



STANDARD MODELING of THE EFFECT OF FOREIGN TRADE ON ECONOMIC GROWTH IN ALGERIA DURING THE PERIOD (2000-2018) USING THE ARDL MODEL

Nassira Mehadjebia

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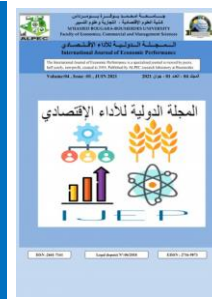
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STANDARD MODELING of THE EFFECT OF FOREIGN TRADE ON ECONOMIC GROWTH IN ALGERIA DURING THE PERIOD (2000-2018) USING THE ARDL MODEL



Nassira MEHADJEBIA

nassiramehadjebia123@gmail.com

University of Blida 2, Algeria

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Abstract:

This study aims to highlight the role of foreign trade in achieving a positive rate of economic growth in Algeria, due to the great importance of foreign trade and its role in the development of the national economy. The econometric modeling was adopted to study the impact of foreign trade on economic growth using the Autoregressive Distributed Lag (ARDL) model, and the study has finally demonstrated the existence of a short-term relationship between foreign trade and economic growth for the period (2000-2018) in Algeria.

Key words: Foreign trade, economic growth, Algerian economy, ARDL model.

JEL Classification Codes: F1.f43.

Introduction:

The development of foreign trade is due to the development of all aspects of life, from means of transportation in the first place to various technical and technological sciences, the development of financial and monetary policies, the emergence of unions and economic blocs, and the emergence of many global concepts supporting the working mechanism of the global trade system, such as the World Bank for Trade and Finance and others. A large number of thinkers and economists have been interested in the issue of foreign trade and economic relations between countries.

Economic growth is also one of the important and expressive indicators of the strength of the national economy. It has positive effects that make it contribute significantly to raising the level of social and economic well-being, which pushes countries to make it a major and pivotal goal that they seek to achieve, but the relationship between foreign trade and economic growth is represented in the contribution of exports and imports to the economic activity of any country, so there is a solid link between foreign trade and economic growth.

Algeria, like other countries, has worked hard to develop its foreign trade and raise its economic growth rates; through the various trade policies it has followed since independence until now, the most important of which was diversifying the structure of exports outside of hydrocarbons and always working to achieve a balance between exports and imports.

-The problem of the study: Through the above, the following problem can be posed:
To what extent does foreign trade contribute to economic growth in Algeria?

-To answer this question, we can put forward the following hypotheses :

- Foreign trade, both types of exports and imports, did not reach the required level due to the nature of the rentier economy and the focus of Algeria's exports on oil as a basic and only material;

- Export is the main determinant of economic growth in Algeria, given that abundant production is what forces countries to export the surplus and thus bring hard currency and achieve acceptable levels of goods and services for individuals within the region;
- There is a positive direct relationship between the volume of foreign trade and economic growth in the short and long term.

-The importance of the study: The importance of this study stems from the role played by foreign trade in advancing economic growth, as it is the main engine of economic growth, increasing the capabilities of the national economy and raising the standard of living of individuals. Hence the importance of foreign trade, as it works to strengthen relations between the countries of the world.

-Research objectives : The objectives of this study are crystallized as follows:

- Drop the light on the reality of the volume of foreign trade in Algeria;
- Analyzing indicators and variables that affect the rate of economic growth;
- Determine the nature of the relationship between the volume of foreign trade and its role in achieving and improving economic growth in Algeria, analytically and econometrically.

To answer the main question, the study was divided into the following topics:

- 1. Literature review - Presentation and analysis of previous studies -;
- 2. An entry point for foreign trade and economic growth;
- 3. Testing the cointegration relationship between foreign trade and economic growth in Algeria using the ARDL model.

1- LITERATURE REVIEW- PRESENTATION AND ANALYSIS OF PREVIOUS STUDIES: In this axis, a group of selected studies that are directly related to the topic of the article tagged with the title will be studied: The impact of foreign trade on achieving economic growth in Algeria for the period 2000-2018-, by highlighting its objective, the method used and the most important results reached, and in the end, previous studies will be compared on the current in the areas of similarities and differences in terms of what was highlighted above.

1.1- An article entitled: “Measuring the impact of foreign trade on economic growth for the period (1990-2020)”, January 2021: This study aims to show the importance of foreign trade in Algeria during the period from (1999-2018) as the main pillar upon which any economy depends, and to show the impact of foreign trade on macroeconomic variables as well as economic growth, and the study focused on the Algerian experience especially in light of the general endeavors of foreign trade policy, which is an important part and an essential component of economic policy after fiscal and monetary policy, and the descriptive analytical approach was used by evaluating the reality of foreign trade for the period (1990-2018), starting from the stage of controlling foreign trade for the period (1962-1970), and the Var autoregressive model was adopted in the applied study using the real values of all model variables in logarithm form for the period (1990-2018) in a million dollars.

The most important results obtained are:

- The autoregressive model showed that the imports parameter came with a negative value (-0.15), which leads to the one-way negative relationship in the long run between imports and the crude internal product, which is consistent with the economic theory, and that the exports parameter came with a positive value of +0.18 in the sense of having a positive effect on the dependent variable, an increase in exports by 10% leads to an increase in the gross domestic product by 1.8%, which proves the effectiveness of trade in promoting economic growth during the study;
- Foreign trade in Algeria did not reach the required level, as it did not achieve self-sufficiency, and it imports many times more than it exports, which made the trade balance always in a state of deficit due to the weak production base and investments in productive projects, and reliance only on the private sector fuels.

1.2-ZirarSomaya&Moussaoui Mohamed (June 2020): This study aims to address some of the economic effects that may result from economic integration agreements, especially the Greater Arab Trade Area Agreement. In light of the changes that the world has witnessed in the 20th century, it has become an imperative for countries to

work on developing their foreign trade movement, and the descriptive approach has been relied upon. Analytical, in order to show the most important characteristics of the Algerian economy, the stages of trade development until its accession to the Greater Arab Trade Area, and analysis of statistics related to the trade balance and the commodity and geographical distribution of Algeria's exports and imports.

The most important results obtained are:

- Orientation to regional blocs has become an inevitable necessity imposed by rapid global developments, which has led to overlapping markets and their breadth;
- Algeria's accession to the Greater Arab Free Trade Area is a way to develop its trade, as the region is an important market for access to Algerian products outside of hydrocarbons;
- During its accession period (2009-2017), Algeria achieved financial surpluses in the trade balance, but they quickly declined in the last years of the study;
- From its accession to the region, Algeria has achieved a set of advantages, such as those related to increased productivity and competition, but it remains somewhat weak as a result of its great connection to the hydrocarbon sector.

1.3- Doctoral thesis entitled: "The Impact of Foreign Trade Liberalization Policies on Economic Growth", 2019/2020: This study aims to determine the impact that foreign trade liberalization policies can have on economic growth, by studying the reality and diagnosing economic growth in Algeria, and finally an attempt to build a standard model in order to know this effect - the impact of trade liberalization policies on economic growth in Algeria - The descriptive approach was also adopted in the theoretical part of the study, and the use of the inductive approach and the necessary standard and statistical methods that allow studying the effects of liberalizing foreign trade policies on economic growth in Algeria, using the Eviews 12 program, which is in line with the nature of the topic. The study reached a set of results, which are summarized as follows:

- Despite many European and African agreements, they did not contribute much to encouraging exports, but rather led to an increase in their imports, especially luxury goods destined for consumption and not for construction.
- The Algerian economy is not subject to flexibility and actually entered the market economy, and this is based on preventing some materials from entering Algeria in order to reduce the import bill;
- Algeria still controls its economy on several variables such as the exchange rate, the flow of foreign currencies, which loses the credibility of laws, and thus the negative impact on attracting foreign direct investment, as 1.691 billion dollars were recorded in 2013, and 1.637 billion dollars in 2016.

The current study differed from previous studies in the type of standard study. There were those who carried out the analytical aspect of the reality of the two variables only, and there were those who conducted standard studies that reached the goal of prediction. As for the current study, the Autoregressive Distributed Lag (ARDL) model was used as one of the most models that show the nature of the relationship, whether direct or inverse. And whether it is short or long.

2- The relationship between foreign trade and economic growth: Foreign trade is the main engine of economic growth, as exports and imports of capital and intermediate goods make an effective contribution to the economic activity of any country. Therefore, there is a strong relationship between foreign trade and economic growth, and to highlight this relationship, the following points will be addressed:(AL-SARITI, A (2008))

2. 1. Positive effects of foreign trade on economic growth: The positive effects of foreign trade on economic growth can be illustrated in the following points: (ABDEL HAMID, A. (2006))

- Foreign trade can return to full exploitation for local resources that are unemployed in the absence of foreign trade;
- Foreign trade is a means or tool for transforming new ideas, new technology, managerial and non-management skills;

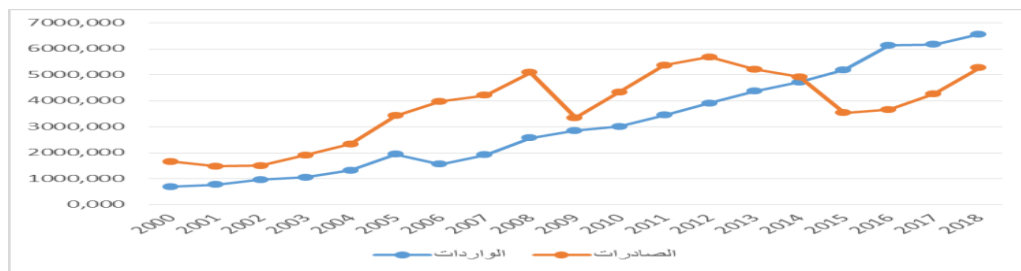
- Foreign trade stimulates and facilitates the international flow of capital from developed countries to developing countries; introducing new products and services;
- Providing products whose production has decreased locally due to labor migration to other sectors;
- Foreign trade can be an excellent weapon against monopoly because it stimulates local producers to be more efficient in facing foreign competition.

2. 2.The importance of exports in economic growth: The importance of exports in economic growth can be highlighted in the following points:(THE CUSTOMER, S (2015))

- The expansion of exports contributes to enabling countries to specialize in the production and export of goods and services in which they have a comparative advantage;
- The policy of expanding exports helps to overcome the difficulties experienced by many developing countries in their balance of payments and trade balance.
- Expansion of exports helps in improving the foreign capabilities of countries by activating the principle of competition among the available factors of production;
- Increasing the intensity of competition between local and foreign producers, which leads to an increase in inventions and to an improvement in production efficiency in all economic sectors.

2. 3. The relationship of imports with economic growth: Imports affect economic growth by providing capital goods and intermediate materials necessary to implement development programs and which lead to improving local productivity and raising the level of production, thus improving economic growth rates. With foreign capital through the transfer of advanced technology to economic growth, and on the other hand, imports are a burden on the economy, which affects the state's foreign exchange reserves. Therefore, a comprehensive plan is necessary that is able to balance the benefits and costs of imports to make the latter serve development goals. And the following figure1.shows the evolution of the volume of Algeria's exports and imports during the period (2000-2018). (HASSAN EL-SISI, P. (2014)), (SAFWA QABEL, M (2002))

Figure 1. The evolution of the volume of Algeria's exports and imports during the period (2000-2018) Unit: \$ million



Source: Prepared by the researcher based on the data of Appendix No. (1).

We note from Figure 1. that the years of the third millennium were characterized by a rise in Algerian exports, this is due to the high oil prices achieved during that period. In 2001, exports fluctuated compared to the year 2000. However, the balance of trade still achieved a surplus, and exports remained greater than imports in varying proportions in view of the oil boom until it reached its peak in 2008, when exports reached a record high. It was estimated at 5095.02 billion dollars, due to the record rise in oil prices, which reached 100 billion dollars per barrel.

And in 2009, the balance of trade balance declined compared to 2008 due to the repercussions of the global financial crisis and the drop in demand for oil. Despite the improvement, since 2012 the trade balance has declined under the double impact of the decline in exports and the rise in imports, despite the intervention of the authorities to devalue the currency and raise the exchange rate of the Algerian dinar to turn the equation. However, the renewed oil crisis had a direct impact on making the difference and the deficit in the trade balance Which was, of course, affected by the oil collapse in 2015, which was clearly reflected in the devaluation of exports and the rise in the import bill from 2015 to 2018. (HUSSEIN, H 2010), (NAJI HASSAN (2001)), (BOUFLIH, N. 2012)

3.COINTEGRATION TESTS BETWEEN FOREIGN TRADE AND ECONOMIC GROWTH IN ALGERIA USING THE ARDL MODEL: Before building the study model, we must first estimate the equation of the study and then study the stationarity of the time series if it is stationary at the first or even second level or difference, which is

one of the most important conditions of the Autoregressive Distributed Lag (ARDL) model, and then test the optimal slowdown periods as follows:

3.1-Building the study model

3.1.1. Estimating the equivalency of the study: We assume that the linear form of the model is of the following form:

$$Tc=f(XMt).....(1)$$

Where as: -1/ Tc : economic growth rate; -2/ XM : the ratio of the volume of foreign trade to the gross domestic product ($X+M/PIB$).

3.1.2.Augmented dickey-fuller test (ADF) Unit Root Testing: The degree of integration of the variables must be either $I(0)$ or $I(1)$, and Table No. 1 shows the degree of stationarity and the degree of integration of the time series under study based on the Phillips-Perron test, and we found that the variable (TC) is stationary at level, and the variable (XM) is stationary at first difference $I(1)$, and the following table shows the stationarity of the two series as follows:

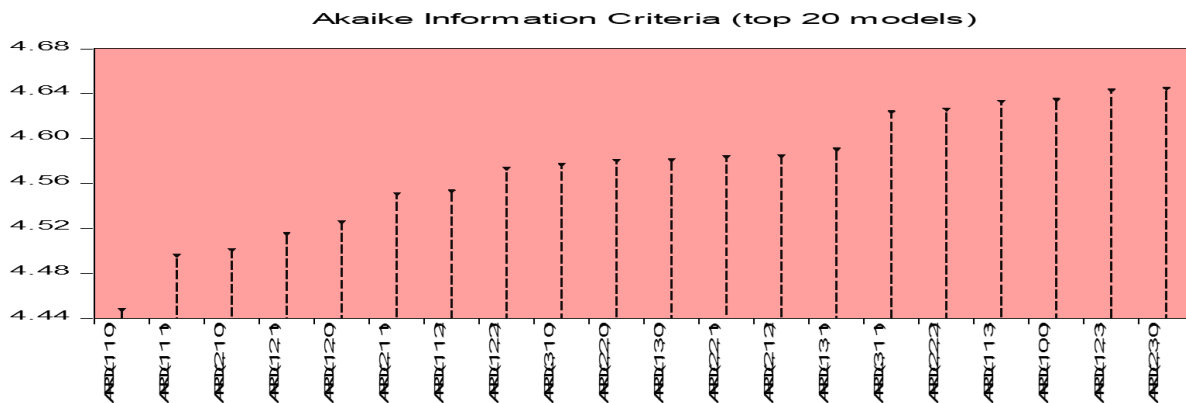
Table 1.Time Series Stationarity Test (Phillips-Perron Test)

Time series	Decision	Level			First difference		
		Constant	Constant direction and constant	Without constant direction and constant	Constant	Constant direction and constant	Without constant direction and constant
TC	$I(0)$	-3.90 (0.00)	-4.19 (0.01)	-1.64 (0.09)			
XM	$I(1)$	-0.07 (0.93)	-0.58 (0.97)	-0.97 (0.28)	-4.33 (0.00)	-8.76 (0.00)	-4.29 (0.00)

Source: see Appendices (2-3) Augmented Dickey-Fuller Test (ADF Test) Unit Root Test based on AIC Selection Criteria

3.1.3.Testing the optimal deceleration intervals for the model: Depending on the Akaike Information Criteria (AIC), the lag periods were determined, and it was found that (1,1) the ARDL model is the optimal model, as shown in the following figure:

Figure 2.Results of the Optimum lag periods Test



Source: Eviews output 12

3.2- Study the cointegration test and test the quality of the model: The step of the cointegration test comes as an essential step in the ARDL model, using the Bounds test methodology, with the aim of knowing the nature of the relationship between economic growth and the independent variable, then comes the step of testing the quality of the model by comparing the real values with the estimated ones.

3.2.1.Cointegration test using the Bounds Test: The table 3.below shows the results of the co-integration test using the Bounds Test methodology. The results indicate that the calculated value of F-statistic is greater than the critical values of the minimum and maximum at most levels of significance, and therefore we reject the null hypothesis which states that there is no relationship Co-integration of variables, which means that there is a long-term equilibrium relationship between economic growth and independent variables.

Table 3.Results of the Bounds Test

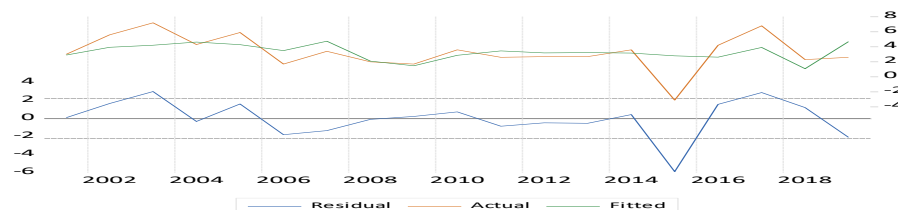
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic k	4.322441 1	10%	Asymptotic: n=1000 3.02	3.51
		5%	3.62	4.16
		2.5%	4.15	4.79
		1%	4.94	5.58
Actual Sample Size 19			Finite Sample: n=35	
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
			Finite Sample: n=30	
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

Source:Eviews output 12

3.2.2. Model Quality Test: Before adopting the ARDL (1,1) model in estimating the short and long-term effects, the quality of the performance of this model should be ascertained by using the following tests:

3.2.2.1. Model quality: In order to study the quality of the model, it is necessary to compare the real values with the estimated ones through the following figure3.:

Figure 3. Real and estimated values and residuals (model quality)

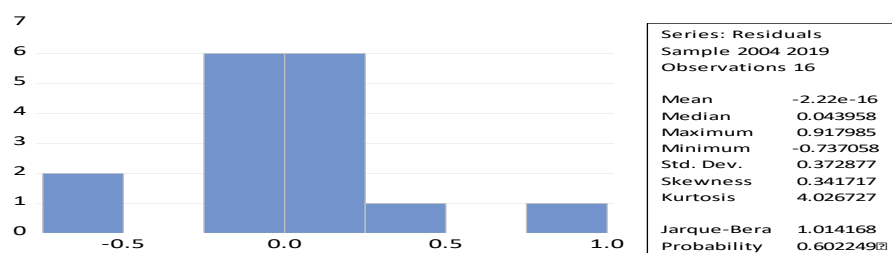


Source: Eviews output 12

Through the previous figure.3, we note that the estimated values are close to the real values, which indicates the quality of the estimated model, so it can be relied upon in the interpretation and analysis of the results.

3.2.2.2. Normal distribution of residuals: To verify the condition of a normal distribution we use Jarque-Bera, and it was found that the test result was not significant ($\alpha > 0.05$), which supports that the residuals are subject to a normal distribution, and through the value of J-B = 1.01 less than $\chi^2 = 5.99$, which confirms that the residuals of the model are subject to distribution normal, as shown in the following figure:

Figure 4. Normal distribution of residuals



Source: Eviews output 12

3.2.3. test self-correlation errors: To ensure that there is no autocorrelation, we use autocorrelation tests, as shown in the following table:

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 2 lags				Date: 06/12/21 Time: 12:01 Sample (adjusted): 2001 2019 Q-statistic probabilities adjusted for 1 dynamic regressor							
F-statistic	0.651069	Prob. F(2,13)	0.5377	Autocorrelation		Partial Correlation		AC	PAC	Q-Stat	Prob*
Obs*R-squared	1.729855	Prob. Chi-Square(2)	0.4211					1 -0.043 -0.043	0.0409	0.840	
								2 -0.203 -0.206	1.0109	0.603	
								3 -0.161 -0.189	1.6585	0.646	
								4 0.127 0.065	2.0854	0.720	
								5 -0.108 -0.179	2.4166	0.789	
								6 -0.025 -0.040	2.4359	0.876	
								7 0.074 0.050	2.6190	0.918	
								8 0.114 0.056	3.0900	0.929	
								9 0.069 0.140	3.2794	0.952	
								10 -0.266 -0.234	6.4235	0.779	
								11 -0.024 0.005	6.4524	0.842	
								12 -0.167 -0.282	8.0503	0.781	
Test Equation: Dependent Variable: RESID Method: ARDL Date: 06/12/21 Time: 12:01 Sample: 2001 2019 Included observations: 19 Presample missing value lagged residuals set to zero.				*Probabilities may not be valid for this equation specification.							

From the previous table.4, we note that all the columns within the confidence domain and the Q-Star test statistic are not significant, and according to the LM test, the Prob chi-square is greater than 0.05, and therefore we accept the null hypothesis that there is no autocorrelation.

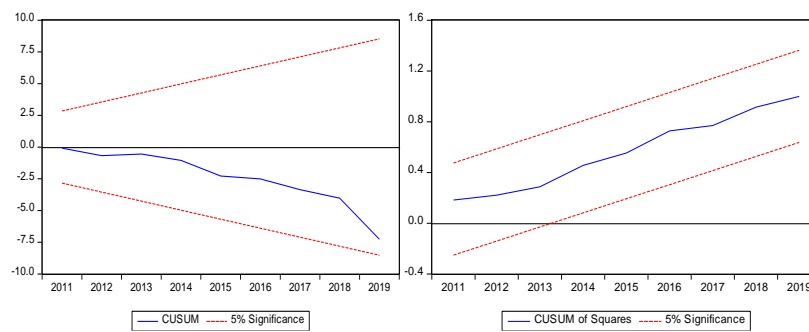
Table 5. Results of the variance instability test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	0.174244	Prob. F(3,15)	0.9122
Obs*R-squared	0.639831	Prob. Chi-Square(3)	0.8873
Scaled explained SS	0.811777	Prob. Chi-Square(3)	0.8466
<p>Test Equation:</p> <p>Dependent Variable: RESID^2</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 11:57</p> <p>Sample: 2001 2019</p> <p>Included observations: 19</p>			

According to this test, the Prob F is greater than 0.05, which means that F is not significant, and therefore we accept the null hypothesis which states that the variance is stable.

3.3.1. Stability test: In order to ensure that the data used is free of any structural changes in it, one of the tests shown in the following figure5.must be used:

Figure 5. Model stability test results



Source:Eviews output 12

The graphic above representation In both the CUSUM Test, and the CUSUM of Squares Test within the critical limits at the 0.05 level, we accept the stationarity of the model.

3.3.2. Estimating model relationship using ARDL: In this element, we will discuss the estimation of the relationship of the studied model between the volume of foreign trade expressed in the ratio of foreign trade in relation to the gross domestic product and the rate of economic growth, with the aim of knowing the relationship in the short and long terms.

3.3.2.1. Estimating the short-term impact using the ARDL model: Annex 4. shows the positive impact of the volume of foreign trade on economic growth, as the higher the volume of trade by 1%, the higher the economic growth by 3.59%, which is consistent with the economic theory and previous studies that have been studied, which confirm that the exploitation of foreign trade resources in sectors that contribute to Increasing economic growth rates directly support economic growth. It can also be said that there is a short-term dynamic relationship between economic growth and independent variables, this is due to the estimated negative and statistically significant error whose value was ($CointEq(-1) = -0.82$), which measures the proportion of imbalance in the dependent variable that can be corrected from one time period to another, and the negative sign supports the existence of a long-term equilibrium relationship between the variables.

3.3.2.2. Estimating the long-term impact using the ARDL model: Annex 5. shows that the volume of foreign trade affects economic growth, but it is not statistically

significant, and therefore there is no effect of total exports on long-term economic growth.

Conclusion: Foreign trade is one of the most important pillars of the national economy of any country. It is responsible for providing individuals' needs of goods and services and on the other hand, it provides hard currency that strengthens the local currency against it and enhances the purchasing power of individuals. It is also one of the important indicators that work on improving economic growth, which is considered the most important indicator that measures the state's production of goods and services during a specific period, usually a year.

Results: By analyzing the various theoretical and applied aspects using the ARDL model for the subject of our study, according to the data and statistics available to us, we reached a number of results as follows:

- Foreign trade in Algeria contributed by increasing the volume of exports abroad contributes at high rates to the development and improvement of the national economy, and this is through its contribution to raising economic growth rates;
- Foreign trade in Algeria recorded high export rates in some years that witnessed high levels of fuel prices, as it is the most important financial resource for Algeria, which contributes more than 94% to the growth of the Algerian economy, and in years foreign trade witnessed weak levels coinciding with the decline in fuel prices in global markets;
- Economic growth rates have known a decline in Algeria, and this is due to the weakness of the Algerian economic sectors, especially the producers, and this is because economic growth is based only on the hydrocarbon sector as a basic material;
- The stationarity of the time series of economic growth at level. As for the series of the ratio of foreign trade to the gross domestic product, it was stationary at first difference, which is considered as a condition for using the ARDL model;
- There is a direct short-term relationship between the volume of foreign trade and the rate of economic growth, as the greater the volume of foreign trades by 01%, the higher the economic growth rate by 3.59%;

- The volume of foreign trade affects economic growth, but it is not statistically significant, and therefore there is no effect of total exports on long-term economic growth.

Recommendations and suggestions: Finally, the study reached a set of recommendations and suggestions that would develop foreign trade and thus reflect positively on economic growth rates, which we summarize as follows:

- Algeria must pay attention to the development of the productive sectors in order to achieve an effective production abundance that contributes to raising the volume of exports, which deposits positively on economic growth rates;
- Working to improve foreign trade transportation services to improve exchanges, which contributes to raising the volume of exports and thus achieving surpluses in the trade balance that reflects the development of economic growth in Algeria?
- Working to provide a stimulating and attractive investment environment for foreign direct investment. These investments help the national economy to implement real productive projects that would raise the productive base of the Algerian economy;
- Working to direct economic reforms towards real productive investments by attracting foreign investors and encouraging them to invest in productive projects and gain experience, as it provides the country concerned with entering hard currency, thus increasing the state's foreign currency reserves.

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MEHADJEBIA Nassira

Appendices:

Annex 1. The volume of Algeria's exports and imports during the period (2000-2018) Unit: \$ million

Years	2000	2001	2002	2003	2004	2005	2006
Import	690.24	764.86	957.04	1047.44	1314.4	1943.64	1558.54
Export	1657.21	1480.33	1501.19	1902.05	2337.44	3421.54	3979.01
Years	2007	2008	2009	2010	2011	2012	2013
Import	1916.82	2572.03	2854.80	3011.80	3442.5	3907.07	4368.54
Export	4214.16	5095.02	3347.6	4333.58	5374.13	5687.36	5217.1
Years	2014	2015	2016	2017	2018	2019	2020
Import	4719.7	5193.4	6139.4	6170.5	6567.60	-	-
Export	4917.5	3537.18	3655.7	4272.1	5274	-	-

Source: Prepared by the researcher based on the data of the World Bank

www.bankdawl.dz

Annex 02. TC .Stationarity Series Tests

<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. Prob.*</p> <p>Phillips-Perron test statistics</p> <p>Test critical values</p> <p>MacKinnon (1996) one-sided p-values</p> <p>Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19</p> <p>Residual variance (no correction)</p> <p>HAC corrected variance (Bartlett kernel)</p> <p>Phillips-Peron Test Equation</p> <p>Dependent Variable: $\Delta \ln Y_{it}$</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 12:26</p> <p>Sample (adjusted): 2001 2019</p> <p>Included observations: 19 after adjustments</p> <p>Variable Coefficient Std. Error t-Statistic Prob.</p> <p>Intercept -0.29991 -0.09128 -3.3442</p> <p>Adjusted R-squared 0.00118</p> <p>S.E. of regression 0.10021</p> <p>Sum squared resid 1.71106</p> <p>Log likelihood -1.75484</p> <p>F-statistic 1.91231</p> <p>Durbin-Watson stat 2.05416</p>	<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. Prob.*</p> <p>Phillips-Perron test statistics</p> <p>Test critical values</p> <p>MacKinnon (1996) one-sided p-values</p> <p>Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19</p> <p>Residual variance (no correction)</p> <p>HAC corrected variance (Bartlett kernel)</p> <p>Phillips-Peron Test Equation</p> <p>Dependent Variable: $\Delta \ln Y_{it}$</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 12:26</p> <p>Sample (adjusted): 2001 2019</p> <p>Included observations: 19 after adjustments</p> <p>Variable Coefficient Std. Error t-Statistic Prob.</p> <p>Intercept -0.18027 -0.18163 -0.99252 0.3481</p> <p>Adjusted R-squared 0.00000</p> <p>S.E. of regression 0.10021</p> <p>Sum squared resid 1.71106</p> <p>Log likelihood -1.75484</p> <p>F-statistic 1.91231</p> <p>Durbin-Watson stat 2.05416</p>	<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. Prob.*</p> <p>Phillips-Perron test statistics</p> <p>Test critical values</p> <p>MacKinnon (1996) one-sided p-values</p> <p>Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19</p> <p>Residual variance (no correction)</p> <p>HAC corrected variance (Bartlett kernel)</p> <p>Phillips-Peron Test Equation</p> <p>Dependent Variable: $\Delta \ln Y_{it}$</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 12:26</p> <p>Sample (adjusted): 2001 2019</p> <p>Included observations: 19 after adjustments</p> <p>Variable Coefficient Std. Error t-Statistic Prob.</p> <p>Intercept -0.03734 -0.17884 -0.20911 0.8410</p> <p>Adjusted R-squared 0.00000</p> <p>S.E. of regression 0.10021</p> <p>Sum squared resid 1.71106</p> <p>Log likelihood -1.75484</p> <p>F-statistic 1.91231</p> <p>Durbin-Watson stat 2.05416</p>	<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. Prob.*</p> <p>Phillips-Perron test statistics</p> <p>Test critical values</p> <p>MacKinnon (1996) one-sided p-values</p> <p>Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19</p> <p>Residual variance (no correction)</p> <p>HAC corrected variance (Bartlett kernel)</p> <p>Phillips-Peron Test Equation</p> <p>Dependent Variable: $\Delta \ln Y_{it}$</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 12:26</p> <p>Sample (adjusted): 2001 2019</p> <p>Included observations: 19 after adjustments</p> <p>Variable Coefficient Std. Error t-Statistic Prob.</p> <p>Intercept -0.03734 -0.17884 -0.20911 0.8410</p> <p>Adjusted R-squared 0.00000</p> <p>S.E. of regression 0.10021</p> <p>Sum squared resid 1.71106</p> <p>Log likelihood -1.75484</p> <p>F-statistic 1.91231</p> <p>Durbin-Watson stat 2.05416</p>	<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. Prob.*</p> <p>Phillips-Perron test statistics</p> <p>Test critical values</p> <p>MacKinnon (1996) one-sided p-values</p> <p>Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19</p> <p>Residual variance (no correction)</p> <p>HAC corrected variance (Bartlett kernel)</p> <p>Phillips-Peron Test Equation</p> <p>Dependent Variable: $\Delta \ln Y_{it}$</p> <p>Method: Least Squares</p> <p>Date: 06/12/21 Time: 12:26</p> <p>Sample (adjusted): 2001 2019</p> <p>Included observations: 19 after adjustments</p> <p>Variable Coefficient Std. Error t-Statistic Prob.</p> <p>Intercept -0.03734 -0.17884 -0.20911 0.8410</p> <p>Adjusted R-squared 0.00000</p> <p>S.E. of regression 0.10021</p> <p>Sum squared resid 1.71106</p> <p>Log likelihood -1.75484</p> <p>F-statistic 1.91231</p> <p>Durbin-Watson stat 2.05416</p>	<p>Null hypothesis: β_0 has a unit root</p> <p>Exogenous: Constant, Linear Trend</p> <p>Bandwidth: 7 (Newey-West automatic) using Bartlett kernel</p> <p>Adj. R-Sqr. 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