Economic diversification in Algeria: An Application of Autoregressive Distributed Lag (ARDL) Model

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Abstract:

This article mainly aimed to measuring the impact of economic diversification on economic growth in Algeria, based on annual data covering 1970-2017. By applying the Auto-Regressive Distributed Lag model (ARDL)-(bounds testing approach). The key findings of the study concluded that there is a negative relationship between the lack of diversification and economic growth in the Algerian economy.

Keywords: Economic Diversification; Economic Growth; Algeria; ARDL model.

JEL Classification Codes : F23, C01, O13

ملخص:

هدفت هذه الدراسة إلى قياس تأثير التنويع الاقتصادي على النمو الاقتصادي في الجزائر. بالاعتماد على بيانات سنوية 1970 إلى 2017.من خلال تطبيق نموذج الاحدار الذاتي (ARDL). خلصت النتائج الدراسة إلى وجود علاقة سلبية بين غياب التنويع والنمو الاقتصادي في الاقتصاد الجزائري.

كلمات مفتاحية: التنويع الاقتصادي، النمو الاقتصادي، الجزائر، نموذج ARDL.

تصنيفات JEL: F23، C01، O13

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1. INTRODUCTION

The economies of rent suffer from the risk of fluctuations in oil prices. They face oil shocks that affect various economic policies, both financial and monetary. This is due to the dependence of their revenues on one source, which is threatened with depletion and disappearance. Therefore, these countries seek to adopt economic diversification policies with the aim of developing and developing productive sectors such as agriculture, tourism and services. To innovate new services developed outside the oil sector to reduce dependence on oil to avoid shocks and crises.

Many countries, such as the brics and the Group of Industrial Countries, achieved optimal rates of economic growth by turning to industry. In 1960, China exported 80% of the commodities, and today it has about 80% of industrial products, India, Brazil, Malaysia, Vietnam, Indonesia and Mexico. Most of these new industrial forces have economies based on single raw materials. At present, they are deeply integrated into global production networks across a wide range of sectors, participate in the rapid growth of South-South trade, and in most cases accelerate the development of their export mix and diversify their economies. Malaysia Was the first importer of palm oil from Nigeria and is currently the first source of this oil, Therefore, most rental countries in general, such as Algeria and Algeria, suffer from high oil prices, which in turn lead to increased consumption expenditure, non-productive projects, diversification of sectors and re-investment of funds in one prosperous sector. In the case of decline, these countries adopt austerity fiscal policy. Likewise Corden (1984), reported that the Dutch disease had no negative effects on manufacturing, but instead of using the boom in sector revenues for social service levels. it was used without Justifications and stressed the need to eliminate the Dutch bug, its presence hinders economic diversification through two effects are the impact of spending and the impact of the transfer of resources as Alan Gelb stressed that economic diversification is a source of wealth and development of countries. (Anyaehie, M. C., & Areji, A. C, 2015),have

discussed the importance of economic diversification in Nigeria by pointing to the need to use its huge oil revenues to diversify the economy by creating jobs and meeting basic needs and seeking development. The diversification of the Algerian economy makes it suffer from the Dutch disease, a large percentage of exports estimated at 97% are fuel, in addition to the decline in interest in other sectors and increase the proportion of imports, especially the bill of imported foodstuffs. In addition, the index of export diversification, which is estimated at 0.495, is far from zero. Algerian and all this is due to the dependence of the state on oil, so seek out the cycle of rents through various strategies that will eliminate crises and shocks and attention to various areas of productivity.

The remainder of the paper is structured as follows: In the second section, we deals with the literature review. In the third section, Definition and measurement of diversification, in the fourth sections we present the methodology, the variables and the hypotheses to be tested. The empirical validation will be presented in the fifth sections; the last section concludes the paper.

2. Literature review

The study of (Dessus, S., & Suwa-Eisenmann, A., 1998) , examines the extent to which the bilateral free trade agreement with the EU has been encouraged to diversify exports and move from the rent economy to a diversified economy. This paper uses a dynamic balance model for forecasting. The researchers concluded that the PTA with Europe. Through technology transfer and pressure from competition. Under these circumstances, the Convention has a similar effect on what can be expected by one State.

(Al–Marhubi, F, 2000), used recent theories of growth. This paper provides empirical evidence that export diversification promote economic growth. This result is strong for different growth rates and different measures of export diversification in developing countries. Diversification of exports is also associated with higher investment rates.

The study of, (Arip, M. A., Yee, L. S., & Abdul Karim, B., 2010), they

assessed the relationship between export diversification and economic growth for the case of Malaysia, during period 1980-2007. The results showed that export diversification has an astonishing role in the economic growth. The result further suggests that Malaysia has to diversify its export in order to reach a sustainable growth.

The study of (Petersson, 2005), employed linear regression method to investigate export diversification and intra-industry trade. The result from the study suggested that reduced export concentration would lead to positive terms of trade and enhance economic growth.

Additionally, (Agosin, 2007), examined the explanatory power of export diversification in empirical model of growth, using a cross-sectional data between 1980 and 2003, mainly from Asian and Latin American countries. The result of the study concluded that export diversification enhanced economic growth.

(Berthélemy, J. C, 2005) , discusses the arguments for the policy of economic diversification and examines the benefits of diversification in light of the theory of international trade. Then determine the determinants of diversification, following a comparative study of some developed, emerging and developing countries. It has been shown that economic diversification can be closely linked to new forms of international specialization that are inter-trade and industry. The successful diversification policy must be based on participation in globalization. According to the study conducted by the author (Anyaehie, M. C., & Areji, A. C, 2015) shows the extent of investment of oil revenues in Nigeria to develop and diversify the economy.

(Kpemoua, 2016)empirically analyzes the effect of exports on economic growth in Togo as well as the existence of a causal relationship between exports and economic growth by applying a model that rely on a production function neoclassical type.

The data cover the period 1960-2014. The methodological approach used is based on cointegration and causality techniques. Empirical results show a positive and significant correlation at the threshold 1% long-term

between exports and economic growth and causality in the sense of Toda and Yamamoto, exports to economic growth.

3. Definition and measurement of diversification

3.1. The concept of economic diversification

From an empirical point of view, (Anyaehie, M. C., & Areji, A. C, 2015) , the Economic diversification is a process of broadening the range of economic activities both in the production and distribution of goods and services. It does not necessarily entail increase in output but it enhances stabilization of economies by diversifying their economic base.

The issue of economic diversification should be observed from the perspective of sustainable development to ensure long-term stability of the economy. Viewed from this angle, it has the capacity to fundamentally strengthen an economy's adaptive capacity and safeguards it's long-term Prospects in the face of depletion of the basic natural resources and the vagaries of economic fluctuations under the pressure of competition in globalization.

Furthermore, Diversification is also defined as developing non-oil sectors and reducing dependence on oil, ie, export diversification, government revenues, and economic base (Fasano, 2003).

In the political sphere, it usually refers to the diversification of the concept of exports, especially for policies to limit dependence on a limited number of export products that may be subject to price fluctuations, volume or low demand for them (Hvidt, 2013).

as for (Bature, B. N. , 2013) ,defines economic diversification as the expansion of economic activities ,in both the production and distribution of goods and services, and the expansion of the economy to create opportunities for various economic activities on a large scale by providing jobs ,and stabilizing the economy against economic fluctuations and maintaining the growth prospects of States. An economy is said to be diversified if its productive structure is dispersed in a large number of activities different from each other by the nature of the goods and services produced (Berthélemy, J. C, 2005).

3.2. Indicators of economic diversification

Economic diversification is measured by several statistical indicators that vary in efficiency and suitability for measurement purposes, some of which depend on the measurement of the dispersion phenomenon such as the difference coefficient and some of them measure the concentration as a genetic index and some on the concept of diversity as **(*ERFINDAL-HIRSHMAN*).**

The variables that are applied to them are many, including the GDP according to the economic activities in the national accounts, the structure of the GDP output and its distribution between the oil output and the non-oil output, the structure of the exports and their distribution and distribution of the actual revenues of the government between the oil and non-oil. The United Nations Development and Trade the least developed countries determine a criterion for economic diversification consisting of four elements: the contribution of the industrial sector to the GDP, the contribution of labor in industry, the amount of individual consumption of electricity and the concentration of exports.

- **Export Diversity Index**

It measures the deviation of the share of exports of a country's major commodities in its total exports from the share of national exports of those major commodities in world exports. This index ranges from 0-1. The closer this indicator is from zero, the higher the variation in exports. National exports with the structure of global exports and takes the following index:

$$Hi = \frac{Xi}{\sum_{j=1}^{n} xj} * \sum_{j=1}^{n} 1$$

Where:

Xj: exports a certain country,∑ **Xj**: The total exports of a particular country

Hi: Scale of export diversification.

3.3. Models of countries adopting economic diversification policy

a. The Economic Diversification Strategy of Malaysia

Malaysia is an example of developing countries that has built diversified economy from initial conditions of strong concentration in mineral sector; it shows a good example of policy effort and relative success. Since its independence in 1957, the Malaysian government has promoted the manufacturing sector with the aim of diversifying its agriculture-based economy. The structural transformation in the Malaysian economy has turned the country from an exporter of primary commodities into an exporter of high-value-added manufactured products (Kamaruddin, R., & Masron, T. A. , 2010)

- **The Malaysian diversification strategy is based on:**

- Adapting its strategies and policies according to the changing conditions.
- Significant public investment in education to create a highly skilled labor force and in new economic sectors (e.g. heavy industry).
- A set of many cores (the Malaysian Industrial Development Finance (MIDF) 1960, the Malaysian Industrial Development Authority (MIDA) 1965) to provide financial and other facilities for investors in the manufacturing sector.
- It has based on cheap manufactures to promote export (1973-74).
- Policies to reduce the costs of labor and manage industrial relations.
- Close collaboration between the government and the private sector to define policies develop market and make policy adjustments.
- An open FDI regime to develop nascent industries (e.g. telecommunications and the automotive sector) and the development of a good business climate.
- Excellent infrastructure development (e.g. roads, telecoms, free ports) to support export industries.
- Active trade openness policy by signing bilateral, regional (ASEAN), and multilateral (WTO) trade agreements.
- Investments and targeted support were provided through a variety of programs including free zones, export financing facilities, assistance

with research, product and marketing, aimed at reducing production costs and increasing competitiveness.

- Development of information and communication technologies (ICT).

b. The Economic Diversification Strategy of the United Arab Emirates

The collapse of oil prices has led to the emergence of the need for economic diversification in the United Arab Emirates states, Although the efforts of economic diversification made by the Gulf governments have made some progress and positive results in the past few years, they are still required to make greater efforts and take bolder action in this area.

The United Arab Emirates diversification strategy is based on: (Hvidt, 2013)

- Creation of infrastructures to reduce costs: During 1970s and 1980s.
- Diversification has been based on the development of - Capital and energy.
- Intensive industries as well as the physical and social infrastructure.
- Development of the productive sectors and heavy industry, at that time Dubai Aluminum started in 1980 & the other sector diversified in 1980s is the service sector.
- Ensuring a stable macroeconomic environment with predictable fiscal and monetary policies aided by an efficient financial sector and appropriate exchange rate.
- Active trade openness policy through unilateral liberalization and free trade agreements: UAE has signed bilateral free trade agreements with 50 countries, and became a member of
- The World Trade Organization (WTO) in 1996.
- Ensuring a stable macroeconomic environment with predictable fiscal and monetary policies aided by an efficient financial sector and appropriate exchange rate.

4. The Empirical Study

We shall present our data sources then the econometric approach

4.1. identify of research period and Sources of Data

The sample includes 44 annual observations for the period 1970-2017. The study data used to estimate ARDL model were obtained from different issues of World Bank database exactly in world development indicators (WDI) and International financial Statistics (IFS).

4.2. Methods Of Estimation

The autoregressive distributed lag (ARDL) is a technique that allows us to simultaneously estimate the short-run and long run dynamics of our model, even when the time-series are stationary I (0) or integrated of order I (1).

The variables may include a mixture of stationary and non-stationary time-series for ARDL Bounds testing approach proposed by (PESARAN, M. Hashem, 1997), (Pesaran, M. H., Shin, Y., & Smith, R. J, 2001).

The estimate of the impact of currency crises on growth is made from the following growth equation:

$$GDP = f(va_{indus}, va_{agri}, t_{expo}, t_{impo}) \ldots\ldots\ldots (3)$$

The mathematical representation of an ARDL regression model is:

$$\mathrm{GDP(t)} = \alpha 0 + +\beta 1\ \mathrm{GDP(t-1)} + \beta 2\ \mathrm{va_{indus(t)}} + \beta 3\, \mathrm{va_{agri_{(t)}}} + \beta 4\ \mathrm{t_{expo}} + \beta 5\ \mathrm{t_{impo}} + \varepsilon(\mathrm{t}) \ldots\ldots (4)$$

Where:

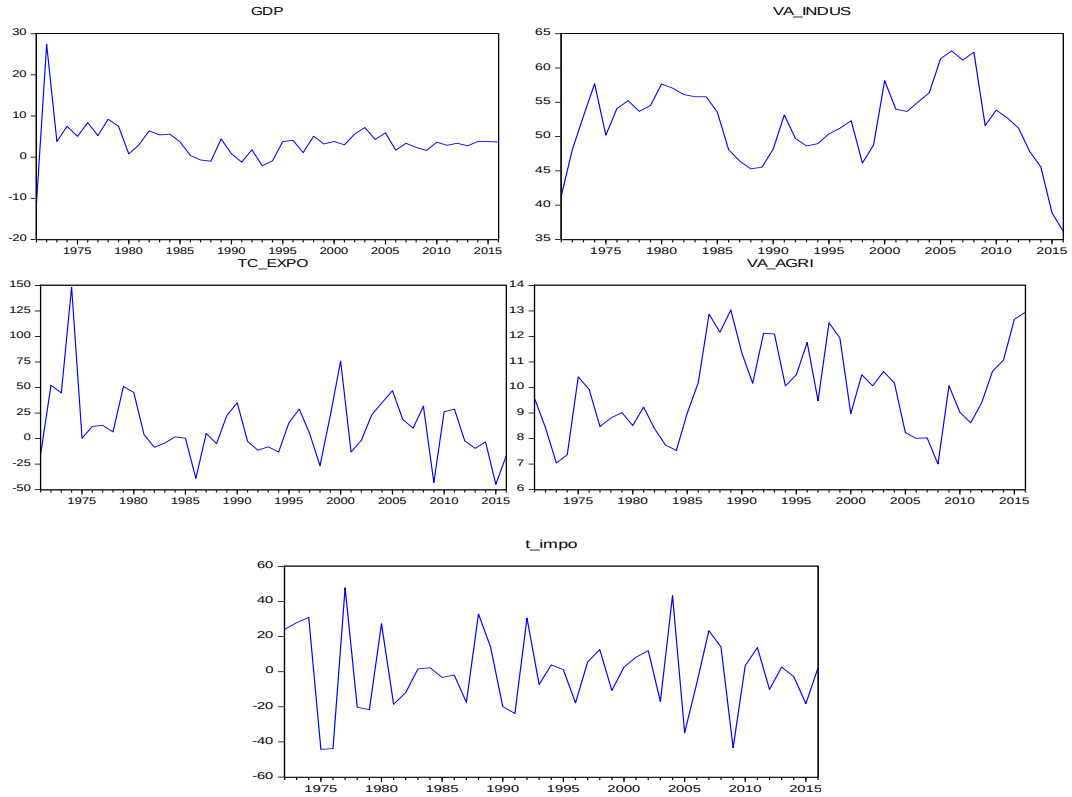
$\alpha 0$ Represent the intercept of the function or we can say the constant, and ε is a random (disturbance) term. Then $\beta 1; \beta 2; \beta 3; \beta 4; \beta 5$ are parameter to be estimated.

5. The Estimation

5.1. Pre-estimation Analysis

Before estimation, the graphs of the time series under study are plotted, descriptive statistics are displayed, unit root test for the variables are performed, and co-integration analysis is done on the variables. The figures below show the line graphs of the historical performance of the variables used in this study.

Fig.1. The Variables used in This Work



Source: Author Computation with E-view 09

5.2. Descriptive Analysais of Variables

The Table(1) below presents the descriptive and statistical summary of each of the variables (dependent and independent variables) employed in the study. The statistics are in terms of mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and Jarque-Bera.

Table 1. Descriptive Statistics

	GDP	TC_EXPO	TC_IMPOR	VA_AGRI	VA_INDUS
Mean	4.013899	12.38276	10.00491	9.915942	52.17464
Median	3.700000	5.098336	6.626876	10.05844	52.98956
Maximum	27.42397	148.3096	80.48942	13.03902	62.49790

Minimum	-2.100001	-44.87167	-23.68877	7.001241	36.19056
Std. Dev.	4.402386	33.06206	19.85177	1.715984	5.537065
Skewness	3.313052	1.503011	1.285130	0.222742	-0.480505
Kurtosis	18.95398	7.768424	5.211100	2.054244	3.631654
Jarque-Bera	559.5650	59.57633	21.55350	2.049207	2.479737

Source: Author Computation with E-view 09

5.3. Unit Root Tests for the Variables

Before presenting empirical results of the ARDL model, we apply the following econometric steps of the stationary and non-stationary Tests of the time series data by Augmented Dickey-Fuller (1979) **(ADF)** & Philips-Perron (1988) **(PP).** (Phillips, P., Perron, P, 1988) (Dickey, D.A. & W.A. Fuller, 1979) Test.

The Augmented Dickey-Fuller (ADF) and Philips-Perron test results for the time series variables are presented in Tables (2, 3) below.

Table 2. Results of unit root test (The Augmented Dickey-Fuller test)

Variables	At level		At First Difference		conclusion
	ADF statistical	Result	ADF statistical	Result	
GDP	-4.654342	stationary	---	---	I(0)
VA_INDUS	-1.952160	No stationary	-6.734108	stationary	I(1)
VA_AGRI	-2.762817	stationary	-----	----	I(0)
T_EXPO	-5.938931	stationary	----	----	I(0)
T_IMPO	-4.397264	stationary	----	----	I(0)

Source: Author Computation with E-view 09

Table 3. Results of unit root test (Phillips-Perron Test)

Variables	At level		At First Difference		conclusion
	(pp) statistical	Result	(pp) statistical	Result	
GDP	-6.613615	stationary	----	----	I(0)
VA_INDUS	-0.386522	Non stationary	-6.745541	stationary	I(1)
VA_AGRI	-2.763241	stationary	----	----	I(0)
T_EXPO	-5.949646	stationary	----	----	I(0)
T_IMPO	-4.438205	stationary	----	----	I(0)

Source: Author Computation with E-view 09

In our final evaluation, all the variables witch are (GDP, VA_AGRI, T_EXPO and T_IMPO) became stationary in at level *I* (0), After taking the first differences, excepting the latter variable VA_INDUS become stable and significant at 1% 5% 10%, as shown in the table in both The Augmented Dickey-Fuller (ADF) and Philips-Perron test statistic. In addition, it is integrated of order *I* (1).

Therefore, to study the long-term relationship between the variables of the study, we will use the autoregressive distributed lag (ARDL) method, because of a combination of stable time series between I (0) and order I (1).

Before estimating the ARDL model, we must determine the optimum lags for the model. The choice of the lags according to the following criteria: Akaike, Schwarz and Hannan-Quinn, depending on the lowest statistical value for the criteria that correspond to the acceptable. VAR Lag Order Selection Criteria Were presented in Table (4) below.

Table 4. VAR Lag Order Selection Criteria

Lag	Logl	LR	FRE	AIC	SC	HQ
0	-99.10334	NA	6.882333	4.766826	4.808199	4.781991
1	**-93.61715**	**10.44988***	**5.558859***	**4.553198***	**4.635944***	**4.583528***
2	-93.18467	0.803179	5.712114	4.580223	4.704342	4.625717
3	-93.04639	0.250226	5.953377	4.621257	4.786749	4.681916
4	-91.70053	2.371273	5.859385	4.604787	4.811653	4.680612

Source: Author Computation with E-view 09

* 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

After examining the number of the degrees of delays, the results indicate that the number of delay intervals followed by variables is **P =one** and this is because it corresponds to the smallest value for most standards.

5.4. ARDL Bounds test estimation results

To determine the existence of long run relationship among the variables of the study, the (Pesaran, M. H., Shin, Y., & Smith, R. J, 2001), Bound test procedure was used. The bound test results were presented in Table (5) below.

Table 5. ARDL Bounds test estimation results

Test Statistic	**Value**	**K**
F-statistic	**18.70021**	4
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author Computation with E-view 09

The result reveals that F-Statistics is(F= 18.70021), which is greater than the upper I(1)and Lower I(0) critical bound of 5.06 at 1% level,4.49 at 2.5% level, 4.01 at 5% level and 3.52 at 10% level. Thus, the null

hypothesis can be rejected.

This suggests that there is long run relationship among GDP, VA_INDUS, VA_AGRI , T_EXPO and T_IMPO over the period of the study (1970 to 2017).

5.5. Estimated Coefficients using the ARDL approach

The next step of the ARDL approach would be to estimate the coefficients long run relationship of the variables. The results of the long run estimated coefficients are presented in Table (6).

Table 6. ARDL Cointegrating and Long Run Form (Dependent Variable: GDP)

Cointegrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P.Value**
Short- Run Coefficients				
D(VA_INDUS)	-0.048590	0.128475	-0.378204	0.7077
D(VA_AGRI)	-0.018260	0.444797	-0.041053	0.9675
D(VA_AGRI(-1))	-0.500054	0.299163	-1.671509	0.1041
D(T_EXPO)	0.018219	0.015078	1.208339	0.2355
D(T_EXPO(-1))	-0.027764	0.012640	-2.196577	0.0352
D(T_IMPOR)	-0.000218	0.022838	-0.009561	0.9924
CointEq(-1)	-0.834020	0.094421	-8.832976	0.0000
Cointeq = **GDP - (-0.0583*VA_INDUS -0.2930*VA_AGRI + 0.0089*T_EXPO + 0.0566*T_IMPOR + 8.6527)**				
Long -Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P.Value**
VA_INDUS	-0.058260	0.152011	-0.383261	0.7040
VA_AGRI	-0.292997	0.501593	-0.584134	0.5631
T_EXPO	0.008925	0.033445	0.266848	0.7912
T_IMPOR	0.056607	0.039990	1.415520	0.1663
C	8.652741	12.053349	0.717870	0.4779

Source: Author's Computation with E-view 09

The results of the estimation in the short term, confirm that there is a common correlation between the variables of the study in the long- run, because the error correction coefficient, which measures, the speed of return to equilibrium is negative and statistically significant. The error correction coefficient (CointEq = -0.834) indicates short-term imbalances will be corrected by 83.4% in the long term.

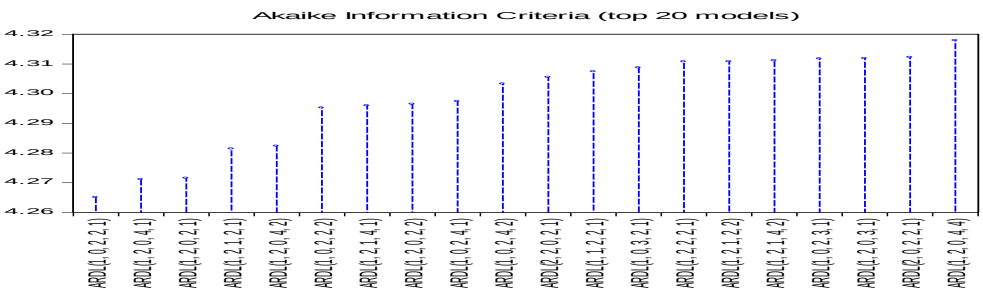
Long-term estimation results indicate, the positive sign of the variables studied is explained by the positive relationship between each variable, and its effect on the output Domestic and vice versa.

Where the increase of one unit of value added for the industrial sector and value added to the agriculture sector leads to a decrease in GDP 0.058 and 0.29 units respectively, which is contrary to the economic theory. Evidence of the weak contribution of the agricultural and industrial sectors to economic activity is due to the weak diversification of the productive base and the overall orientation towards the rental economy.

On the other hand, exports contribute to raising the GDP by 0.008 units, which is weak compared to the actual importance of the export sector in the national economy.

However, the contribution of imports leads to an increase of 0.056 units on GDP, which is contrary to economic theory, as imports contribute to weakening the economic capacity of the country.

In general, and through the standard study of the proposed model, the contribution of value added to the agricultural and industrial sectors is very weak, as its contribution to the GDP is very weak due to the absence of development plans that contribute to the advancement of investments.



Source: Author Computation with E-view 09

5.6. Stability test of the model

To make sure**,** that the data used in this study, does not contain any structural changes, we should use one of the appropriate tests **CUSUM,** and **CUSUM OF SQUARES.** which (Brown , Robert L ,Durbin,James,& EVANS ,James M, 1975) , developed in order to clarify the structural change in data ,and the extent of stability and consistency ,of long-term parameters with short-term parameters.

If the plot of CUSUM-SQ and CUSUM statistic stays within **5%** significance level, then the estimated coefficients are said to be stable. A graphical presentation of this test for our ARDL model is provided in Figures 2, 3 below.

Fig.2. Plot of CUSUM showing stability of the Model

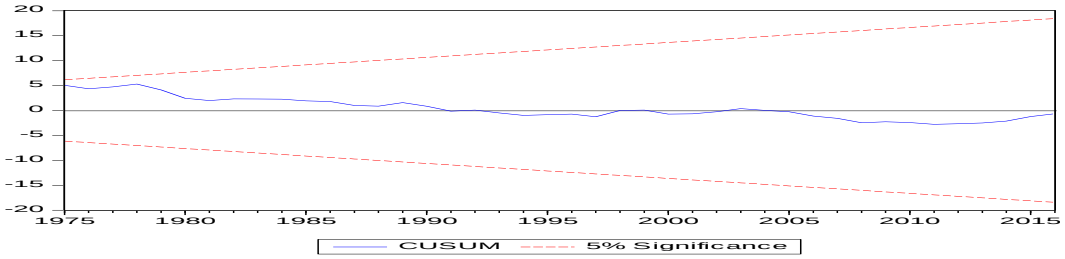
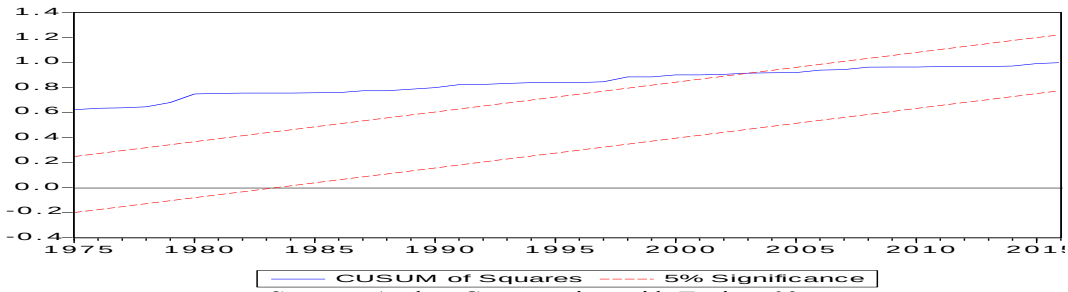


Fig.3. Plot of CUSUM-SQ showing stability of the Model



Source: Author Computation with E-view 09

The result in The Figure shows that the curve (CUSUM) is located within the critical limits for 5%, but the curve (CUSUM OF SQUARES) does not within the critical limits for 5%, which explains that the model is

acceptable statistically.

6. CONCLUSION

This paper aims to study the effect diversification of non-hydrocarbon on economic growth in Algeria. The Autoregressive Distributed Lag (ARDL) newly developed approach has been employed to capture the short-run and long -run cointegration between oil price and economic growth variable. Annual time series data from 1970 to 2017 has been used for analysis.

To achieve high levels of economic growth in Algeria requires the need to adopt effective strategies. Which contribute to the shift from the economy based on oil revenues to the economy based on the diversification of different sources of income and can only be done with attention to sensitive sectors in the national economy, through the development of investments in agriculture and Industry sector.

The study highlighted the following results:

- The weak contribution of the agricultural, industrial and services sectors in raising the levels of economic growth, with negative indicators, which translates into the inability of these sectors to cover the volume of financial allocations directed at the investment stimulation process.
- The positive relationship between capital accumulation and economic growth shows that the increase in the ratio of investments can raise growth rates. The positive relationship in this period indicates the support provided for investments.
- The price of oil positively affects the economic growth during this period, but the fuel sector is the main sector that plays a prominent

role or important in achieving economic growth. During this period 1986-2017, oil prices rose significantly after the crisis of 1986 to be an oil shock for Algeria, but the year 2000 to 2004 was called the oil price revolution, but in late 2014 until 2016 oil prices fell, but this decline did not show the impact in the study period.

- Exports outside of hydrocarbons negatively influence economic growth rates, which indicates that exports outside the fuel are not sufficient purpose, and this is indicative of the lack of economic diversification in the Algerian economy because the proportion of total exports affect positively. Therefore, stepping out of dependency on oil and diversifying the economy requires attention to foreign direct investment, energy diversification and other strategies that encourage the role of institutions and promote sustainable and comprehensive

  Growth outside of hydrocarbons.

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