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THE REALITY OF DATE PRODUCTION IN ALGERIA AND ITS RELATIONSHIP WITH NATIONAL INCOME: AN ECONOMETRIC STUDY USING THE AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) MODEL DURING THE PERIOD 2000-2019

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ABSTRACT

Objective: The objective of this study is to investigate the evolution of date production in Algeria and its impact on the country's national income (GDP) from 2000 to 2019. This research aims to analyze the short-term and long-term relationships between date production and national income, assessing the significance of agricultural policies in enhancing the productivity and economic contribution of the date sector. Ultimately, the study seeks to highlight the role of date production in diversifying Algeria's exports and contributing to sustainable economic growth.

Theoretical Framework: This study explores the relationship between date production and national income in Algeria, using agricultural productivity theory, endogenous growth theory, export diversification theory, and the ARDL model. It aims to understand the impact of agricultural policies, human capital investment, and export diversification on Algeria's date production, highlighting the potential for economic diversification.

Method: This study analyzes the relationship between date production and Algeria's GDP from 2000 to 2019, using the Autoregressive Distributed Lag (ARDL) model. Data sources include Algeria's GDP and date production data. The study uses unit root tests, bounds testing, and error correction models to estimate the relationship. Statistical software like EViews or R is used for analysis.

Results and Discussion: The study reveals a positive relationship between date production and national income in Algeria from 2000 to 2019. The data suggests that agricultural policies have led to an upward trajectory in date production, while GDP has grown significantly. The study also highlights the importance of date production in Algeria's economy, particularly in diversifying exports. The long-term relationship suggests sustained investment in date production will yield continued benefits for national income.

Research Implications: The study highlights the importance of supporting agricultural policies that enhance productivity in Algeria's date sector. It suggests broader export diversification strategies, infrastructure development, and economic development. Strengthening date production can create job opportunities, stimulate rural development, and contribute to food security. Future research should explore other agricultural products, climate change, and technological innovations to improve yields and sustainability in the sector.

Originality/Value: The study explores Algeria's date production and national income relationship, providing insights for policymakers to diversify the economy beyond hydrocarbons and foster sustainable growth.

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A REALIDADE DA PRODUÇÃO DE TÁBUA NA ARGÉLIA E SUA RELAÇÃO COM A RENDA NACIONAL: UM ESTUDO ECONOMÉTRICO ATRAVÉS DO MODELO DE ATRASO AUTO-REGRESSIVO DISTRIBUÍDO (ARDL) DURANTE O PERÍODO 2000-2019

RESUMO

Objetivo: O objetivo deste estudo é investigar a evolução da produção de tâmara na Argélia e seu impacto na renda nacional do país (PIB) entre 2000 e 2019. Essa pesquisa visa analisar as relações de curto e longo prazo entre a produção de tâmaras e a renda nacional, avaliando a importância das políticas agrícolas para melhorar a produtividade e a contribuição econômica do setor de tâmaras. Por fim, o estudo visa destacar o papel da produção de tâmaras na diversificação das exportações da Argélia e sua contribuição para o crescimento econômico sustentável.

Estrutura Teórica: Este estudo explora a relação entre a produção de tâmaras e a renda nacional na Argélia, usando a teoria da produtividade agrícola, a teoria do crescimento endógeno, a teoria da diversificação das exportações e o modelo ARDL. O objetivo é entender o impacto das políticas agrícolas, do investimento em capital humano e da diversificação das exportações sobre a produção de tâmaras na Argélia, destacando o potencial de diversificação econômica.

Métodos: este estudo analisa a relação entre a produção de tâmaras e o PIB da Argélia de 2000 a 2019, usando o modelo ARDL (Autoregressive Distributed Lag). As fontes de dados incluem o PIB da Argélia e dados de produção de tâmaras. O estudo usa testes de raiz unitária, testes de limites e modelos de correção de erros para estimar a relação. Softwares estatísticos como o EViews ou o R são usados para a análise.

Resultados e Discussão: O estudo revela uma relação positiva entre a produção de tâmaras e a renda nacional na Argélia entre 2000 e 2019. Os dados sugerem que as políticas agrícolas levaram a uma trajetória ascendente na produção de tâmaras, enquanto o PIB cresceu significativamente. O estudo também destaca a importância da produção de tâmaras na economia da Argélia, especialmente na diversificação das exportações. A relação de longo prazo sugere que o investimento sustentado na produção de tâmaras trará benefícios contínuos à renda nacional.

Implicações para a Pesquisa: O estudo destaca a importância de apoiar políticas agrícolas que melhorem a produtividade do setor de tâmaras da Argélia. Ele sugere estratégias mais amplas para a diversificação das exportações, o desenvolvimento da infraestrutura e o desenvolvimento econômico. O fortalecimento da produção de tâmaras pode criar oportunidades de emprego, estimular o desenvolvimento rural e contribuir para a segurança alimentar. Pesquisas futuras devem explorar outras commodities agrícolas, mudanças climáticas e inovações tecnológicas para melhorar o desempenho e a sustentabilidade do setor.

Originalidade/Valor: O estudo explora a relação entre a produção de tâmaras e a renda nacional da Argélia, fornecendo ideias para que os formuladores de políticas diversifiquem a economia para além dos hidrocarbonetos e promovam o crescimento sustentável.

Palavras-chave: Produção de Tâmaras, Renda Nacional Argelina, ARDL, Argélia.

LA REALIDAD DE LA PRODUCCIÓN DE DÁTILES EN ARGELIA Y SU RELACIÓN CON LA RENTA NACIONAL: UN ESTUDIO ECONOMÉTRICO MEDIANTE EL MODELO DE RETARDO AUTORREGRESIVO DISTRIBUIDO (ARDL) DURANTE EL PERIODO 2000-2019

RESUMEN

Objetivo: El objetivo de este estudio es investigar la evolución de la producción de dátiles en Argelia y su impacto en la renta nacional (PIB) del país entre 2000 y 2019. Esta investigación pretende analizar las relaciones a corto y largo plazo entre la producción de dátiles y la renta nacional, evaluando la importancia de las políticas agrícolas para mejorar la productividad y la contribución económica del sector de los dátiles. En última instancia, el estudio pretende destacar el papel de la producción de dátiles en la diversificación de las exportaciones de Argelia y su contribución al crecimiento económico sostenible.

Marco Teórico: Este estudio explora la relación entre la producción de dátiles y la renta nacional en Argelia, utilizando la teoría de la productividad agrícola, la teoría del crecimiento endógeno, la teoría de la diversificación de las exportaciones y el modelo ARDL. Su objetivo es comprender el impacto de las políticas agrícolas, la inversión en capital humano y la diversificación de las exportaciones en la producción de dátiles de Argelia, destacando el potencial de diversificación económica.

Método: Este estudio analiza la relación entre la producción de dátiles y el PIB de Argelia desde 2000 hasta 2019, utilizando el modelo Autoregressive Distributed Lag (ARDL). Las fuentes de datos incluyen el PIB de Argelia y los datos de producción de dátiles. El estudio utiliza pruebas de raíz unitaria, pruebas de límites y modelos de corrección de errores para estimar la relación. Para el análisis se utiliza software estadístico como EViews o R.

Resultados y Discusión: El estudio revela una relación positiva entre la producción de dátiles y la renta nacional en Argelia entre 2000 y 2019. Los datos sugieren que las políticas agrícolas han llevado a una trayectoria

ascendente en la producción de dátiles, mientras que el PIB ha crecido significativamente. El estudio también destaca la importancia de la producción de dátiles en la economía de Argelia, en particular para diversificar las exportaciones. La relación a largo plazo sugiere que la inversión sostenida en la producción de dátiles reportará beneficios continuados para la renta nacional.
Implicaciones de la Investigación: El estudio subraya la importancia de apoyar políticas agrícolas que mejoren la productividad del sector argelino de los dátiles. Sugiere estrategias más amplias de diversificación de las exportaciones, desarrollo de infraestructuras y desarrollo económico. Reforzar la producción de dátiles puede crear oportunidades de empleo, estimular el desarrollo rural y contribuir a la seguridad alimentaria. La investigación futura debería explorar otros productos agrícolas, el cambio climático y las innovaciones tecnológicas para mejorar el rendimiento y la sostenibilidad del sector.
Originalidad/Valor: El estudio explora la relación entre la producción de dátiles y la renta nacional de Argelia, aportando ideas a los responsables políticos para diversificar la economía más allá de los hidrocarburos y fomentar el crecimiento sostenible.

Palabras clave: Producción de Dátiles, Renta Nacional Argelina, ARDL, Argelia.

1 INTRODUCTION

The date palm is a blessed tree, unlike any other tree, favoured by God Almighty and mentioned in many places in His Holy Book. Date palms have religious, economic and social significance in both the Islamic and Arab worlds, and God has given them a high status, as evidenced by their mention in many verses of the Qur'an (17 surahs and 20 verses). The Qur'an describes the characteristics of the date palm and its role in serving mankind, whom God has honoured and provided with the means of life on earth. It encourages people to consume dates in abundance, as it says:

> And shake the trunk of the palm tree towards you; it will drop on you fresh, ripe dates. (Surah Maryam, 25).
>
> And from the fruit of the palm tree and the vine you take intoxicants and good food. Indeed, in this is a sign for a people who use reason (Surah An-Nahl, 67).
>
> And He it is Who sends down water from the sky, and We make of it vegetation of all things. And from it We produce green stalks, from which We produce grains arranged in heaps. And from the palm-tree, from its sprouting bud, clusters of hanging fruit. And gardens of vines, and olives, and pomegranates, similar and different. Look at their fruit when it is ripe, and their fragrance. In these are signs for a people who believe (Surah Al-An'am, 99).
>
> And grains and date palms with soft fruit (Surah Ash-Shu'ara, 148).
>
> And the date palms with their fruits piled one on top of the other (Surah Al-Ghashiyah, 10).

> Does any of you wish to have a garden of date palms and vines, with rivers flowing beneath it, and all kinds of fruit for him therein, while he is afflicted with old age? (Surah Al-Baqarah, 266).
>
> And in the earth are adjoining plots and gardens of vines and grain and date palms, similar and different. They are irrigated with the same water, but We make some of them better in taste than others. Surely in this are signs for a people who use reason (Surah Ar-Ra'd, 4).
>
> So We have created for you gardens of date palms and vines, in which there is much fruit for you to eat (Surah Al-Mu'minun, 19).
>
> And We placed therein gardens of date palms and vines, and We made springs to gush forth therein (Surah Ya-Sin, 34).

The date palm is also mentioned in the noble Prophetic traditions, which emphasise the virtues of planting palms and the benefits of eating dates. The Messenger of God, peace be upon him, said: "A house without dates is the house of its people in hunger". He also said: "Feed your wives with dates during the period of childbirth, for the woman whose food during the period of childbirth is dates, her child will be wise. For this was the food of Mary on the day she gave birth; if God had known a better food than dates, He would have provided it for her".

The fruit of the date palm is rich in all the necessary nutritional components for humans, including water, minerals, salts, vitamins, sugars and more. The Messenger of God, peace be upon him, lived on the two black things (water and dates) for two months.

Poets have praised the date palm, including the poet Ahmed Shawqi in his poem entitled "The Date Palm", where he describes it as food for the poor, a delicacy for the rich, and sustenance for travellers and expatriates.

Algeria has vast tracts of land with millions of date palms that produce some of the finest dates in the world. In an effort to develop the date production sector and promote the country's exports, the authorities are making significant efforts in this sector and in agriculture in general. These efforts are manifested in a series of support measures for the agricultural sector, such as the implementation of the National Agricultural Development Plan, the establishment of the National Fund for Agricultural Regulation and Development, the approval of the Green Corridor and the provision of accompanying loans.

With regard to the export of agricultural products, the Algerian authorities have adopted a number of laws and created a number of bodies to achieve this objective, such as the adaptation of the customs code, the creation of the Algerian Agency for the Promotion of Foreign Trade, the

creation of a special fund for the development of exports, the adoption of the (OPTIMEXPORT) programme and the creation of the National Association of Algerian Exporters.

On this basis, the following question can be posed:

What is the reality of date production in Algeria and its impact on national income?

In order to answer this question, this study will focus on the following points:

- the theoretical literature on date production and the volume of date production in Algeria;
- an econometric study of the impact of date production in Algeria on national income.

The theoretical literature on date production and the volume of date production in Algeria:

Origin of date palms and their cultivation areas worldwide:

The date palm (Phoenix dactylifera) belongs to the palm family (Arecaceae) and is one of the most important fruit trees in the Arab and Islamic regions. Originating in this area, it has spread to many regions of the world and continues to provide high nutritional value through its fruits and numerous benefits limited only by human innovation (Othman, 1998).

A symbol of the desert environment, the date palm is one of the oldest trees known to man, dating back more than four thousand years before Christ. It is said that the date palm originated in prehistoric times in the region that stretches from Senegal to the Andalusian basin, generally between 15° and 30° latitude (Majid & Al-Hajiri, 1990).

The date palm is considered to be one of the oldest fruit-bearing trees, and historians disagree as to its original home. Ibn Wahshiyah, one of the earliest Arab agricultural writers, suggests that the island of Harthan, at the head of the Arabian Gulf in Bahrain, may be the original home of the date palm, from where it spread to Babylon in Iraq (Hassan, 1971).

The cultivation of dates is as old as agriculture itself, dating back over ten thousand years. The Arabs introduced date cultivation to Andalusia in the 7th and 8th centuries AD. The date palm was introduced to Mexico long ago, and its cultivation in North and South America began in the 18th century. It was introduced to the United States in 1769, followed by widespread cultivation from 1900 to 1908 through important offshoots, due to the efforts made to select good varieties from different growing sources (Ibrahim & Khalif, 2004).

2 FEATURES OF THE DATE PALM

The date palm has a tall trunk, typically between 15 and 25 metres, cylindrical in shape and covered with a fibrous layer from the base of the leaves, which are also fibrous. Its flowers are monoecious, and this type of tree is mainly cultivated in deserts and regions with dry climates. However, it shows great adaptability as it can grow in poor soils and is resistant to drought and cold (Al-Hawahir & Farida, 1996-1997).

The date palm has many characteristics that allow it to thrive in different types of soil. Although it is not a sand plant, it can grow in such soils. It is also considered an aquatic plant, but its roots contain large air spaces that allow it to grow in areas with high groundwater levels. It is also not a halophyte, but has a high resistance to high salt concentrations. Although it is classified as a desert plant, the presence of a waxy layer on its leaflets (fronds), combined with a reduced surface area and the transformation of some parts into spines to protect the growing tip from high temperatures, makes it well suited to desert conditions (Othman, 1998).

The date palm has unique characteristics that make it more important than other fruit trees. It is the only tree that does not shed its leaves and has the ability to tolerate high temperatures while producing an important food crop. Its growth thrives in arid and semi-arid environments more than other trees, creating a specific environment that provides essential shade and shelter from heat and dry winds for a significant number of crops, fodder and other trees. It plays a crucial role in stabilising soils and sand dunes, maintaining soil moisture, which helps to create an ecological balance in arid and semi-arid regions.

Every part of the date palm has great utility (its fruits, fibres, trunk, fronds and leaves), in addition to other materials extracted from the different parts of the palm. Its fruit is rich in all the essential nutrients required by humans, including water, minerals, salts, vitamins, sugars and more.

The cultivation of date palms in Arab communities is of particular importance, not only as a source of food, but also because of its association with customs, traditions and social values that have been handed down from generation to generation. This has led to a special appreciation of the date palm in these countries due to its status and harmony with the local environment. The date palm is considered a symbol of the desert environment, as it is one of the most adaptable plants to the desert, tolerating high temperatures, drought and salinity, conditions that many other plants cannot withstand (Abbas, 2012-2013).

The Babylonians benefited greatly from dates and date palms. In a Babylonian poem from the Persian era, the benefits of the date palm are listed, with a total of 365 advantages

(Abdullah, 2006). As a result, many Arab countries, including Algeria, have focused on the cultivation of date palms and date production, including them in their agricultural plans, programmes and strategies.

3 VOLUME OF DATE PRODUCTION IN ALGERIA

Algeria has more than 55 varieties of dates, classified according to the following characteristics:

Table 1

Varieties of dates

Soft dates	Semi-dry dates	Dry dates
Examples: Gharas, Bent Akhbala, Adala, Hamrayya, Hamira, Takramst, Ali Warachat.	Examples: Deglet Nour, Tafvzwin, Tamjhurt, Azward, Ouargla, Arshiti, Zamrat Maimoun, Takribs.	Examples: White Deglet, Mish Deglet, Tim Nasir, Thawri, Deglet Mshahl.

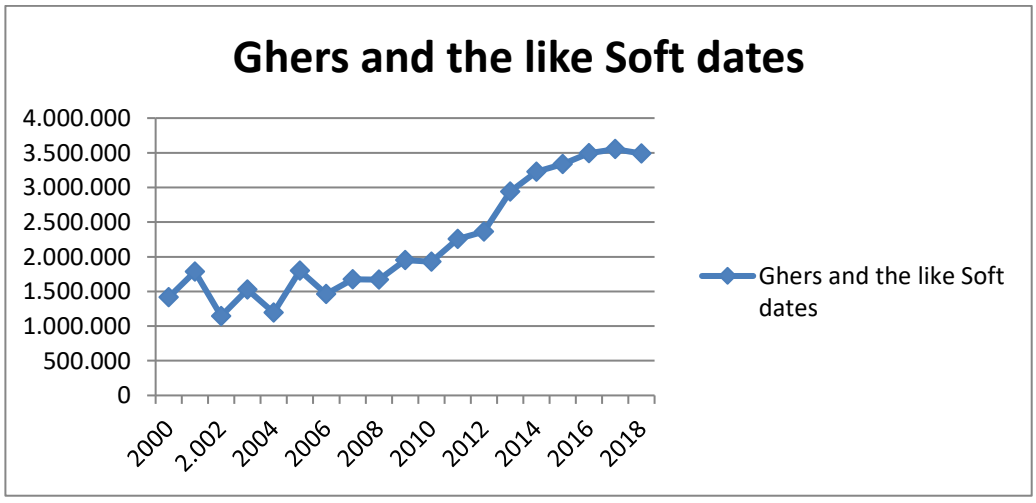
Source: Author 2024

3.1 GROUP OF SOFT (MOIST) DATE VARIETIES

The varieties in this group are characterised by a low sugar content and a high moisture content, making them unsuitable for long-term storage without appropriate preservation methods, as they tend to ferment. This group is characterised by the variety of colours of its fruits, which are consumed fresh, with a significant amount being consumed during the ripening stage.

Figure 1

Development of Ghers date production 2000-2018



Source: Ministry of Agriculture, Rural Development and Fisheries

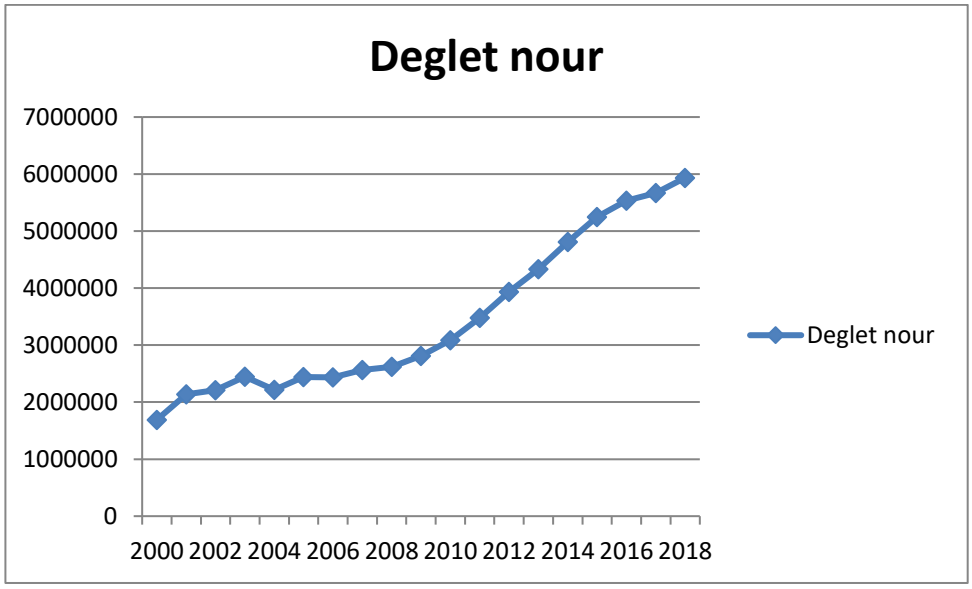
From Figure 1, we can see that the production of dates in Ghars has doubled during the study period from 2000 to 2018, with an increase of 146%. This is due to the great interest in desert agriculture and the use of large areas for date palm cultivation made available by the state within the framework of the so-called reclamation of desert and semi-arid lands.

3.2 GROUP OF SEMI-DRY VARIETIES

This group is characterised by fruit that, when ripe, has a medium moisture content in the flesh - neither wet nor dry. They can be stored naturally for a long time after harvest and are suitable for processing.

Figure 2

Development of Deglet Nour production from 2000 to 2018



Source: Ministry of Agriculture, Rural Development and Fisheries

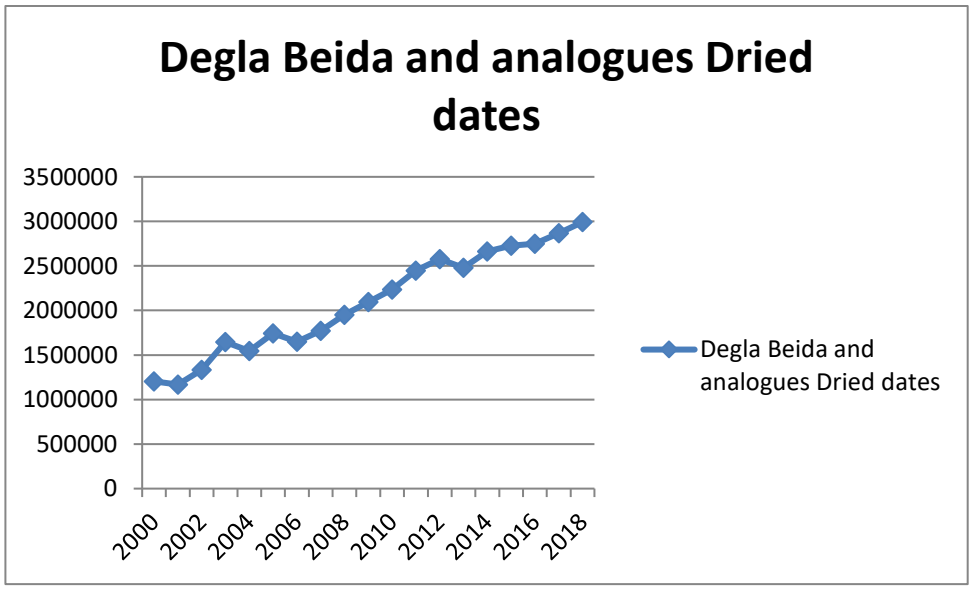
From Figure 2, we can see that the production of Deglet Nour dates increased by 251.13% during the study period from 2000 to 2018. This growth can be attributed to the great interest in desert agriculture and the use of large areas for date palm cultivation made available by the state within the framework of the so-called reclamation of desert and semi-arid lands.

3.3 DRY DATES

These are the varieties that reach a state of total dryness. This group is characterised by fruit that, when ripe, has a dry flesh with a low water content and a high sugar content, which allows it to be stored for long periods using natural methods, while retaining its specific characteristics.

Figure 3

Evolution of white date production from 2000 to 2018

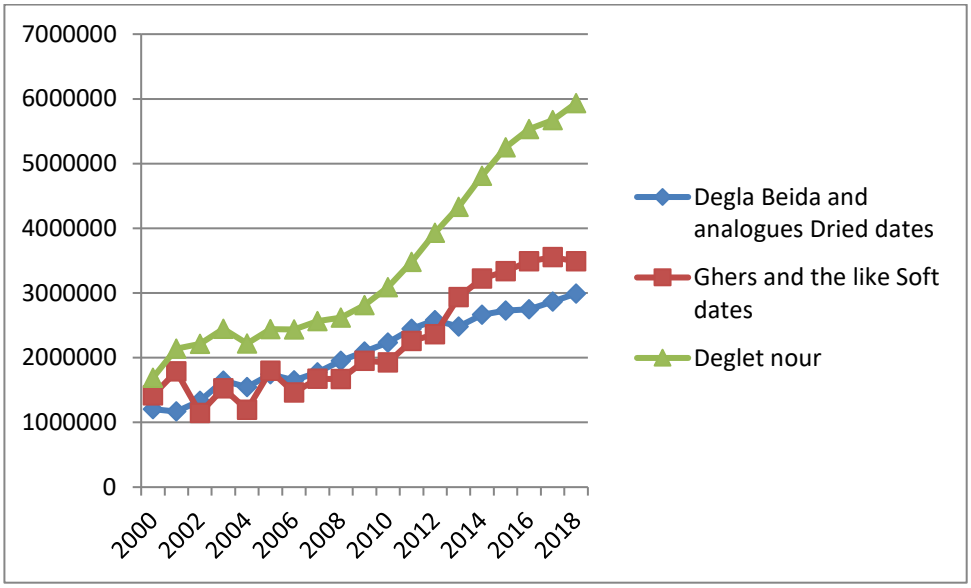


Source: Ministry of Agriculture, Rural Development and Fisheries

Figure 3 shows that the production of white dates increased by 149% during the period studied, from 2000 to 2018. This growth can be attributed to the great interest in desert agriculture and the use of large areas of land made available by the state for date palm cultivation as part of the so-called reclamation of desert and semi-arid lands.

Figure 4

Distribution of production of different types of dates produced in Algeria from 2000 to 2018



Source: Ministry of Agriculture, Rural Development and Fisheries

From the previous figures, we can see an increase in date production during the period under study. The main reasons for this are attributed to the reforms in the agricultural sector, in particular the implementation of Law 83/18 of 13/08/1983 on the ownership of agricultural land. This process involved the distribution of significant areas of agricultural land to beneficiaries for reclamation, in addition to the renewal of date palms. This increase can also be attributed to agricultural support programmes, the National Rural Development Plan and the Economic and Rural Renewal Programme, which aim to increase agricultural (Rimi & Rimi, 2013) production of dates and provide quality dates for export, especially in the context of diversifying exports beyond hydrocarbons.

Regarding the qualitative distribution of date production, the 2018 statistics show the importance of "Deglet Nour" date production, which accounts for 54.21% of Algeria's total date production. The high percentage of "Deglet Nour" production in relation to total date production in Algeria reflects the productivity of date palms producing this type of date compared to other palms. It also has considerable commercial value, as it is exported abroad in large quantities.

The production of dry dates was estimated at 27.33% in the same year, while the production of soft dates was estimated at 31.86%.

3.4 ECONOMETRIC STUDY ON THE IMPACT OF DATE PRODUCTION IN ALGERIA ON NATIONAL INCOME

This part of the study aims to present the methods and tools used in the research, including the study population and sample, sources of information collection, study variables, tools used and statistical methods applied. It will also present, interpret and discuss the results of the applied study.

4 METHOD AND TOOLS

Study variables: The variables of the applied study are represented as follows:

- independent variable: this is represented by the production of dates in Algeria, denoted by the symbol dates;
- dependent variable: this is represented by the national income of Algeria, denoted by the symbol GDP.

Table 2

National income and date production in Algeria from 2000 to 2019

Dattes Production per kilo	GDP	Years
3656160	1,04367E+13	2000
4373320	1,07499E+13	2001
4184270	1,13518E+13	2002
4922170	1,21692E+13	2003
4426000	1,26924E+13	2004
5162934	1,34413E+13	2005
4921880	1,36698E+13	2006
5269210	1,41346E+13	2007
5527650	1,44738E+13	2008
6006960	1,47054E+13	2009
6447410	1,52348E+13	2010
7248940	1,56766E+13	2011
7893570	1,62096E+13	2012
8481990	1,66635E+13	2013
9343772	1,72967E+13	2014
9903769,5	1,79367E+13	2015
10295956,55	1,85106E+13	2016
10585586,9	1,87513E+13	2017
10947000,06	1,89763E+13	2018
11 360 249	1,9166E+13	2019

Source: Ministry for Agriculture, Rural Development and Fisheries

4.1 TOOLS USED IN THE STUDY

Several tools were used to conduct the applied study, including:

- ARDL cointegration for slow time lags;
- statistical software Eviews 12 sv and Excel;
- presentation and discussion of the results of the field study.

4.2 UNIT ROOT TEST

The unit root test not only reveals the presence of a deterministic trend component, but also helps to determine the appropriate method for making the series stationary. The distinction between these two models of non-stationary time series is made using the unit root test proposed by Dickey and Fuller in 1979 and later refined in 1980.

4.3 FULLER-DICKEY TEST

This test allows us to determine whether the time series is stationary by assuming the presence of either a deterministic or a stochastic trend component. Three basic models are used in this test, the basic principle being to test the null hypothesis against the alternative hypothesis.

Table 3

Shows the unit root for the study variables.

Null Hypothesis: D(GDP) has a unit root Trend Specification: Trend and intercept Break Specification: Intercept only Break Type: Additive outlier				Null Hypothesis: D(DATTES) has a unit root Trend Specification: Intercept only Break Specification: Intercept only Break Type: Innovational outlier			
Break Date: 2013 Break Selection: Minimize Dickey-Fuller t-statistic Lag Length: 3 (Automatic - based on Schwarz information criterion, maxlag=4)				Break Date: 2007 Break Selection: Minimize Dickey-Fuller t-statistic Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=4)			
		t-Statistic	Prob.*			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.953790	< 0.01	Augmented Dickey-Fuller test statistic		-8.111053	< 0.01
Test critical values:	1% level	-5.347598		Test critical values:	1% level	-4.949133	
	5% level	-4.859812			5% level	-4.443649	
	10% level	-4.607324			10% level	-4.193627	
*Vogelsang (1993) asymptotic one-sided p-values.				*Vogelsang (1993) asymptotic one-sided p-values.			

Source: Outputs from the Statistical Software Eviews 12 sv

From the previous tables, we can see that the study variables are stationary at the first difference, as the calculated value of the Dickey-Fuller test is greater than the critical value in absolute terms in all models of the unit root methodology. This is also supported by the probability value, which is less than 0.05. Based on this, and given that there is a difference in the degree of integration of the time series of the study variables, we can test for the existence of a cointegrating relationship between the study variables in the long run by modelling the economic relationship between the dependent variable and the explanatory variables for its changes in both the long and short run.

4.4 ARDL COINTEGRATION TEST

We use the cointegration bounds methodology specific to the ARDL model to verify the existence of a long-run equilibrium relationship between date production and national income. We rely on the cointegration test according to ARDL through the null hypothesis and alternative hypothesis as follows:

- null hypothesis (H0): there is no long-run relationship between date production and national income;
- alternative hypothesis (H1): there is a long-run relationship between date production and national income.

4.5 BOUNDS TEST

After the preliminary tests and the determination of the stability of the series, we proceed to tests specific to the time gap method, the most important of which is the bounds test. In order to determine whether there is a long-run equilibrium relationship between the variables under study, we compare the tabulated and calculated F-statistics. Based on the F-value, we either accept or reject the null hypothesis and accept the alternative hypothesis.

Table 4 below presents the results of the cointegration test using the bounds test methodology. The results show that the calculated F-statistic value reached 16.27, which is greater than the critical value for the upper bound at the 10%, 5%, 2.5% and 1% levels of significance. Therefore, we reject the null hypothesis that there is no cointegrating relationship between the variables and accept the alternative hypothesis that there is a long-run equilibrium relationship between date production and national income.

Table 4

Bounds test results

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	1.62E-06	8.07E-08	20.03545	0.0000

EC = DATTES - (0.0000*GDP)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	16.27475	10%	4.04	4.78
k	1	5%	4.94	5.73
		2.5%	5.77	6.68
		1%	6.84	7.84
Actual Sample Size	15		Finite Sample: n=30	
		10%	4.29	5.08
		5%	5.395	6.35
		1%	8.17	9.285

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	2.678361	10%	-2.57	-2.91
		5%	-2.86	-3.22
		2.5%	-3.13	-3.5
		1%	-3.43	-3.82

Source: Results from the statistical software Eviews 12 sv

Model estimation: The study model is estimated using ARDL cointegration for slow time lags and its validity is tested. The following table illustrates the study's ARDL model, which relates the independent variable (date production) to the dependent variable (national production) in Algeria.

Table 5

Estimation of the ARDL model

R-squared	0.999865	Mean dependent var	7959792.
Adjusted R-squared	0.999529	S.D. dependent var	2324136.
S.E. of regression	50438.75	Akaike info criterion	24.63982
Sum squared resid	1.02E+10	Schwarz criterion	25.15905
Log likelihood	-173.7986	Hannan-Quinn criter.	24.63429
F-statistic	2972.106	Durbin-Watson stat	1.592074
Prob(F-statistic)	0.000000		

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

Source: Results of the statistical software Eviews 12 sv

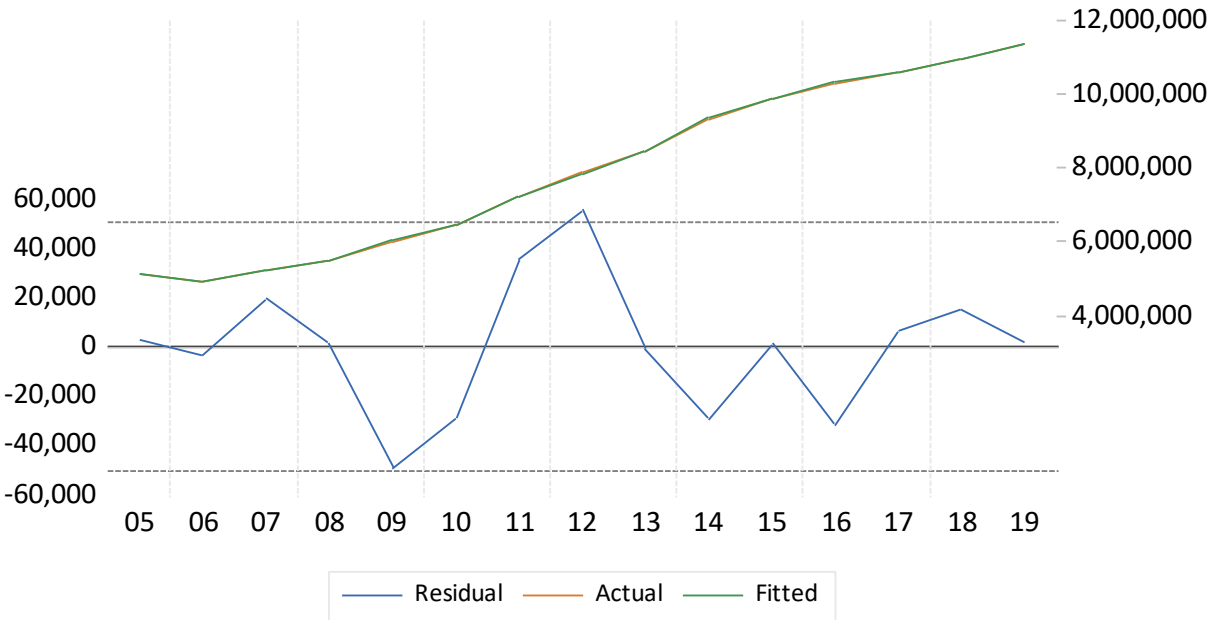
From the table we can see that the Fisher's significance value reached 0.0000, indicating statistical significance. In addition, the coefficient of determination (R^2) was 0.99986, which means that 99.95% of the changes in national income are explained by the independent variable, date production, while the remaining percentage is due to other factors not included in the model.

4.6 TEST OF MODEL QUALITY

Figure 5 shows that the estimated values are close to the actual values, which indicates the quality of the estimated model. Therefore, it can be relied upon when interpreting and analysing the results.

Figure 5

Actual and Estimated Values and Residuals (Model Quality)



Source: Results from the statistical software Eviews 12 sv

4.7 AUTOCORRELATION TEST OF ERRORS (LM TEST)

To ensure that there is no autocorrelation, we run autocorrelation tests. The results are shown in the following table:

Table 6

Autocorrelation of errors

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.436380	Prob. F(2,2)	0.4104
Obs*R-squared	8.843325	Prob. Chi-Square(2)	0.0120

Source: Results from the statistical software Eviews 12 sv

In this context, it is important that the model errors are independent of each other; if this is not the case, the parameter estimates may not be consistent due to the different values of the dependent variable that appear as residuals in the model. The presence of this problem is revealed by the LM test.

This test shows that the F-statistic is greater than 0.05. We therefore accept the null hypothesis (H0) that there is no serial autocorrelation between the residuals of the regression equation.

4.8 ERROR HOMOSCEDASTICITY TEST

To test for homoscedasticity, we use the LM ARCH test. The results of this test are as follows:

Table 7

Homoscedasticity test of errors

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	11.85607	Prob. F(10,4)	0.0146
Obs*R-squared	14.51045	Prob. Chi-Square(10)	0.1510
Scaled explained SS	0.964220	Prob. Chi-Square(10)	0.9999

Source: Results of the statistical software Eviews 12 sv

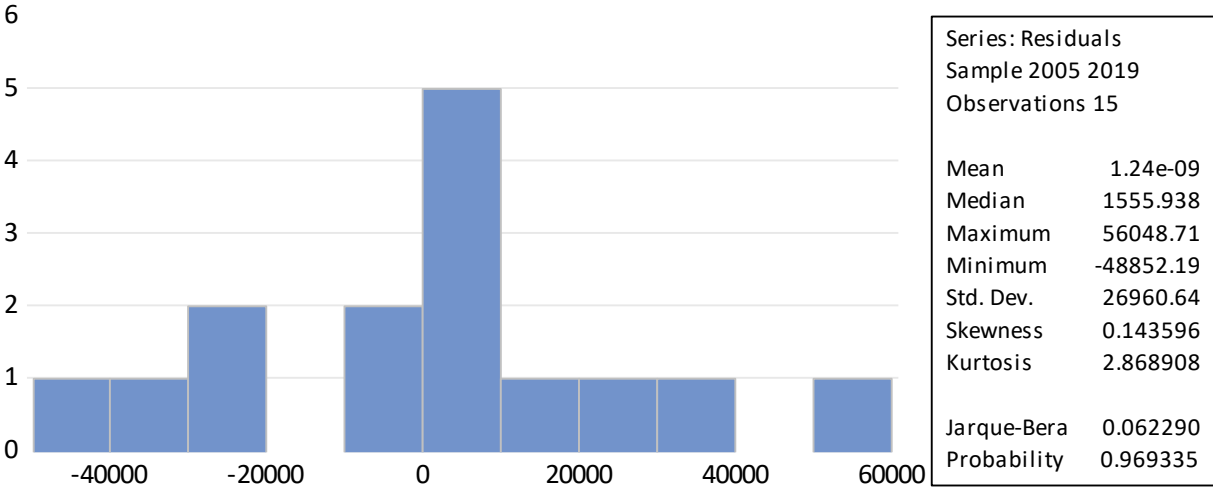
From the table we can see that the value of Obs R-squared-.Prob is 0.1510, which is greater than the 0.05 significance level. Therefore, we accept the null hypothesis and reject the alternative hypothesis, indicating that there is homogeneity of variance.

Normality test of regression residuals:

Regression analysis assumes that the residuals are normally distributed at all points of the independent variable. The results of the Bera-Jarque test are summarised in the following figure:

Figure 6

Normal distribution of regression residuals



Source: Results of the statistical software Eviews 12 sv

We use the Bera-Jarque test to verify the normal distribution condition. The test result was not significant, greater than 0.05, confirming that the residuals follow a normal distribution. The Bera-Jarque value was 0.062290 with a significance level of 0.969335, which further supports that the residuals of the model are normally distributed, as shown in the figure.

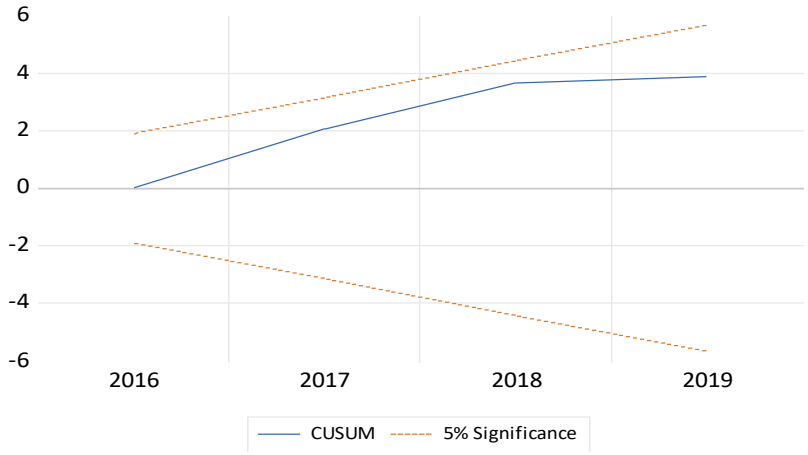
4.9 STRUCTURAL STABILITY TEST

This is assessed using the cumulative sum of residuals and the cumulative sum of squared residuals (CUSUMSQ). Both are within the critical limits, indicating structural stability of the ARDL model at a 5% level of significance. Therefore, we can say that there is stability and consistency in the model between the long term and short term results.

This is illustrated in the following figure:

Figure 7

Structural Stability Test (CUSUMSQ)



Source: Output from Eviews 12 sv statistical software.

Model estimation and error correction:

We estimate the short and long term effects as follows:

Estimation of the error correction model in the short run:

Table 8

Results of the estimation of the relationship in the short run.

ARDL Error Correction Regression
Dependent Variable: D(DATTES)
Selected Model: ARDL(5, 4)
Case 3: Unrestricted Constant and No Trend
Sample: 2000 2019
Included observations: 15

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7268077.	995349.6	7.302035	0.0019
D(DATTES(-1))	-0.506938	0.072475	-6.994640	0.0022
D(DATTES(-2))	0.564968	0.108518	5.206232	0.0065
D(DATTES(-3))	1.097493	0.127701	8.594259	0.0010
D(DATTES(-4))	0.547461	0.077282	7.083968	0.0021
D(GDP)	-4.04E-08	1.75E-07	-0.231429	0.8283
D(GDP(-1))	-7.32E-07	1.46E-07	-5.029465	0.0073
D(GDP(-2))	-1.26E-06	1.26E-07	-10.03652	0.0006
D(GDP(-3))	-1.13E-06	1.27E-07	-8.927926	0.0009

Source: Results of the statistical software Eviews 12 sv

The results from the above table, which relate to the estimation of the ECM model capturing short-term dynamics (short-term relationship), indicate that all variables are statistically significant at the 1% level.

We note that the significance of date production is at the level of 0.0031 with the expected positive sign, confirming the existence of a long-run equilibrium relationship between the model variables. The value of the error correction term (0.326688) indicates that date production is corrected towards its equilibrium value each year by a percentage of the imbalance equal to 32.66%. In other words, if date production deviates from its equilibrium position in the short run, it is not fully corrected by 32.66% each year, i.e. it takes about 1.5 years to return to equilibrium values after a shock to the model.

4.10 ESTIMATION OF THE ERROR CORRECTION MODEL IN THE LONG RUN

Table 9

Results of the estimation of the long-run relationship

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	1.62E-06	8.07E-08	20.03545	0.0000

Source: Results of the statistical software Eviews 12 sv

Table 9 shows that there is a significant positive long-run relationship between date production and national income.

5 CONCLUSION

Algeria's shift towards economic diversification strategies requires improving the performance of key sectors of the national economy, particularly the agricultural sector. The date sector in Algeria has developed both in terms of production levels and productivity, thanks to the agricultural policies implemented, particularly within the framework of the National Plan for Rural and Agricultural Development. The study concluded with a number of key findings:

1. Algeria has considerable potential in the agricultural sector, including arable land and various substantial water resources;

2. the production of Algerian dates has not yet reached the expected status, despite the competitive advantages that Algerian dates enjoy, making them one of the best agricultural products in the world;
3. there is a short-term dynamic relationship between date production and national income in Algeria for the period 2000-2019 at a significance level of 0.05;
4. there is a long-term relationship between date production and national income in Algeria at the 0.05 level of significance.

This indicates a positive and statistically significant impact, confirming the economic importance of date production in diversifying Algeria's exports beyond hydrocarbons. Encouraging and supporting agricultural production to diversify exports as part of economic development strategies leads to economic growth. This is confirmed by the econometric results, which show that an increase in date production leads to an increase in Algeria's national income.

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