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Trade openness and economic growth in Algeria : An empirical analysis based on ARDL model

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Abstract :

Through this research paper we have tried to analyze, theoretically and empirically, the nature of the link between trade openness, real exchange rate, inflation and economic growth, in Algeria using tests and the autoregressive distributed lag (ARDL) cointegration framework , during the period 1990-2018 and this was done using a program, called E-Views9. The empirical results based on the bounds testing procedure found that a long-run relationship between trade opennes , real exchange rate, inflation and economic growth exist and found a negative and statistically significant impact of trade openness on economic growth in the short and long run.

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Introducion

The theoretical basis for trade openness goes back to the classic debate on specialization including Adam Smith[1] (1776) and David Ricardo[2](1817). Since then, numerous studies have been devoted to the discovery and the effects of openness on economic growth. Historical experience, particularly that of the 18th century, suggests that the extension of economic freedoms is a condition for growth.

In the early 1840s, Friederich List[3], refuted the thesis that free trade was profitable for all nations involved in international trade: in fact, the most developed countries captured the gains of free trade at the expense of weak countries industrialized. In the 19th century, Eli Heckcsher[4] (1919) and Bertil Ohlin[5] (1933) note that foreign trade leads to maximizing individual and global production, to increasing incomes and savings in order to reach greater capital and on this to access more strong growth compared to that of countries which have not opened up to international trade. Rodriguez and Rodrik[6] (1999) raise skeptical concerns about the strength of the argument for the beneficial effects of openness. Ben-David, D and Kimhi A[7]., (2000) argue that "trade is good for growth". International trade is important to stabilize and promote economic growth[8] (see, for example, H.Thanh-Tung, 2015).

There are number of reasons why being open to international trade leads to economic growth. Because openness to international trade stimulates innovation and efficient production, gains from specialization and trade, and adoption of sound policies to make sure the country is attractive to the foreign investors.

The objective of this work is to answer the following question: what is the impact of trade openness on economic growth in Algeria during priod 1980-2018?

I. Literature Review

The link between international trade, often assimilated to the increase in foreign trade, and economic growth, measured by the change in GDP, is the subject of numerous theoretical and empirical works.

Given the breadth of economic literature on each of the two relationships, it is impossible to cite all of the existing work, so we are only referring to those that we consider to be the most significant. The importance of trade opening for a country was mentioned by David Ricardo (1817) in his theory of comparative advantages. The author has shown that international trade allows a differentiation of relative production costs, a reorientation of scarce resources towards the most efficient sectors and an improvement in the well-being of the population. This theory was later extended by Heckscher and Olin (1933). These authors have come to confirm these gains by adding those linked to the remuneration of the factors of production. Solow's[9] (1956) analysis has shown that a country's trade policies do not affect economic

[1] Adam,S.(1776), «An inquiry into the nature and causes of the wealth of nations », first EDITION of London. ISBN : 1-9056-4126-5, p257.vol.1.

[2] Ricardo D.(1817), « On the principles of political economy and taxation », 3rd edition 1821, Batoche Books, Kitchner, Ontario, Ontario, 2001.

[3] List,F. (1840) , « The national system of political economy by Friedrich List»,trans. Sampson S. LIoyd, with an introduction by J. Shield Nicholson (London : Longmans, Green and Co.,1909).

[4] Heckscher, Eli. 1919. "The Effect of Foreign Trade on the Distribution of Income." In Ekonomisk Tidskrift. p. 497-512.

[5] Bertil ohlin (1933), « interregional and international trade » , cambridge, harvard university press , pp 617

[6] Rodriguez F. and D. Rodrik , (1999), "Trade policy and economic growth: a skeptic's guide to the cross-national evidence", *NBER,* WP 7081.

[7] Ben-David, D and Kimhi A., (2000). "Trade and the rate of income convergence," Journal of International Trade & Economic Development, Taylor and Francis Journals, vol. 13(4), pages 419-441.

[8] Tung, L. T., & Thanh, P. T. (2015), « Threshold in the relationship between inflation and economic growth: Empirical evidence in Vietnam ». Asian Social Science, 11(10), 105–112.

[9] Solow,R., (1956), "A Contribution to the Theory of Economic Growth", The Quarterly Journal of Economics, Vol 70, N° 1,

growth because it is explained by exogenous factors. Kaldor[10](1970) analyzed the relationship between trade openness and economic growth where he found that external trade demands and economic growth are important elements that determine production in a country. Young[11] (1990) has shown that trade opening for developing countries appears to be more disadvantageous than beneficial for economic growth, while for developed countries appears to be more beneficial. The nature of the link between foreign trade and growth is clarified through the exchange rate : Busson and Villa[12] (1997).

Other authors such as Krugman[13] (1987), (Lucas[14] (1988), Acemoglu and Zilibotti[15] (2001), Banerjee and Newman[16] (2003) show that openness is not always favorable for growth. It can push developing countries towards specialization in low-productivity sectors with a total negative impact on growth. Grossman and Helpman[17] (1991) show that the most open economies grow at a faster rate than those which are protectionist, trade drives productivity and growth by providing a wider range of intermediate inputs, as it facilitates the international diffusion of technology (Benhabib et Spiegel[18], 1994; Coe et Helpman[19], 1995; Eaton et Kortum[20],1996). Xavier Sala i Martín[21] (2002), The idea that international trade is the engine of economic growth is not new. In the case of a large country influencing world pricing, unilateral liberalization can have a negative impact (Verdier[22], 2004). According to (Stiglitz[23], 2005), a focus of economic research on how the differences between countries influence their experience of trade opening, as well as on how to best adapt trade policies to the specific situation of each country is desirable. An IMF report shows that more recent microeconomic studies describe several ways in which openness leads to increased productivity, we can cite as an example the importation of machinery and equipment which is generally accompanied by a transfer of know-how. However, this literature has not led to any definite conclusion, some studies even estimating that the growth of developing countries having practiced structural adjustment is lower on average than that of the others (Barro and Lee[24], 2001).

Openness to trade is seen as having a positive impact on economic growth primarily by facilitating technology spillovers, which, in turn, would increase productivity, international competitiveness, and export revenues. Some articles, such as Ulason[25] (2013),

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P 66 -68.

[10] Kaldor, N. (1970). The Case for Regional Policies. Scottish Journal of Political Economy. November.

[11] Young, A. W., Ellis, H. D., Szulecka, T. K., *et al*,(1990). « Face processing impairments and delusional misidentification». *Behavioural Neurology*, 3, 153–168.

[12] Busson F., Villa P. (1997), "Croissance et Spécialisation", Revue Economique, 48(6), p. 1457-83.

[13] Krugman ,P,R,.(1987), « Is free trade passe », Journal of Economic Perspectives. Vol.1,n°2,pp.131-144.

[14] RE Lucas, On the mechanic of economic development, J. Monet. Econ., Vol. 46, No. 1, 1988, pp. 167-182.

[15] Acemoglu,D and Zilibotti,F. (2001), « PRODUCTIVITY DIFFERENCES », The Quarterly Journal of Economics, by the President and Fellows of Harvard College and the Massachusetts Institute of Technology.

[16] Banerjee, A, V and Newman A,F,. (2003), « Inequality, Growth, and Trade Policy », November.pp 1-16 .

[17] GM Grossman and E Helpman, Innovation and Growth in the Global Economy, MIT Press, Cambridge, MA, 1991.

[18] Benhabib, J. and M. M. Spiegel (1994), 'The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-country Data', Journal of Monetary Economics, 34, 2, 143–73.

[19] Coe, D. T. and E. Helpman (1995), 'International R&D Spillovers', European Economic Review, 39, 5, 859–87.

[20] Eaton, J. and S. Kortum (1994), 'International Patenting and Technology Diffusion', Working Paper No. 4931, Cambridge, MA: National Bureau of Economic Research.

[21] Sala-i-Martin, X. (2002), "The Disturbing 'Rise' of Global Income Inequality", NBER Working Paper 8904, April.

[22] Verdier T. (2004), « Socially Responsible Trade Integration; A Political Economy Perspective »,Communication à la Conférence ABCDE Europe, Bruxelles, April.

[23] Stiglitz, Joseph E. et Charlton A. (2005), *Fair Trade For All ; How Trade Can Promote Development*, New York : Oxford University Press.

[24] Barro, R.J. and Lee, J.W. (2001). « International Data on Educational Attainment : Updates ans implications », Oxford Economic Papers, vol.53 (3), pp 1-27.

[25] Ulason, B. (2014). Trade openness and economic growth: panel evidence. Applied Economics Letters, 22(2), 163–167.

have shown that lower trade barriers are not associated with economic growth. This question has received different answers; the economic history of each country or region cannot be the same; the experience of developed countries is very different from that of developing countries recently opened up to world trade.

Touitou [26](2016) showed that by reducing tariffs, domestic output increase in almost all the sectors, but government revenue and savings decline significantly.

Kurihara et Fukushima[27] (2016) Kurihara and Fukushima did a comparative study on developed and developing countries and concluded that foreign trade is bad for developing economies for the benefit of developed ones.

According to Biao[28](2017), the WAEMU countries are not benefiting from the positive effects of trade liberalization initiated through the deepening of regional integration and the launch of the common external tariff (CET). Looking at the countries of West and Central Africa,

Agbahoungba and Thiam[29] (2018) found that foreign trade has a negative effect on the economic growth of countries in the ECOWAS zone.

II. Empirical review

The theoretical work has failed to decide on a favorable or unfavorable effect of openness on economic growth. In recent years many empirical studies aimed at highlighting a relationship between trade openness and growth have increased considerably.

1- The openness rate of a country is generally calculated as the proportion of foreign trade volume to GDP besides the usage of the proportion of import to GDP (Romer[30] (1993) and the rate of export increase (Chow, 1987; Kwan and Cotsomitis[31], 1991; Anoruo and Ahmad[32], 2000; Dar and Amirkhalkhali[33], 2003).

2- Nye, Reddy and Watkins[34] (2002) note that countries such as China, Korea, Taiwan and Vietnam have all successfully integrated into the global economy by pursuing export growth strategies combined with unorthodox trade policies: restrictions on foreign investment; export subsidies; relatively high levels of tariff and non-tariff barriers, etc.

3- Lee, Ha Yan, Ricci, Luca Antonio & Rigobon, Roberto[35] (2004), a group of economists have used around 100 countries; from 1961 until 2000, using panel data

[26] Touitou.M. (2016). « A CGE Analysis of the Economic Impact of Trade Liberalisation on the Algerian Economy », European Journal of Sustainable Development, 5, 3, 397-408.

[27] Kurihara, Y., et Fukushima, A. 2016. « Openness of the Economy, Diversification, Specialization, and Economic Growth », Journal of Economics 4, 31–38.

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[29] Agbahoungba, L.S.W. et Thiam, I. 2018. « Effets du Commerce Extérieur sur la Croissance Economique en zone CEDEAO », Annales de l'Université de Parakou, Série « Sciences Economiques et de Gestion » Vol. 3, pp 87-104.

[30] Romer, D. (1993). Openness and inflation: theory and evidence, *Quarterly Journal of Economics,* 108: 869-903

[31] Kwan, A. C. C., & Cotsomitis, J. (1991). Economic growth and the expanding export sector: China 1952-1985. International EconomicJournal, 5: 105-117.

[32] Anorua, E., & Ahmad, Y. (2000). Openness and economic growth: evidence from selected Asian countries. The Indian Economic Journal, 47(3): 110-117.

[33] Dar, A. & Amirkhalkhali, S. (2003). On the impact of trade openness ongrowth: further evidence from OECD countries. Applied Economies, 35(2): 1761-1766.

[34] Nye H. L. M., Reddy S. G. et Watkins K. (2002), « Dollar and Kraay on « Trade, Growth and Poverty": A Critique », Mimeo, New York, Columbia University, August.

[35] Lee, Ha Yan, Ricci, Luca Antonio & Rigobon, Roberto (2004), « Once again, is openness good for growth? » Journal of Development Economics, Vol 75, pp. 451–472.

4- estimation, Heteroscedasticity identification, GMM, OLS. They found that the opening had a positive effect on growth.

5- Nourzad[36] (2005) in his study believes that Granger's productivity causes trade. Some have reported that the results are confusing.

6- Konya[37] (2006) studied 24 OECD countries; during the period 1960-1997 using panel data based on "Safe systems", Granger causality tests bi varied and sorted varied and the results are as follows: a unidirectional causality for exports and GDP in some ; two-way causality between exports and growth in a few; and no two-way causation for others.

7- Xiaming Liu,Haiyan Song &Peter Romilly[38], (2006), examined the causal relationship between openness and economic growth in China. The integration and cointegration properties of the data are analysed and the models of Granger, Sims, Geweke and Hsiao are used to identify a bi-directional causal relationship between GNP and exports plus imports. This bi-directional causation is consistent with China's development strategy of protected export promotion.

8- As indicated by Van den Berg and Lewer[39] (2007), not only international trade, but also accompanying activities such as international marketing, market research, product planning, and international travel contribute to the transfer of knowledge and technology. Hence, globalization would allow trade, under certain circumstances, to expand knowledge and ideas and by these means, to enhance economic growth.

9- Joshua J. Lewer[40](2010), during his study, 28 countries were chosen, from 1962 to 1997, using the Granger causality test and the VAR Autoregressive Vector model, he found that for the countries which imported consumer goods and export capital goods, it was difficult for them to experience economic growth in the medium term, while the countries that imported capital goods and exported consumer goods experienced a decline in costs to replace amortized capital.

10- Dekkiche djamale[41](2012), his work was focused on the study of the influence of trade opening on economic growth in Algeria, during the period 1992-2009, the econometric study was made from several tests and to use time shift models (linear autoregressive model and staggered delay model), this allowed us to conclude that openness has a positive and significant impact on economic growth in Algeria.

11- Berrached Amine[42] (2013), studied trade opening and economic growth in the countries of the South and East of the Mediterranean (SEMC), he carried out a comparative study between all the developing countries and the group of nine SEMCs. He took as a

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[36] Nourzad, F., (2005), « Macroeconomic and Sectoral Effects of International Trade: A Vector Error Correction Study ». Atlantic Economic Journal, N°33, pp 43–54.

[37] Konya, L., (2006), « Exports and Growth: Granger Causality Analysis on OECD Countries with a Panel Data Approach », Economic Modelling, Vol 23, N°6, pp 978–992.

[38] Xiaming Liu,Haiyan Song &Peter Romilly, 2006. « An empirical investigation of the causal relationship between openness and economic growth in China », Pages 1679-1686.

[39] Hendrik Van den Berg, Joshua J. Lewer, (2007), « Religion and International Trade: Does the Sharing of a Religious Culture Facilitate the Formation of Trade Networks? ». The American Journal of Economics and Sociology, Vol 66, Issue 4, Pages 765-794.

[40] Joshua J. Lewer. (2010), « International trade composition and medium-run growth: Evidence of causal relationship », The International Trade Journal, Vol 16 :N°3, pp : 295-317.

[41] Dekkiche, D., (2012), « l'influence de l'ouverture commerciale sur la croissance économique de Algérie, au cours de la période 1992-2009 », Mémoire de Magister en Economie, Faculté des Sciences Economiques, de Gestion et Commerciales, Université d'Oran, Es-Sénia.

[42] Berrached, A., (2013), « Ouverture commerciale et croissance économique dans les pays du sud et de l'est de la méditerranée (PSEM) », Mémoire de Magister en Economie, Faculté des Sciences Economiques, de Gestion et Commerciales, Université d'Oran.

model; a cross-sectional estimate, the results indicate that there is a positive correlation combined with that of human capital, openness to growth for both developing countries and SEMCs.

12- Helmi Hamdi & Rashid Sbia[43], (2013), investigated the dynamic relationship between natural resources rents and Algerian economic growth within a trivariate framework by adding trade openness as a third variable. By using cointegration and error correction model techniques, Granger causality tests revealed a bidirectional causal relationship between natural resources rents and economic growth in the short-run and the long-run as well. Moreover, they found a unidirectional causality running from trade to economic growth without any feedback effect.

13- Ghecham[44] (2013) contended that trade liberalization in Algeria could lead to an appreciation of the real exchange rate, which in turn could hamper efforts aimed at diversification of the economy.

14- Ghecham. M. A, Could Trade Liberalization Kurihara and Fukushima[45] (2016) examined whether openness of the economy promotes production diversification or production specialization, and whether or not specialization/diversification spurs economic growth. They focused on the existence of empirical patterns of production of diversification/specialization between international trade and economic growth. They showed that greater openness of the economy does not always mean the greatest economic growth in emerging and developing countries. Economic conditions and market structures related to international trade must be considered carefully to achieve the economic growth.

15- Touitou[46] (2016) showed that by reducing tariffs, domestic output increase in almost all the sectors, but government revenue and savings decline significantly.

16- Some studies have identified a positive association between trade openness and economic growth (Chang, Kaltani and Loayza [47]., 2009; Kim[48], 2011; Jouini[49], 2015), while others have found no association, or even a negative association (Musila and Yiheyis[50], 2015; Ulaşan[51], 2014).

17- Gnangnon[52] (2018) investigated on multilateral trade liberalization and growth of the economies for an unbalanced data of 150 countries for 20 years.

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[43] Helmi Hamdi & Rashid Sbia, (2013). "The relationship between natural resources rents, trade openness and economic growth in Algeria," Economics Bulletin, AccessEcon, vol. 33(2), pages 1649-1659.

[44] Ghecham. M. A,(2013), « Could Trade Liberalization Help Diversification of the Algerian Economy » ?, Al Ain University of Science & Technology.

[45] Kurihara,Y, Fukushima,A., (2016), **Openness of the Economy, Diversification, Specialization and Economic Growth**, Journal of Economics and Development , Vol. 4, No. 1, pp. 31-38

[46] Touitou.M. (2016). « A CGE Analysis of the Economic Impact of Trade Liberalisation on the Algerian Economy », European Journal of Sustainable Development, 5, 3, 397-408.

[47] Chang,R, Kaltani L, and NV Loayza,(2009), « Openness can be good for growth: the role of policy complementaries », J. Dev. Econ., Vol. 90, No. 1, pp. 33-49.

[48] Kim,D,H (2011)., « Trade growth and income », J. Int. Trade Econ. Dev., Vol. 20, No. 5, pp. 677-709.

[49] Jouini,J., (2015), « Linkage between international trade and economic growth in GCC countries: empirical evidence from PMG estimation approach », J. Int. Trade Econ. Dev., Vol. 24, No. 3, pp. 341-372.

[50] Musila J,W and Z Yiheyis, (2015) , « The impact of trade openness on growth: the case of Kenya », J. Policy Model, Vol. 37, No. 2015 , pp. 342-354.

[51] B Ulaşan, (2014), « Trade openness and economic growth: panel evidence », Appl. Econ. Lett., Vol. 22, No. 2, pp. 163-167.

[52] Gnangnon, S., 2018. Multilateral Trade Liberalization and Economic Growth, Journal of Economic Integration, Vol: 33(2), 1261-1301. Available at: https://doi.org/10.11130/jei.2018.33.2.1261.

17-He found that trade liberalization is positively correlated with economic growth. He added that upper-income countries and the higher income have more trade advantage comparing to the middle income and lower income countries. So, the upper and higher income countries have more gain to economic growth comparing to the others.

These weak and confused results cause difficulties for the general public to imagine or perceive how free trade can stimulate economic growth. However, these studies are confronted with several limitations linked mainly to the econometric methods used and the choice of indicators which represent openness.

III. Empirical investigation:

The study aims to examine the relationship between trade openness and economic growth in Algeria, using the tests and the ARDL model, in the short and the long run, over the period 1990-2018 and this was done using a program, called EViews 9.0.

Hypothesis:

In order to try to provide an answer to our objective, we wanted to put forward two hypotheses, which will be subjected to an econometric verification.

H1: There is a positive relationship between the trade openness, the growth of GDP ,the inflation and the real exchange rate.

H2: The trade openness has a negative effect on the GDP growth, inflation and real exchange rate.

3.1 Description of data:

The data used for the analysis were collected from international databases: data from the World Bank national accounts and OECD national accounts data files, the UNCTAD database (United Nations Conference on trade and development).

The variables that were retained for our empirical analysis are:

GDP: is the dependent variable which represented the growth of GDP

OPEN: is the rate of trade openness; it is calculated by the sum of exports and imports of goods and services measured as a share of gross domestic product

RER: is the real effective exchange rate based on the year 2010

INF: inflation, consumer price (annual %)

3.2 Research Methodology

To test the relationship between trade openness and GDP growth, it is necessary to check whether the variables are stationary and for this We use the ADF[53] test (1981) and the Phillips Perron (PP)[54] test, then we use the VAR Lag test selection criteria, the Bound test of coitegration, After finding the existence of cointegration between the variables, we study the long and the short run effects of trade openness, real exchange rate and inflation on economic growth.

The "AutoRegressive Distributed Lag / ARDL" models, or "autoregressive models with staggered or distributed delays / ARRE" in French, are dynamic models. The latter have the particularity of taking into account the temporal dynamics (adjustment period, anticipations, etc.) in the explanation of a variable (time series), thus improving the forecasts and effectiveness of policies (decisions, actions, etc. .).

The basic equation for estimating the effect of trade opening on GDP growth takes the following form:

GDP= F(OPEN, RER, INF)

$GDP= \alpha_0 + \alpha_1$ OPEN+ α_2 REER+ α_3INF+ ε_t

Where:

- α_0: The constant term
- α_1, α_2, α_3: are the estimation coefficient to be estimated
- ε_t: is the error term

IV.Empirical result: Economic interpretation of the results:

4.1.Result of unit test:

Table n°1: The results of the tests (ADF) and phillips perron (PP)

Variables	ADF		PP	
	Level	First difference	Level	First difference
GDP	−3.275** (0.0260)	−8.508*** (0.0000)	−3.193 (0.0311)	−9.905*** (0.0000)
OPEN	−0.897 (0.7739)	−5.018*** (0.0000)	−0.891 (0.7760)	−5.017*** (0.0004)
RER	−3.633** (0.0120)	−10.817*** (0.0000)	−5.553*** (0.0001)	−35.150*** (0.0001)
INF	−1.496 (0.5207)	−5.392*** (0.0002)	−1.450 (0.5433)	−5.498*** (0.0001)

*, ** and * indicate the significance at 1%, 5% and 10% levels respectively. Values in parentheses are probabilities.
Source: Author's estimate of results using EViews 9.0.

The test results in Table 1 show that only GDP growth and RER are stationary at the level but OPEN and INF are stationary at the first deference. we can reject the null hypothesis for OPEN and INF in the first deference.

[53] Dickey, D.A. et Fuller, W.A. (1979), « Distribution of the estimtors for autoregressive time series with a unit root », in Journal of the American Statistical Association, vol.74, n° 366, pp. 427-431.
[54] Phillips Perron C. (1987), « Time Series Regression with a Unit Root », in Econometrica, vol.55, No.2, March, pp. 277-301.

4.2. Results of cointegration

In the next step, we examine whether a long and short run relationships exist among our variables using ARDL approach. To analyze the cointegration of variable it is necessary apply the information selection criterion for determine the number of optimal lag existing in

our model based on the value of Akaike information criterion, criteria (AIC) and the Schwarz Criterion (SC). The results are represented in the table n°2.

Table n°2: The results of the VAR Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-550.0138	NA	7.81e+12	41.03806	41.23004	41.09515
1	-485.0512	105.8650*	2.11e+11*	37.41120*	38.37108*	37.69662*
2	-476.0513	11.99993	3.88e+11	37.92972	39.65750	38.44348
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Source: Author's estimate of results using EViews 9.0.

According to the results obtained from the AIC and SC information criteria the number of lag that minimize the criteria AIC and SC is 1 lag.

4.3. Results Bound test of coitegration:

To test the long run effect of trade openness on economic growth in Algeria we use Pesaran's (Pesaran et al., 2001) Bounds test. The ARDL bounds test can be performed by using the F-statistics or Wald test to check the significance of the lagged coefficient of variables, the table n°3 summarizes bound test results:

Table n °3: The Results of the Bound testing cointegration

Test Statistic	Value	K
F-statistic	3.728349	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.37	3.2
5%	2.79	3.67
2.5%	3.15	4.08
1%	3.65	4.66

Source: Author's estimate of results using EViews 9.0.

The Wald test of joint significance is performed and the calculated F-statistics value is compared with both the upper and lower bounds critical values by Pesaran et al. (2001) at (1%, 5%, 10%) significance level

In our estimation we find that there is a long-run relationship between the variables because F-statistics value (3.72) is more than both the upper and lower bounds critical value at 5% level of significance. This suggests that GDP growth, OPEN, RER and INF are cointegrated in the long-run and are moving together.

4.4 Results of long run estimation:

After finding the existence of cointegration between the variables, we further estimate the long run effects of trade openness, real exchange rate and inflation on economic growth, the results are reported in the table n°4:

Table n°4: The results of the Estimation of the long-term coefficient

Long Run Coefficients				
Variable	Coefficient	Std. Error	t–Statistic	Prob.
INF	–0.084934	0.042789	–1.984942	0.0592
OPEN	–0.000060	0.000022	–2.699068	0.0128
REER	–0.088987	0.033103	–2.688172	0.0131
C	15.700305	4.176144	3.759522	0.0010

Source: Author's estimate of results using EViews 9.0.

In the long run, the coefficient of trade openness to be negative and significant. Thus the 1% increase of the trade openness reduces the GDP growth by 0.006%, This result is explained by the fact that Algeria's growth is strongly linked to the outside through, in large part, oil exports, it is confirmed that the country remains dependent on oil, and that non-hydrocarbon exports represent only 3% of the total volume of exports.

Also,the coefficient of inflation has a negative and statistically significant impact, so the increase of inflation of 1% leads to a decrease in GDP growth of 8%,

inflation can lead to a deterioration of employment when it is high, which leads to a slowdown in economic growth in the country.

In addition, we find that the real exchange rate has a negative and significant impact on the GDP growth, similarly a 1% increase in the real exchange rate reduces the GDP growth by 8%, A low real exchange rate makes it possible to increase exports by effect of competitiveness, their development loosens the external constraint and makes it possible to import capital not produced locally, which supports growth.

4.5. Results of the short run estimation:

We examine the short-term relationship between model variables using the error correction model includes short-term dynamics with long-run equilibrium

Table n°5: The Results of the short run estimation:

Cointegrating Form				
Variable	**Coefficient**	**Std. Error**	**t–Statistic**	**Prob.**
D(INF)	**–0.060534**	**0.075013**	**–0.806988**	**0.4279**
D(OPEN)	**–0.000031**	**0.000042**	**–0.724216**	**0.4762**
D(REER)	**–0.076602**	**0.023671**	**–3.236150**	**0.0036**
CointEq(–1)	**–1.112213**	**0.205932**	**–5.400864**	**0.0000**

Source: Author's estimate of results using EViews 9.0.

According to the results of the table n°5, the coefficient of the ECM is −1.11, which is negative and statistically significant (prob= 0.0000) this means that any deviation from the long-run equilibrium between variables is corrected in the short run. This result give validity of our model, our variables have also short run equilibrium relationship.

Conclusion and recommendations:

This paper investigates the impact of trade openness on economic growth in Algeria over the period from 1990-2018 , the empirical analysis has used ARDL approach to test the short-term and long-term relationship between the variables .Empirical results from the study can be summarized as follows : firstly, openness trade have negative and significant effect on economic growth in the short and long run, Which leads us to conclude that there is no effective policy to diversify the country's export structure. This dependence on petroleum resources is a major handicap for the Algerian economy**.** Secondly, inflation affects economic growth negatively and significant in the short and long run. the growth corresponds overall to a monetary variation corrected for inflation, which proves well that the money supply does not circulate in the real sphere as one could believe it. The growth is positive if the net quantity of money "deflated" injected into the real sphere is greater during a period than during the previous one, and it is negative other wise. In addition, the real exchange rate negatively and significantly affects GDP growth, The real exchange rate is of great importance for the economy of a country, and in particular for its foreign trade . A low real exchange rate makes it possible to increase exports by effect of competitiveness, their development loosens the external constraint and makes it possible to import capital not produced locally, which supports growth.

Based on the above conclusions, we recommend that Algeria should ensure better integration into the world economy and take advantage of a potential growth vector (technology transfer, improvement of human resources qualifications, FDI .....), openness must to be continued and directed according to the restructuring, change and development carried out in the national economy. Moreover, to avoid political, legal and social instability, the State must adopt a new economy less dependent on hydrocarbons. Finally, It is essential for Algeria to establish an environment favorable to national companies, allowing them to meet the challenges imposed by the international environment, or even the global one which is more and more restrictive.

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