Short and long term determinants of export diversification in Algeria: ARDL model (1995-2020)

محددات المدى القصير والطويل لتنويع الصادرات في الجزائر: نموذج ARDL (1995-2020)

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Abstract:

The object of this paper is to examine the determinants of the diversification of exports in Algeria over the period 1995-2020 using the ARDL model. The cointegration analysis revealed the presence of long-run relationship between export diversification and its determinants. The error correction model also revealed a short-run relationship among export and its determinants. The study found that all the explanatory variables had a long- run relationship with export diversification. Specifically, terms of trade had the expected negative sign. On the other hand, GDP growth and degree of freedom to invest found to affect, in long-term, negatively export diversification in Algeria. The short-term results showed that the positive drivers of export diversification are GDP growth and degree of freedom to invest. While terms of trade favours export specialization. These results suggest a diversification in the export basket, structural transformation of the Algerian economy and improvement of the business climate.

Key words: *determinants, diversification, exports, ARDL model, Algeria*

ملخص:

تهدف هذه الورقة إلى دراسة محددات تنوع الصادرات في الجزائر خلال الفترة 1995-2020 باستخدام نموذج ARDL. كشف تحليل التكامل المشترك عن وجود علاقة طويلة المدى بين تنويع الصادرات ومحدداتها. كما كشف نموذج تصحيح الخطأ عن وجود علاقة قصيرة المدى بين التصدير ومحدداته. وجدت الدراسة أن جميع المتغيرات التفسيرية لها علاقة طويلة الأمد بتنويع الصادرات. على وجه التحديد ، كان لشروط التبادل التجاري إشارة سلبية متوقعة. من ناحية أخرى ، وجد أن نمو الناتج المحلي الإجمالي ودرجة حرية الاستثمار يؤثران ، على المدى الطويل ، بشكل سلبي على تنويع الصادرات في الجزائر. أظهرت النتائج قصيرة المدى أن الدوافع الإيجابية لتنويع الصادرات تتمثل في نمو الناتج المحلي الإجمالي ودرجة حرية الاستثمار. بينما تفضل شروط التجارة التخصص في التصدير. تشير هذه النتائج إلى تنوع في سلة الصادرات وتحول هيكلي للاقتصاد الجزائري وتحسين مناخ الأعمال.

الكلمات المفتاحية: المحددات ، التنويع ، الصادرات ، نموذج ARDL ، الجزائر .

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1. INTRODUCTION

Export diversification is considered as a key component of structural transformation of an economy. An increase in export variety can lead to output growth and help reduce exposure to external shocks and reducing macroeconomic volatility. Export diversification is essential to reduce dependence on a single export product and mitigate the risks associated with a high level of export concentration. (McLntyre, Li, Wang, & Yun, 2018)suggest that diversifying the economy and exports in particular helps to strengthen resilience to shocks and achieve a higher sustainable growth rate.

Diversification plays a crucial role in helping countries to achieve its macroeconomic goals of sustainable economic growth, suitable balanced of payment conditions, employment and redistribution of income (Sannassee, Seetanah, & Lamport, 2014). In his work, (Osakwe, 2007) finds that diversification into new primary export products or manufactured goods is generally linked with dynamic spillover effects since it leads to economic growth and more stable export earnings, job creation, alleviating poverty and development of new skills and infrastructure that would facilitate the development or discovery of new export products.

Algeria has implemented a number of devices to diversify its exportations. For instance : National Agency for the Promotion of Foreign Trade and the Special Export Promotion Fund, National Consultative Council for the Promotion of Exports also was established to promote export diversification. However, the policies initiated as a means of diversifying exports have yielded somewhat little success as the country continues to rely heavily on hydrocarbon sector.

The question of determining factors for export diversification, particularly in developing countries, is comprehensively discussed in the empirical literature: (Elhiraika & Mbate, 2014), (Mubeen & Ahmad, 2016), (Fonchamnyo & Akame, 2017), (Gbolonyo, 2019), (Diop, 2019) and (Espoir, 2020). However, empirical studies have a limited discussion on export diversification in Algeria.

Given the importance export diversification for growth and development as well as the efforts made to promote non-hydrocarbon exports in Algeria, the main purpose of this study is to examine the factors that determine export diversification in Algeria. Specifically, the study aims to examine the short and long-run relationship between export diversification and its determinants.

Based on the foregoing, we have adopted the following hypothesis as the basis and starting point for discussion of the subject: there is a long-run and short-run relationship between export diversification and its determinants.

To test this basic hypothesis, the study will be based on the ARDL model applied to annual data from 1995 to 2020. The choice of this period is motivated by the fact that this period coincides with the first measures taken within the framework of the promotion of non-hydrocarbon exports (creation of support organizations). The modeling approach is based on the ARDL model, as this technique is considered the most flexible and least restrictive (suitable for our small sample size and the stochastic characteristics of our study variables). This approach also makes it possible to model the long-term and short-term dynamics of the impact of FDI flows on the structure of exports. The study will rely on the database World Bank's, *UNCTAD* data and data of Heritage foundation.

The article is structured around 4 sections, the first is devoted to the literature review, the second briefly presents the export promotion policy in Algeria and the structure of exports, the third describes the research methodology and the last section is devoted to the interpretation of the results.

2. Literature review

Diversification refers to the changing of country's export composition and structure. The process can be achieved by changing existing export commodities pattern or through expanding innovation and technology on them. As part of an export led growth strategy for most developing economies, export diversification is considered as the evolution from traditional to non-traditional exports (Samen, 2010). Export diversification can be horizontal or vertical:

An horizontal diversification of exports is defined as an increase in the number of primary products mix which usually takes place within the same export sector. Referring to studies by (Herzer & Lehmann, 2006) and (Samen, 2010), adding new products on existing export basket within the same sector helps reduce the effects of fluctuation of global commodity prices and alleviate adverse economic risks. (Herzer & Lehmann, 2006) have highlighted the importance of positive externalities generated by the horizontal diversification of exports to other sectors of the economy. These externalities are induced by the dynamic learning activities in export-oriented sectors acquired through exposure to foreign firms and international competitions.

A vertical diversification of exports occurs when a country's export structure shift from primary products to secondary or tertiary sectors, or manufactured products. The process employs a use of existing and new advanced merchandises by undertaking value addition such as processing and marketing. This process creates spill-over effects in the form of externalities on knowledge and new technologies, relative to a production of primary exports which does not generate such spillovers (Matthee & Naudé, 2007). Such spill-over benefits going to other sectors generate and improve capabilities of other industries to compete in the world market (Al-Marhubi, 2000). (Herzer & Lehmann, 2006). These improvements bring the stability of export earnings as prices of manufactured exports are less fluctuating compared prices of primary exports (Ali, Alwang, & Siegel, 1991).

Several ways of measuring export concentration (diversification being the complement to 1 of concentration) have been developed in the empirical literature. The Herfindhal-Hirschman concentration index is chosen in our study because of its availability and simplicity.

The theoretical foundation of export diversification is offered by the new trade theory, the new economic geography models and endogenous growth theory.

According to the new trade theory, increases in the number of products (extensive margin) drive trade growth. Krugman's theory offers an interesting framework that replaces the classical trade with modern economic realities of consumer's thirst and variety, product differentiation, brand monopoly, similar factor, monopolistic competition, increasing returns, active government and industrial thrust among other assumptions. The new trade models emphasize the extensive margin of trade and are better suited for understanding the determinants of export diversification. In his work,

(Krugman, 1979) presents the workhorse model of trade with a monopolistic competitive market structure. Krugman emphasizes on the extensive margin of trade, with countries in equilibrium producing an endogenous number of varieties. The number of varieties produced in a country is proportional to the size of the economy, with each country (conditional on exporting a particular variety) exporting that variety to all other countries.

In accordance with the new economic geography models (Krugman & Venables, 1990) (Venables & Limao, 2002) transport costs and distance affect the level of specialisation of a country. In effect, a lower distance to the main world markets, access to the sea and overall lower transport costs determine the ease with which a country can increase the variety of products exported to the world markets. The models also suggest that trade liberalization in a context where economies of scale and transport costs play a significant role are likely to improve product diversification. The new economic geography models also emphasize that a decrease in transaction costs resulting from trade liberalization may lead to a decrease in export diversification especially in peripheral economies (Cabral & Veiga, 2010).

According to the endogenous growth theory, export diversification plays a key role in curbing export earnings uncertainties and has the capacity of inducing the gains of comparative advantage of an economy's production structure. The basic idea underlying the endogenous growth theory is that export diversification affects long term growth. This usually results from increasing returns to scale and dynamic spillover effects as a result of new methods of production, management or marketing practices which potentially helps other industries and enhances growth in the long run – that is, backward and forward linkages. Export diversification under the endogenous growth includes various elements such as changes in demand and supply, industry capability, risk aversion, environmental considerations and changes in commercial policies (Gbolonyo, 2019).

However, the theoretical framework explaining the determinants of export diversification at the macroeconomic level are not unified (Bebczuk & Berrettoni, 2006).

Several studies have been conducted to model determinants of export diversification. (Imbs & Wacziarg, 2003) examined the relationship between a country's level of development and diversification of its exports, and they found that diversification is initially increasing, and then decreasing, depending on the country's per capita income. Similarly, (Berthélemy, 2005) confirmed the results of (Imbs & Wacziarg, 2003). The empirical study of (Agosin, Alvarez, & Ortega, 2012), based on two-step GMM estimation, shows the nonlinear effect of per capita income on diversification. Three groups of explanatory variables are distinguished: the first group of variables included reform related ones like trade openness and financial sector developments; the second group included structural determinants of exports like factor endowments and distance; the third group consisted of macro-economic factors that affect exports like exchange rate volatility, terms of trade, interaction of human capital with terms of trade. They found that trade openness encourages specialisation and therefore is negatively related to export diversification. On the other hand, financial development and higher schooling have a positive relation while exchange rate overvaluation and terms of trade improvement have a negative impact. Moreover, (Noureen & Mahmood, 2016) studied the role played by country-specific factors in the determination of export

product diversification process. They applied the OLS co-integration model to a panel of selected ASEAN and SAARC countries to find out the main determinants of export product diversification. Their analysis showed that foreign direct investment, domestic investment, competitiveness, real depreciation of domestic currency, financial sector development and institutional strength are significantly and positively related to export product diversification in both regions.

Furthermore, using Bayesian Model Averaging, (Giri, Quuayyoum, & Yin, 2019) identify key factors, from large set of potential determinants, that explain the variation in export diversification across countries during the period 1975 -2015, he concluded that the most important variables explaining export diversification is the accumulation of human capital, reducing barriers to foreign trade, improving the quality of institutions and developing the financial sector. For commodity-exporting countries, the reduction of barriers to foreign trade is the most important driver of export diversification, followed by improved education outcomes at the secondary level and the development of the financial sector.

More recently, (Hadjira & Zakane, 2021) investigate the determinants of exports diversification for 151 developed and developing countries during a period of 22 years (1996-2017). The estimation results of the pooled OLS model, Fixed Effect model, Random Effect model, the Bayesian model averaging and the weighted-average least squares method, indicate the importance of investments, governance, individual income and the added value in the industrial sector, in enhancing the diversification of exports process, while the economic reforms variables (trade openness and financial development) do not have much impact on the diversification of exports. In his work, (Altowaim, 2018) investigated the impact of financial development on export diversification in resource-rich developing countries for the period 1995 to 2013 using two methods: panel Fixed Effect and panel cointegration estimations (using the Dynamic Ordinary Least Square estimator). In the first method, the study found that financial development has no significant impact on export concentration. While in the second method, the results suggested that financial development has a significant positive impact on export concentration.

Several empirical studies carried out in Africa to identify the determinants of export diversification. (Osakwe, 2007) , using a System-GMM methodology and panel data for African countries, studied the role of aid, geography, and resource endowment on diversification of exports in Africa and found that aid and resource endowments determine export diversifications in Africa while geography has no influence. It also suggests that there is no systematic relationship between geography and diversification. Furthermore, there is some evidence that institutional factors are important although it is not robust. Moreover, the study of (Elhiraika & Mbate, 2014) based on system GMM to estimate a cross country regression model using a panel of 53 African countries for a period spanning from 1995-2011, identified per capita income, infrastructure, public investment, human capital and the institutional framework as key drivers of export diversification.

In their contribution, at the individual level, several econometric studies addressing the determinants of exports diversification are carried out. We cite, for example, the study of (Mubeen & Ahmad, 2016) who explored the determinants and degree of export diversification in Pakistan using (ARDL) model by taking time series data of 1980 to 2015. The findings of the study

indicated that geographic concentration of exports enhances product concentration in exports and reduces export diversification, while foreign direct investment, world income and real effective exchange rate play significant role in enhancing export diversification. On the other hand, trade openness improves export concentration. (Fonchamnyo & Akame, 2017) have used panel data from 32 countries from 1995 to 2013 to analyze export diversification determinants in sub-Saharan Africa and employed the fractional logit technique. The results indicates that the overall diversification of exports is most favoured and determined by trade opening, the added value of agriculture, the added value of the manufacturing sector, and foreign direct investment. At the same time, GDP per capita enormously slows down the diversification of exports in this region. (Eneje & Ikpor, 2017) examined the determinants of export in West Africa sub-region. The study adopted fixed effect model to analyze the data sourced from 17 West African countries from year 1995 to 2015. The results indicate that per capital income, human capital, investment, geographical location and good governance are significant drivers of export diversification, while terms of trade and population have negative relationship with export diversification in Africa. Recently, using (ARDL) approach, (Gbolonyo, 2019) examined the determinants of export diversification in Ghana for the period 1983 to 2016. The results of this study indicated that GDP per capita, real effective exchange rate, trade openness, foreign direct investment and infrastructure, improve export diversification in both the long-run and short-run. (Diop, 2019) identified the explanatory factors for the diversification of exports in the UEMOA countries over the period 1995- 2015, using the Fully Modified Ordinary Least Squares method. The results show that openness to trade, the accumulation of human and physical capital, a competitive real exchange rate and the endowment of natural resources constitute the main explanatory factors for the diversification of exports in the UEMOA countries. More recently, (Espoir, 2020) examined the determinants of the diversification of exports in SADC (Southern African Development Community) countries members during the period 1990-2018. The results show that there is a long-term relationship between the diversification of exports and the Gross Domestic Product per capita of housing (GDP), openness to trade, and accumulation of human and physical capital, foreign direct investment. All of its variables are the main explanatory factors for the diversification of exports in SADC countries. Contrariwise, corruption and inflation are obstacles on the diversification of exports in the economic sub-region of SADC.

3. Export structure and measures to promote export diversification in Algeria

Since independence, hydrocarbons constitute the bulk of Algerian exports. The 1986 crisis demonstrated the need to rely on external resources other than oil and gas exports. From the beginning of the 1990s, the public authorities initiated reforms aimed at the liberalization of foreign trade and the diversification of products intended for export. Aid and support mechanisms for non-hydrocarbon exports have been adopted.

3.1 Measures to promote export diversification

The public authorities have set up support institutions for exporters and have granted fiscal and financial incentives to support non-hydrocarbon exports. The institutional framework has notably resulted in the creation of:

• the Algerian Company of Insurance and Guarantee of Exports in order to take care of the commercial and political risk insurance.

• National Consultative Council for the Promotion of Exports whose mission is to contribute to the definition of the objectives and the export development strategy, to evaluate the programs and actions carried out and to propose any measure to promote the expansion non-hydrocarbon exports.

• the Algerian Society of Fairs and Exhibitions which aims to contribute to the development and promotion of commercial activities. This Company operates in several areas such as the organization of fairs, specialized exhibitions and exhibitions, of a national, international, local and regional nature; the organization of Algerian participation in fairs and exhibitions abroad; and assistance to economic operators in international trade.

• The National Agricultural Control and Development Fund (FNRDA), established pursuant to the Finance Law of 2000, provide financial support for the development of agricultural production and support the export of dates.

• The Special Export Promotion Fund aims to provide financial assistance to resident export companies that produce goods or services to help them promote and sell their products abroad. The Fund covers: a portion of the costs incurred when those companies participate in international fairs and exhibitions; a portion of transit, and handling and transport costs incurred both within and outside the country; a portion of the costs of export diagnostics and the creation of internal export cells to help small and medium-sized enterprises, and; a portion of the costs of external market research and prospecting. The Fund also provides assistance to small and medium-sized enterprises to help them penetrate foreign markets, publish and disseminate promotional materials for products and services for export; label products correctly, pay for product protection abroad (labels, trademarks and patents for inventions) and conduct training courses on exports.

• the National Agency for the Promotion of Foreign Trade whose main missions are: a) contribution to the development of the promotion strategy for non-hydrocarbon exports; b)the popularization and provision of commercial, economic and technical information necessary for the conduct of foreign trade operations; d)The establishment of an information portal allowing operators to obtain online information on various aspects of foreign trade; e)Support and assistance for companies during events organized abroad.

Moreover, export intermediaries are established in order to help small and medium-sized enterprises gain a foothold in export markets. The main initiatives in this area include the following:

- Algerian-French Export Consortium (CALFREX) was created by the National Agency for the Promotion of Foreign Trade (ALGEX) and the National Chamber of Agriculture in Algeria, and the Optimexport association in France to promote the export of agricultural products. The Consortium was established as a public limited company: the Algerian contingent owns 60 per cent of the Consortium and the French side owns 40 per cent. The Consortium has three subsidiaries, two of which are based in Algeria and one in France, and seeks to enhance the quality of agricultural products, ensure that they are labelled

correctly and promote them in international markets.

- In 2013, with the support of the United Nations Industrial Development Organization, two agrifood export consortia were established: the General Industrial Agrifood Products Consortium (GIPA), for animal proteins, and the Algerian Agrocereal Consortium (AAC) for cereal products.

- In 2014, the Algerian Agrifood Industry Consortium (ACIA) was established. This Consortium comprises 45 companies and promotes the export of agrifood products. It carries out promotional activities, and product labelling for its members, and in 2015 organized several trade fairs. It has already provided assistance to 80 companies. In 2015, a consortium specializing in the export of dates was set up in Tolga in the province of Biskra and comprises 12 producers in that province.

On the tax front, exemptions are granted to export activities. They relate to the Tax on Professional Activity, the Value Added Tax and the Corporate Profit Tax. Regarding banking facilities, any company producing goods or services established in Algeria, working in the field of the export of products of Algerian origin, benefits from banking facilities, either for participation in fairs and exhibitions abroad, or for an export, justified by supporting documents.

As part of the Technical Assistance program proposed by the World Bank to support the diversification of exports in Algeria, the "Removal of export barriers" project financed with a grant from the World Bank for a total amount of USD 2 million is divided into four components (Ministére de l'Industrie, 2021):

1. Public-private dialogues on 2 or 3 sectors with export potential: led by the Ministry of Industry and Mines. In this context, several meetings were organized with public and private operators of certain sectors with export potential, in particular: Textiles and leather, construction materials, auto mechanics and chemical fertilizers.

2. Customs and port facilitation for foreign trade: led by the Ministry of Finance and involving the Ministry of Transport and Public Works and Port of Algiers; MIM is involved in the port logistics sub-component as part of its management of the Cross-border Trade working group.

3. Support for the development of agricultural exports: led by the Ministry of Agriculture, Rural Development and Fisheries;

4. Technical support for the development of the new export strategy: led by the Ministry of Commerce.

In addition, the Support Program for Industrial Diversification and Improvement of the Business Climate in Algeria (PADICA) aims to contribute to improving the performance of the Algerian economy, through: (Ministére de l'industrie, 2021):

- better diversification of the economy by accompanying measures aimed at increasing the weight of non-hydrocarbon economic sectors in the gross domestic product (GDP) and in the country's external income;

- improvement of the business climate, in particular the simplification and securing of procedures related to national and foreign private investment.

3.2 Export structure in Algeria

Hydrocarbon exports have long represented nearly 95% of Algeria's export earnings.

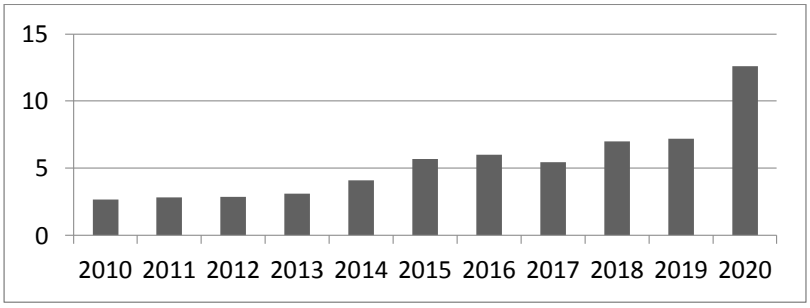
Table 1. Evolution of the structure of merchandise exports

Libellé	2013	2014	2015	2016	2017	2018	2019
Food, drinks, tobacco	0,6	0,5	0,7	1,1	1,0	0,9	1,13
Energy and lubricants	96,9	95,8	94,4	94,0	94,5	93,0	92,79
Raw products	0,2	0,2	0,3	0,2	0,2	0,2	0, 26
Semi-finished products	2,2	3,5	4,5	4,4	4,0	5,6	5,46
Agricultural equipment	0,0	0,0	0,0	0,0	0,0	0,0	/
Industrial equipments	0,0	0,0	0,1	0,2	0,2	0,2	0, 23
Consumer goods	0,0	0,0	0,0	0,1	0,1	0,1	0,10
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Established by the authors from the periodic reports of the CNIS from 2013 to 2020.

The examination of the structure of non-hydrocarbon exports reveals a predominance of the group of crude and semi-finished products which represent more than 80% of non-hydrocarbon exports. This group of products comes from the transformation of hydrocarbons. Industrial and agricultural finished products represent only a very small proportion of non-hydrocarbon exports. The structure of exported non-hydrocarbon products shows a very narrow base (CNIS, 2021).

Fig.1. Evolution of the share of non-hydrocarbon exports in total exports in (%) (2010 - 2020)



Source: Author's construction based on periodic reports of the CNIS from 2010 to 2020

The share of non-hydrocarbon exports in total exports increased at a high rate, from 2.67% in 2010 to 12.59% in 2020. 2020. Even if the share of non-hydrocarbon exports increased, but it remained very low.

Table 2 .Evolution of the structure of merchandise exports by economic region

Economic region	2013	2014	2015	2016	2017	2018
European Union	63,5	64,2	66,3	57,4	57,9	57,4
Other European countries	3,7	4,4	5,4	4,9	5,5	6,1
North America	13,7	10,1	8,2	17,2	11,8	10,4
Latin America	5	5,1	4,9	6,6	7,2	6,4
Maghreb	4,1	4,9	4,5	3,9	3,6	4
Arab countries	1,2	1	1,6	1,3	2,2	1,8
Africa	0,2	0,2	0,2	0,2	0,3	0,3
Asia	8,5	10	8,7	7,9	10,9	12,9
Rest of the world	0,1	0	0,2	0,6	0,5	0,6
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: Author's construction based on periodic reports of the CNIS from 2010 to 2019

The breakdown by economic regions during the period from 2013 to 2019 (illustrated in the tables below) clearly shows that the bulk of Algeria's foreign trade still remains focused on its traditional partners. Indeed, the OECD countries occupy the largest shares with an average of 81.64% of exports. The countries of the European Union are still Algeria's main partners during the period from 2013 to 2019 with an annual average of 57.60% of exports to these countries. The OECD countries (outside the EU) come in second position with an annual average share of 24.04% of Algeria's exports to these countries. Trade between Algeria and other regions is still marked by low proportions with a slight increase in trade with Asian countries.

4. Research method

In order to estimate relationship between macroeconomic indicators and export diversification in Algeria, the study adopted the Autoregressive Distributed Lag (ARDL) model. The Distributed Lag Model means the inclusion of unrestricted lag of the explanatory variables in a regression function. The choice of this approach is centred on the fact that the ARDL cointegration technique has been proven to be more efficient for small sample data sizes as in the case of this study. The current study uses an annual data covering a period from 1995 to 2019. Specifically, the data points are 25 which is comparatively small. Secondly, unlike other cointegration techniques, the autoregressive distributed lag model makes it possible to estimate the cointegration among the various variables by the Ordinary Least Square (OLS) methods given that the lag of the model is known. Moreover, the ARDL approach to cointegration takes into account sufficient number of lags to capture the data generating process from general to specific modelling framework. The approach solves the problem of endogeneity and seral correlation inherent in macroeconomic variables with the help of the appropriate number of lags.

4.1. Definition and Measurement of Variables

The data used in this study comes from the database of (World Bank, 2021), (UNCTAD, 2021) and (Heritage Foundation, 2021). The variables were selected on the basis of the literature. These

include, among others:

- The diversification index (IDIV) is defined as the difference between 1 and the Herfindahl-Hirschman concentration index according to this formula: IDIV = 1-HHI. Diversification index data are taken from the (UNCTAD, 2021) database.

- GDP growth is included as the proxy for level of development or country's standard of living (World Bank, 2021) (noted: GDPC): A positive sign is expected with the IDIV.

- Terms Of Trade (noted: TOT) is measured as the ratio of the export unit value index to the import value index (World Bank, 2021). The terms of trade could increase sectoral concentration due to the rise in oil prices, which encourages the export of unprocessed raw materials. Thus, positive terms-of-trade shocks from crude oil discourage the propensity to diversify exports due to increases in export earnings associated with higher oil prices (Gbolonyo, 2019). Therefore, in Algeria, the terms of trade are expected to have a negative relationship with the diversification index.

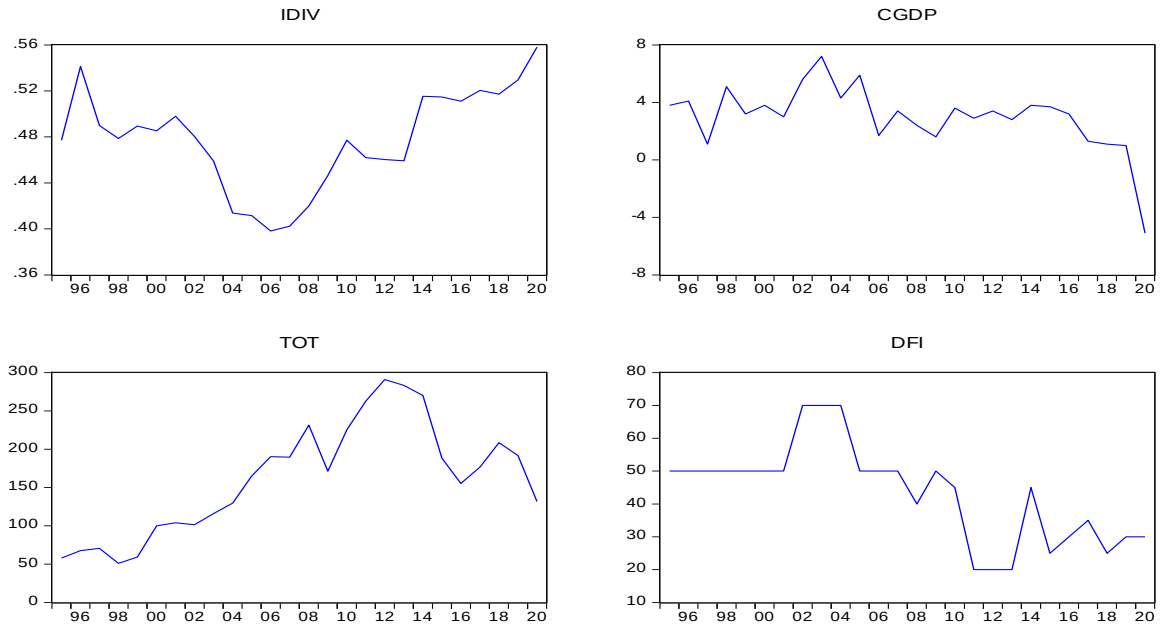
- Degree of freedom to invest (noted: DFI): A degree close to 100 means that investments can be made with few limits. The constraints are multiple: they can affect foreign or domestic investment. Limitations can be financial, bureaucratic or property related. To determine this degree, several sources are used, including the Economist Intelligence Unit. This indicator was developed by the Heritage Foundation, in partnership with the Wall Street Journal (Héritage Foundation, 2022). Literature places greater emphasizes on the importance of institutional factors as pre-requisites to export diversification. Governance is a pre- condition to promoting diversification through stronger protection of property rights, facilitation of transactions and ensuring a level-playing field for firms to compete (OECD/United Nations, 2011).

Table 3. Explanatory variables and their expected sign

Explanatory Variable	Definition	Expected Sign
GDPC	Gross domestic product per capita growth	+
TOT	Terms Of Trade	−
DFI	Degree of Freedom to Undertake	+

Source: Author's construct (2022)

Fig. 2. Graphical evolution of study variables



Source: Established by the authors from data (World Bank, 2022), (UNCTAD, 2022) and (Heritage Foundation, 2022)

Table 4. Summary Statistics of the Variables used for Analysis (1995-2020)

	IDIV	CGDP	TOT	DFI
Mean	0.477552	2.996154	161.1296	43.26923
Median	0.479520	3.300001	168.1616	50.00000
Maximum	0.558000	7.200000	290.9305	70.00000
Minimum	0.398162	-5.100000	50.92593	20.00000
Std. Dev.	0.043479	2.254503	73.05619	14.89579
Skewness	-0.247843	-1.533168	0.139126	0.037793
Kurtosis	2.288138	7.742499	1.980073	2.327365
Jarque-Bera	0.815156	34.55151	1.210815	0.496330
Probability	0.665259	0.000000	0.545852	0.780231
Sum	12.41636	77.90000	4189.370	1125.000
Sum Sq. Dev.	0.047260	127.0696	133430.2	5547.115
Observations	26	26	26	26

Source: Established by the authors from data (World Bank, 2022) , (UNCTAD, 2022) and (Heritage Foundation, 2022)

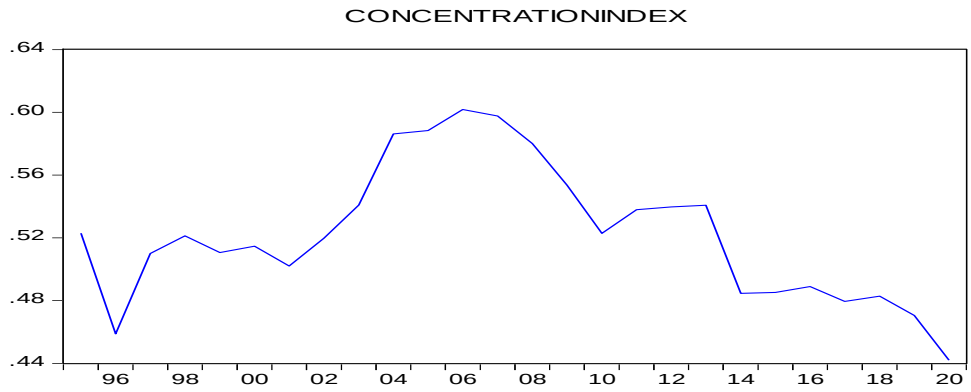
The average export diversification index for the country over the period was approximately 0, 47. It can also be observed that growth GDP averaged about 2,99%. The maximum value of growth of GDP was 7,2% with a minimum of about -5,1%. The terms of trade and Degree of freedom to

invest averaged about 161 and 43, 26percent respectively.

To analyze the diversification of the basket of goods exported to Algeria, we used the export diversification index. The index was obtained by differentiating between 1 and the Herfindahl-Hirschman concentration index (see the figure 01 for the evolution of Herfindahl-Hirschman concentration index). This makes it possible to directly analyze the level of diversification of the basket of exported products and to judge the degree of inequality between the shares of each product in the total value of exports of goods (Cadot E. , 2009) and (Coulibaly & Akia, 2019).

A Normalised Herfindahl-Hirschman Index (HHI) is used which measures a concentration of exports. The HHI index is used to proxy for export concentration. The index H, indicates values $0 \leq H \leq 1$. An index closer to 1 represents a high concentration of exports (extreme low diversification) and value close to 0 indicates a low concentration of exports (high diversification).

Fig.3. Evolution of the concentration index for Algeria

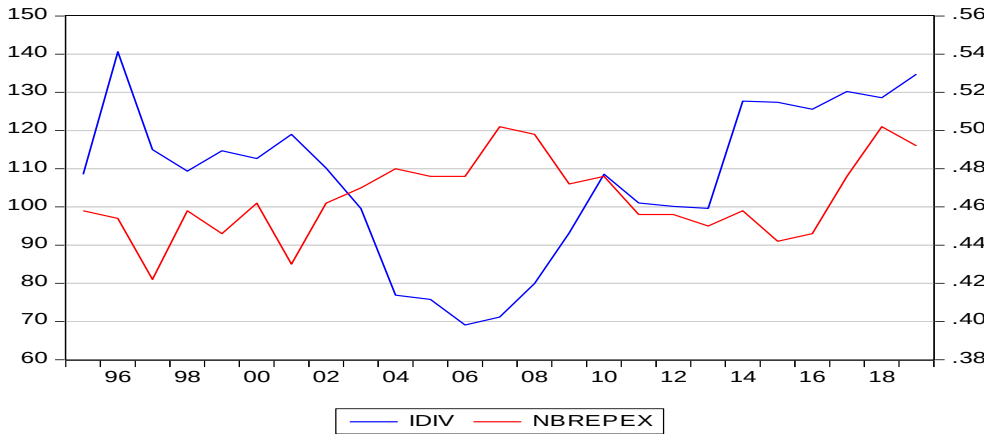


Source: *EViews9 program output based on (UNCTAD, 2022) database*

Figure 3 shows that the concentration index evolves in the form of saw tooth. From 1997 to 2001, the concentration index for Algeria's export products was consistently below 0.51. Algeria has implemented a number of devices to diversify its exportations, despite the reforms undertaken, product concentration remains high. The value of the concentration index largely depends on the evolution of oil prices. In effect, the index reached high levels in 2006 as the share of hydrocarbons in total exports was at its highest level due to high oil prices. Following the fall in oil prices in 2014, the concentration index recorded a decrease to stabilize at 0.47 (between 2015 and 2020).

The diversification index (IDIV) is defined as the difference between 1 and the Herfindahl-Hirschman concentration index according to this formula: IDIV = 1-HHI. This method makes it possible to directly analyze the level of diversification of the basket of exported products and to judge the degree of inequality between the shares of each product in the total value. This method is recommended by (Cadot, 2009) and (Coulibaly & Akia, 2019). The evolution of this index is illustrated in the figure 4.

Fig.4. Evolution of the number of exported products and the concentration index for Algeria



Source: *EViews9 program output based on (UNCTAD, 2022) database*

The remarkable points of figure N ° 4 were the periods from 2001 to 2007, from 2008 to 2016 and from 2010 to 2012. At these different dates, the observation was that the increase or decrease in the number of products exported on the first two periods resulted in a variation of the diversification index in the opposite direction.

4.2 ARDL approach to cointegration

To carry out the estimation of (ARDL) model procedure, the study firstly analyzed the time series characteristics of the dataset. The Augmented Dickey-Fuller (ADF) is employed to undertake unit root rests to check for stationarity of variables in the order to ensure that none of the variables are any more than I (0) or I (1).

Following existing empirical stadies, the empirical model for the determinants of export diversification can be specified. Thus, equation (1) can be written as:

$$\text{IDIV}_t = (GDPC_t, TOT_t, \text{DFI}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For purpose of estimation, equation (2) which gives the general specification is transformed into a behavioral equation. IDIV, GDPC, TOT have their values in log form for easy interpretation and to remove outliers. $LIDID_t = \beta_0 + \beta_1 LGDPC_t + \beta_2 LTOT_t + \beta_3 LDFI_t + \varepsilon_t$ ....(2)

Where β_0 is the constant term, β_i are the coefficients of the respective explanatory variables, L is the natural log operator, t denotes time and ε_t is the error term.

4.2.1 Unit root test procedure

To conduct the ADF test on LIDIV, we have begun by estimating the general model (model 3), including a constant and a linear trend. Results for model 3 of ADF show that the trend is not significant because its t-statistics, in absolute value, equal to 1.28, below the critical value tabulated by Dickey & Fuller (3.25) at the 5% level. In that wise, we accept the hypothesis H0: β=0, so model (3) is not the right one. Then we pass to estimate model 2. Results indicate an insignificant constant

because its t-statistics is lower than its critical value tabulated by Dickey & Fuller (-0.85). So, we accept H0: c = 0. That is, we test model (1), and we find the Dickey-Fuller statistics (-0.68) more significant than the tabulated value at the 5% level (-1.95). In that case, we accept the null hypothesis (H0: ϕ= 1), that is, the existence of unit roots and hence, the series is non-stationary. In the end, we find a non-stationary series; it should be removed by differentiating to correct the non-stationary. Thus, LIDIV is integrated of order 1. Given the unit root test results and following the same strategy, we studied the LGDPC, LTOT, LDFI series. The results of unit root tests using the ADF test are shown in Table 5.

Table 5: Results of unit root tests using the ADF test

Variables	**Level**						**ADF Difference Test**	
	t-statistics and tabulated value	model 3 Intercept and Trend		Model 2 Intercept		Model 1 None	Model 1 None	Order of Integration
		t-ADF	t-trend	t- ADF	t-cons	T ADF	T ADF	
LDIV	t-statistics	-1.14	1.28	-0.92	-0.85	-0.68	-5.32	**I (1)**
	tabulated value	-3.60	3.25	-2.98	2.97	-1.95	-1.95	
LGDPC	t-statistics	-3.11	-2.20	-1.47	0.99	-1.37	-7.05	**I (1)**
	tabulated value	-3.60	2.79	-2.99	2.54	-1.95	-1.95	
LTOT	t-statistics	-0.66	-0.38	-1.81	1.89	0.57	-3.99	**I (1)**
	tabulated value	-3.60	3.25	-2.98	2.97	-1.95	-1.95	
LDFI	t-statistics	-3.05	-2.18	-1.98	1.94	- 0.52	-6.52	**I (1)**
	tabulated value	-3.60	3.25	-2.98	2.97	-1.95	-1.95	

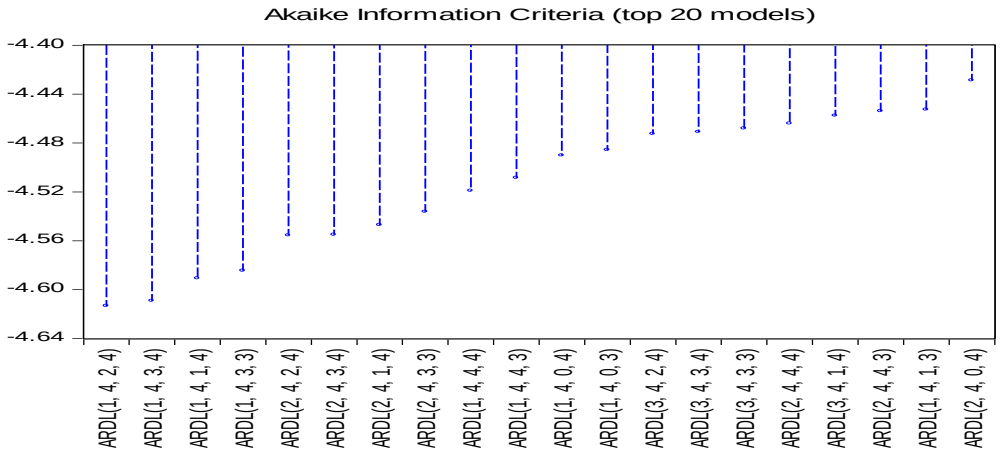
Source*:* EViews9 program output

The results reported in Table (5) shows that the all variables (LIDIV, LGDPC, LTOT, LDFI**)** are stationary in the first difference, i.e. they have no order of integration greater than one. Therefore, we can use the bound test of cointegration technique to look at the extent of a long-run relationship between the two studied variables.

4.2.2 Determination of the optimal lags and estimation of the ARDL model

After conducting ADF test, and ensuring that the time series are not integrated to order 2, the model can be estimated. However, before that, the optimal lags *p*, *q* should be determined, where the ARDL method is very sensitive to the lag number of dependent variable. For this purpose, we will use the Akaike Information Criterion (AIC). Then the model was estimated using the Eviews9 program. According to the AIC criterion the results indicate that the optimal model is the ARDL (1, 4, 2, 4) model, where it was chosen among 500 models evaluated. (Table 6 in appendices and Figure No. 5**.**).

Fig. 5. AIC graphics values



Source *: EViews9 program output*

After estimating the parameters of the ARDL model (1, 4, 2, 4), it is necessary to verify the possibility of a long-run equilibrium relationship, using the Bounds Test Approach (ARDL). Table 7 shows the test results, where the calculated f-statistic value is equal to (**8,932**) and is greater than the upper limit value of the critical values in the model. Consequently, we reject the null hypothesis at the significance levels 1%, 5% and 10%, where there is a long-run equilibrium relationship between LIDIV and its determinants in Algeria.

Table 7 : Results of the Bounds Test Approach

ARDL Bounds Test Date: 06/08/22 Time: 16:35 Sample: 1999 2020 Included observations: 22 Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	**8.932754**	3
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source *: EViews9 program output*

5. RESULTS AND DISCUSSION

After confirming the existence of a cointegration relationship, we will measure both the long-run and the short-run relationship.

5.1 Short and long run parameters estimation

The parameters estimations under the ARDL model are reported in Table 8:

Table 8 : Estimation results of the ARDL model

ARDL Cointegrating And Long Run Form
Dependent Variable: LIDIV
Selected Model: ARDL(1, 4, 2, 4)
Date: 06/08/22 Time: 17:01
Sample: 1995 2020
Included observations: 22

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CGDP)	-0.003126	0.002919	-1.070801	0.3198
D(CGDP(-1))	0.009422	0.004459	2.112940	0.0725
D(CGDP(-2))	0.001625	0.004034	0.402968	0.6990
D(CGDP(-3))	0.011097	0.004611	2.406502	**0.0470**
D(LTOT)	-0.007365	0.038585	-0.190878	0.8540
D(LTOT(-1))	0.028975	0.031608	0.916707	0.3898
D(LDFI)	0.046409	0.022609	2.052725	0.0792
D(LDFI(-1))	0.038632	0.021752	1.775970	0.1190
D(LDFI(-2))	0.066636	0.023553	2.829175	**0.0254**
D(LDFI(-3))	0.048358	0.028631	1.689018	0.1351
CointEq(-1)	-0.725121	0.151153	-4.797273	0.0020

Cointeq = LIDIV - (-0.0586*CGDP -0.0857*LTOT -0.1927*LDFI + 0.6080)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CGDP	-0.058629	0.012708	-4.613476	**0.0024**
LTOT	-0.085729	0.026687	-3.212383	**0.0148**
LDFI	-0.192693	0.041221	-4.674647	**0.0023**
C	0.608043	0.224122	2.712994	0.0301

Source *: EViews9 program output*

According to the results of the estimation, the value of the error correction coefficient shows that 0.72% of the short-term imbalance can be corrected annually in order to return to the long-term equilibrium situation. However, the rate of correction reflects a slow speed of adjustment to return to the equilibrium position after the impact of any shock in the model, due to the change in the determinants of diversification. According to the results of the model, all the independent variables in level affect the variable LIDIV, in addition to the constant.

The results from the long run estimates show that the all variables, namely; the growth of gross domestic product (GDPC), terms of trade (LTOT) and degree of freedom to invest are strong long-run determinants of export diversification in Algeria.

The negative coefficient of GDP growth rate indicates an inverse relationship between the level of development and export diversification. A percentage increase in GDP growth is accompanied by a decrease in diversification by approximately 0.05 percent. This result implies that as income increases in Algerian economy, there is not a corresponding change in the pattern of consumption preference. This result which does not conform to theoretical predictions can be explained by the fact that economic growth in Algeria is driven mainly by the hydrocarbon sector. (Fonchamnyo & Akame, 2017) found that GDP slows down the diversification of exports in sub-Saharan Africa.

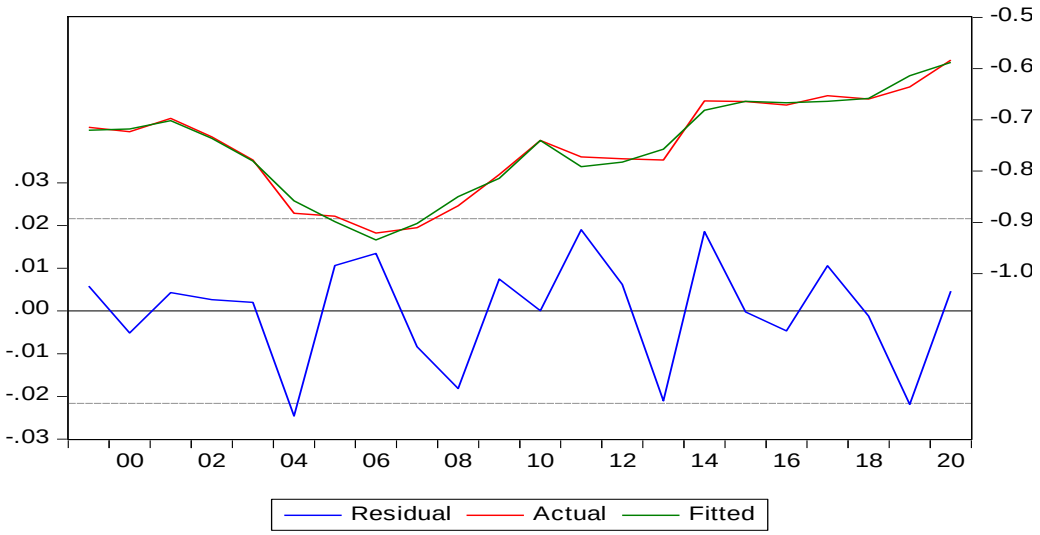
The results of the long-term estimation show that the terms of trade negatively affect export diversification. This implies that as oil prices raise Algeria is more likely to specialize in the production and export of hydrocarbons in order to benefit from increased export revenues. Results from the long-run estimation indicate that a unit increase in terms of trade will lead to a reduction in export diversification by 0.08 percent. The result is consistent with the empirical findings of (Agosin, Alvarez, & Ortega, 2012); (Elhiraika & Mbate, 2014) and (Eneje & Ikpor, 2017).

The negative sign of degree of freedom to invest indicates that an increase in the LDFI unit reduces export diversification by about 0,19 percent. The result, counterintuitive, is not conforms to the a' priori expected sign and the empirical result of (Cabral & Veiga, 2010). Moreover, an adequate business climate provides a very significant stimulus to private sector development, sectoral and product diversification.

In the short term, the results reveal that the positive factors of export diversification are GDP growth and degree of freedom to invest. While the coefficient terms of trade is not statistically significant. Indeed, the gross domestic product growth coefficient is statistically significant and positive. This implies that a 1% increase in gross domestic product growth lagging by three years will improve export diversification by about 0.011% in the short term. Similarly, it was found that lagging GDP by one year will increase diversification by 0.010% (at the 10% significance level). This result is consistent with the results of empirical studies of (Obeng, 2018).

The results as presented in Table 8 indicate that independent variables have statistical significance. The results (the good statistical significance of the estimated model parameters, the critical probability values less than 0.05, and the determination coefficient ratio) denote the efficiency of the model in interpreting the changes of the dependent variable. This latter can be seen through the representation of the estimated series (Fitted) and compared with its real data. We note in Figure 6, the semi-conformity between the curves of the real series and the estimated series.

Fig.6. The original series of LIDIV and its estimated series



Source *: EViews9 program output*

5.2 Diagnostic tests

The following diagnostic tests will be performed for the estimated model

5.2.1 Test of autocorrelation of the residuals using The Breusch–Godfrey Test

Table 9. Results of the first-order autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.823379	Prob. F(1,6)	0.3992
Obs*R-squared	2.654747	Prob. Chi-Square(1)	0.1032

Table 10. Results of the second-order autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	3.267223	Prob. F(2,5)	0.1237
Obs*R-squared	12.46335	Prob. Chi-Square(2)	0.0020

Source *: EViews9 program output*

From table (9) we note that the critical probability for Fisher equals 0,39, so we accept the null hypothesis H_0 at level of 5% of significance, which states that there is no first-order autocorrelation between the error terms.

The Breusch-Godfrey Serial Correlation LM test reveals the absence of serial correlation

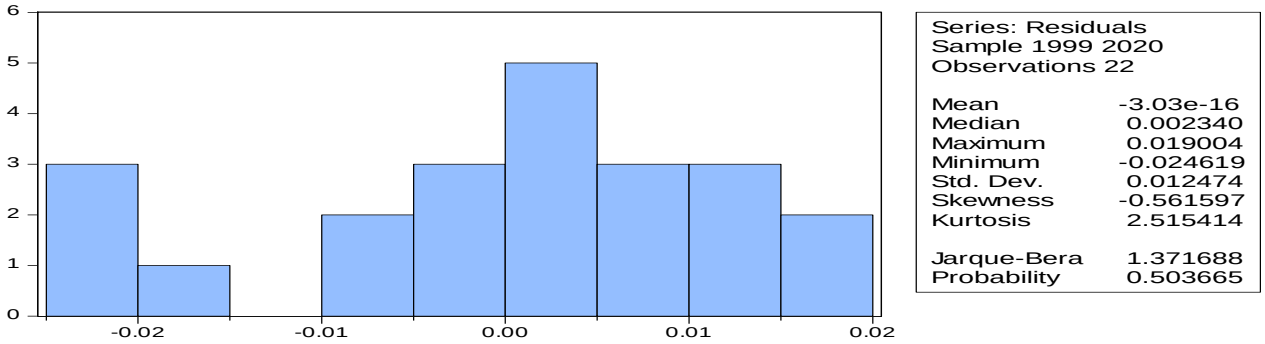
among the variables, as the F-statistic of 3.26 was not statistically significant with a P-value of 0.13.

5.2.2 Test of the Normality of Residuals (Jarque-Bera test)

We can study the distribution of the Residuals, by testing the normality of distribution, which based on the Jarque-bera statistic.

Since the probability value (p-value) of the JB statistic equal to 0.50 is greater than the level of 5% of significance, so we cannot reject the null hypothesis, and from it we accept the hypothesis that the residuals are normally distributed at level of 5% of significance.

Fig. 7. Normality Test of the Residuals



Source *: EViews9 program output*

5.2.3 Test of Heteroskedasticity

The Breusch-Pagan-Godfrey test for Heteroskedasticity presented in table 11 is statistically insignificant with F-statistics of 0.43 and P-value of 0.91 therefore indicating the absence of heteroskedasticity among the error terms.

Table 11. Results of the Heteroskedasticity test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.437014	Prob. F(14,7)	0.9112
Obs*R-squared	10.26059	Prob. Chi-Square(14)	0.7429
Scaled explained SS	0.787090	Prob. Chi-Square(14)	1.0000

Source *:* EViews9 program output

5.2.4 Test of the Regression Equation Specification

The results shown in table 12 indicates that probability value P-value equals to 0.91 is greater than the level of 5% of significance; therefore, we accept the null hypothesis that there are no specification errors at level of 5% of significance, i.e. the RESET statistic indicates the validity of the formula for the function used in the model.

Table 12. Results of the RESET test

Ramsey RESET Test
Equation: UNTITLED
Specification: LIDIV LIDIV(-1) CGDP CGDP(-1) CGDP(-2) CGDP(-3) CGDP(-4) LTOT LTOT(-1) LTOT(-2) LDFI LDFI(-1) LDFI(-2) LDFI(-3) LDFI(-4) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.107115	6	0.9182
F-statistic	0.011474	(1, 6)	0.9182

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	6.24E-06	1	6.24E-06
Restricted SSR	0.003268	7	0.000467
Unrestricted SSR	0.003261	6	0.000544

Source *:* EViews9 program output

6. CONCLUSION

This study aimed to examine the short and long term determinants of export diversification in Algeria. Specifically, the study focused on investigating the relationship between export diversification and explanatory variables used annual data from 1995 to 2019.

The available literature indicates that export diversification is significantly influenced by several factors and these factors have different influence on export diversification among countries. These factors are categorized into three namely; structural factors, economic/policy reforms and macroeconomic factors.

The cointegration analysis revealed the presence of long-run relationship between export diversification and its determinants. The error correction model also revealed a short-run relationship among export and its determinants. The study found that all the explanatory variables had a long- run relationship with export diversification. Specifically, terms of trade had the expected positive sign. On the other hand, GDP growth and degree of freedom to invest found to contribute negatively to export diversification in Algeria.

The short-term results showed that the positive drivers of export diversification in the short-run are three -year lag of GDP, and two-year lag of degree of freedom to invest.

On the basis of these different results, we make the following suggestions:

- Modify the basket of exported products: Algeria would benefit from carrying out vertical diversification as described by (Herzer & Lehmann, 2006). Despite a marked improvement between 2001 and 2020, its basket of exported goods has not changed much. To this end, a transformation of its basket by adding products from other sectors could improve its mode

of diversification and correct the negative effects it has on current growth.

- Begin a structural transformation of the national economy: the Algerian economy is highly dependent on the hydrocarbon sector; a structural transformation of the economy will require the diversification of its economy and the development of the manufactured sector. This will materialize the vertical diversification project advocated in the first recommendation and allow Algeria to integrate into global value chains.

- Improve the business climate by reducing restrictions on the freedom to undertaken;

However, the results of this study present certain limits from which it is possible to draw new avenues of research. As a research perspective, it would be interesting to integrate other macro-economic variables (such as the exchange rate and FDI), geographic factors (natural resources), human capital and infrastructure as a determinant of the diversification of exports to Algeria.

7. Bibliography List :

Agosin, R., Alvarez, R., & Ortega, C. (2012). Determinants of Export Diversification around the World 1962-2000,. The World Economy .

Ali, R., Alwang, J., & Siegel, P. (1991). Is export diversification the best way to cchieve export growth and stability? A look at three African countries . (Policy Research Working Paper Series No. 729).Washington, DC: World Bank Publications .

Al-Marhubi, F. (2000). Export diversification and growth: an empirical investigation. Applied economics letters, 7(9) , 559-562.

Altowaim, S. (2018). Promoting and financing industrial diversification in resource-dependent developing countries. PhD thesis. Universty of Glasgow.

Bebczuk, R., & Berrettoni, O. (2006). Explaining export diversification: An empirical analysis . Working Paper No 65, Caf Research Program On Development Issues, Department of Economics, Universidad Nacional De La Plata.

Berthélemy, J. (2005). Commerce international et diversification économique. revue d'économie politique 5/2005 (Vol. 115) , 591-611 .

Cabral, M. H., & Veiga, P. (2010). Determinants of export diversification and sophistication in sub-saharan Africa. Nova SBE Working Paper Series wp550, Universidade Nova de Lisboa, Nova School of Business and Economics.

Cadot, E. (2009). Export diversification: what's behind the Hump. Etudes et Documents .

Cadot, O., DeMelo, J., Plane, P., Wagner, L., & Woldemichael, T. (2016). Industrialisation et transformation structurelle : L'afrique Sub-Saharienne peut-elle se développer sans usines ? Revue D'économie Du Développement, 2016(2) , 19-49.

CNIS. (2021). Statistiques du commerce exterieur de l'Algérie.

Coulibaly, R., & Akia, S. (2019). Export structure and economic growth in a developing country : case of Cote d ' Ivoire. Munich Personal RePEc Archive 94116.

Diop, M. (2019). Facteurs de diversification des exportations : Une analyse empirique au cas des pays de l'UEMOA. Finance &Finance Internationale , 2489-1290.

Edwards, J. (2009). Trading Partner Volatility and the Ability for a Country to Cope: A Panel GMM Model, 1970-2005. Applied Econometrics and International Development, Vol. 9. (2) , 5-20.

Elhiraika, A., & Mbate, M. (2014). Assessing the determinants of export diversification in Africa. Applied Econometrics and International Development, 14(1) , 147-160.

Eneje, B., & Ikpor, I. (2017). Export diversification determinants in west african subregion. European Journal of Accounting, Auditing and Finance Research Vol.5 No.3 , 76-88.

Espoir, L. (2020). Determinant of export diversification: An empirical analysis in the case of SADC countries. International Journal of Research in Business & Social Science, Special Issue , 130-144.

Ferdous, F. (2011). Pattern and determinants of export diversification in East Asian economies. Proceedings of the International Conference on Social Science and Humanity, (pp. 26-28). Singapore.
Fonchamnyo, D., & Akame, A. (2017). Determinants of export diversification in Sub-Sahara African region: a fractionalized logit estimation model. Journal of Economics and Finance April 2017, Volume 41, Issue 2, , 330–342.
Gbolonyo, E. Y. (2019). Determinants of export diversification in Ghana, ,. Thesis, University of Cape Coast .
Giri, R., Quuayyoum, S. N., & Yin, R. J. (2019). Understanding export diversification , key drivers and policy implications. IM F working paper .
Hadjira, A., & Zakane, A. (2021). Determinants of export diversification: An empirical study, the case of developing and emerging countries during the period 1996-2017. Revue d'Economie et de Statistique Appliquée? Volume 18 number 1, June 2021 , 7-15.
Héritage Foundation. (2022). Perspective Monde.
Herzer, D., & Lehmann, N. (2006). What does export diversification do for a growth? An econometric analysis. Applied Economic Letters, 38(15), 1825-1838.
Imbs, J., & Wacziarg, R. (2003). Stages of diversification. American Economic Review , 93 (1), 63–86.
Kamuganga, D. (2012). What drives Africa's export diversification? . (Graduate Institute Of International And Development Studies Working Paper No. 15/2012). Geneva, Switzerland: International Economics Session.
Krugman, P. (1979). A model of innovation, technology transfer, and the world distribution of income. Journal of political economy, 87(2) , 253-266.
Krugman, P., & Venables, A. J. (1990). Integration and the competitiveness of peripheral industry . (CEPR Discussion Paper No. 363). Unity with diversity in the European Community , 56-77.
Matthee, M., & Naudé, W. (2007). Export diversity and regional growth: empirical evidence from South Africa . Research Paper (No. 2007/11). , UNU-WIDER, United Nations University (UNU) .
McLntyre, A., Li, M., Wang, K., & Yun, H. (2018). Economic benefits of export diversification in small states. The International Monetary Fund.
Ministére de l'industrie. (2021). Synthese diversification. Retrieved from https://www.industrie.gov.dz: https://www.industrie.gov.dz/?Synthese-diversification
Mubeen, N., & Ahmad, N. (2016). Towards measurement and determinants of export diversification: An empirical analysis of Pakistan. Journal of Commerce and Social Sciences .
Noureen, S., & Mahmood, Z. (2016). Explaining trends and factors affecting export diversification in ASEAN and SAARC Regions: An Empirical Analysis. Nust Journal of Social Sciences and Humanities Vol.2 No.1 (January-June 2016) , 1-28.
Obeng, C. (2018). Is the effect of exchange rate volatility on export diversification symmetric or asymmetric? Evidence from Ghana. Cogent Economics & Finance, 6(1) .
OECD/United Nations. (2011). Economic Diversification in Africa: A Review of Selected Countries. OECD Publishing.
Osakwe, P. (2007). Foreign aid, resources, and export diversification in Africa: A new test of existing theories. African Trade Policy Centre.(Vol. 61) .
Parteka, A., & Tamberi, M. (2013). What determines export diversification in the development process? Empirical assessment. The World Economy , 807–26.
Samen, S. (2010). A primer on export diversification: Key concepts, theoretical underpinnings and empirical evidence. Washington, DC: Growth and Crisis Unit World Bank Institute.
Sannassee, R., Seetanah, B., & Lamport, M. (2014). Export diversification and economic growth: the case of Mauritius. In 4th World Trade Organization Annual Conference, (pp. 1-2). Geneva,Switzerland.
UNCTAD. (2022). Base de donnée. Retrieved from https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx.
Venables, A. J., & Limao, N. (2002). Geographical disadvantage: a Heckscher– Ohlin–von Thünen model of international specialisation. Journal of international Economics, 58(2) , 239-263.
World Bank. (2022). Base de donnée de la Banque Mondiale.

8. Appendices

Table 8 : Estimation results of the ARDL model (1, 4, 2, 4)

Dependent Variable: LIDIV
Method: ARDL
Date: 06/08/22 Time: 17:00
Sample (adjusted): 1999 2020
Included observations: 22 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): CGDP LTOT LDFI
Fixed regressors: C
Number of models evalulated: 500
Selected Model: ARDL(1, 4, 2, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIDIV(-1)	0.274879	0.151153	1.818553	0.1118
CGDP	-0.003126	0.002919	-1.070801	0.3198
CGDP(-1)	-0.017243	0.004162	-4.142587	0.0043
CGDP(-2)	-0.009422	0.004459	-2.112940	0.0725
CGDP(-3)	-0.001625	0.004034	-0.402968	0.6990
CGDP(-4)	-0.011097	0.004611	-2.406502	0.0470
LTOT	-0.007365	0.038585	-0.190878	0.8540
LTOT(-1)	-0.025824	0.036355	-0.710321	0.5005
LTOT(-2)	-0.028975	0.031608	-0.916707	0.3898
LDFI	0.046409	0.022609	2.052725	0.0792
LDFI(-1)	-0.032509	0.019889	-1.634513	0.1462
LDFI(-2)	-0.038632	0.021752	-1.775970	0.1190
LDFI(-3)	-0.066636	0.023553	-2.829175	0.0254
LDFI(-4)	-0.048358	0.028631	-1.689018	0.1351
C	0.440905	0.199252	2.212797	0.0625

R-squared	0.983335	Mean dependent var	-0.750828
Adjusted R-squared	0.950005	S.D. dependent var	0.096628
S.E. of regression	0.021606	Akaike info criterion	-4.613207
Sum squared resid	0.003268	Schwarz criterion	-3.869314
Log likelihood	65.74527	Hannan-Quinn criter.	-4.437968
F-statistic	29.50270	Durbin-Watson stat	2.498752
Prob(F-statistic)	0.000075		

*Note: p-values and any subsequent tests do not account for model selection.

Source *:* EViews9 program output