estimate.

6. Conclusion:

This study worked on the impact of foreign direct investment on economic growth in the Algerian economy, during the period 1990-2021, and the study found:

- According to the estimation results of the ARDL model, as it appears that fisher probability is 0.005920, which is less than 5%, indicates the quality of the model and the ability of the independent variables to explain the dependent variable where The adjusted R-squared was 65.91 which implies that 65.91%, proved that the independent variables (foreign direct investment (FDI), gross fixed capital formation (GFCF), and inflation rate as measured by Prices (CP) and the official exchange rate (EXR).) were able to explain the dependent variable, which is economic growth.

- The ARDL test showed a significant negative impact of foreign direct investment on the rate of economic growth in the short and long term, which was contrary to expectations. The majority of foreign investments inflow into the Algerian economy are directed to the hydrocarbons sector, and this led to a significant negative impact on the Algerian economy and its structure, especially in recent periods as a result of the conflicting events that the entire world experienced.

- It also showed from the study that the total fixed capital formation had a significant positive effect for the short and long term, consistent with expectations, due to the great attention given by Algeria to improve its infrastructure, but it neglected the investment aspect that attracts foreign direct investments (acquisition of machinery and equipment, commercial and industrial buildings...etc).

Based on the findings of the research, the researcher came up with a set of suggestions and recommendations :

o Directing foreign direct investment inflows outside the hydrocarbon sector to avoid economic concentration.

o Work to remove economic and political obstacles that limit the flow of foreign direct investment to Algeria, given its active role in providing production sources that are not

available locally.

o Enhancing the rules and foundations on which the investment environment is based, to attract foreign direct investment.

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