Structure and dynamics of date export sector in Algeria, 2000-2018: A quantitative study

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Abstract

This study conducts a quantitative analysis of the date export sector in Algeria over a 19-year period, spanning from 2000 to 2018, utilizing data sourced from different official organizations. The study explores the structure and dynamics of date exports, through export propensities and further employs the gravity model as an econometric tool in order to identify key determinants influencing trade patterns. The main findings of this study are twofold. Firstly, it reveals a pronounced and positive growth trajectory in the propensity to export Algerian dates over the past decade, highlighting a promising upward trend in the sector's development. Secondly, the study establishes a significant correlation between the observed date export patterns and the predictions of the gravity model, further affirming the model's relevance in explaining the dynamics of the date export sector. The findings offer evidence for policymakers and stakeholders seeking to enhance Algeria's position in the global date market and facilitate sustainable growth in the export sector.

Keywords*: Date exports, Propensity to export, Gravity model, Quantitative analysis, Algeria.*

1. Introduction

The palm date sector in Algeria stands as a significant pillar of the nation's agricultural and economic landscape. With a rich history and cultural heritage deeply intertwined with date cultivation, Algeria has emerged as one of the leading producers and exporters of premium dates worldwide (Bouguedoura *et al*., 2015; Amor *et al*., 2015; El-Juhany, 2010). According to the FAO statistics 2023, Algeria's production of palm dates in 2021 is 1.18 million tons, which ranks the country fourth globally among producers. This quantity represents approximately 12% of the total global date production. Despite favorable date production and yields, Algerian date exports are indeed inversely proportional to production. Algerian exports account for only about 5% of the total date production, while the exports are about 68.8 thousand tons and it is currently ranked as the seventh largest exporter of dates in the world, behind countries such as Saudi Arabia, Iran, Egypt, and Tunisia.

More particularly, the palm date industry plays a crucial role in contributing to the country's trade balance, providing employment opportunities, and fostering socio-economic development, particularly in the arid regions of the country. Over the past two decades, from 2000 to 2018, the palm

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date sector has undergone notable transformations and witnessed remarkable growth. Despite its significance, the industry also faces a myriad of constraints that pose challenges to its full potential realization (Cheriet & Benziouche, 2012).

The palm date sector is not only crucial for its economic contributions but also for its socio-cultural importance in Algeria. It serves as a central pivot around which the life in the arid Saharan regions revolves (Mokdad, 2002; Benmehaia & Benmehaia, 2018; Benmehaia, 2019; Mokdad *et al*., 2020, 2019). Palm date cultivation is deeply ingrained in the traditions and livelihoods of the local communities, playing an essential role in sustaining their way of life and preserving their cultural heritage. In terms of economic impact, the palm date industry has proven to be a major player in Algeria's export market. With over 17 million palm trees and more than 800 date varieties, Algeria occupies a prominent position among the world's date-producing and exporting countries (Benziouche & Chehat, 2019). The premium *Deglet Nour* variety, known for its exceptional taste and quality, accounts for a relatively substantial portion of the country's date exports (Ben Mya *et al*., 2017; Benmehaia, 2019). Furthermore, the revenue generated from date exports makes it one of the primary agricultural products exported by Algeria. The share of date exports in Algeria typically ranges between 5% and 15% of agricultural exports. In 2018, date exports ranked second after the sugar and confectionery group (Abdelmalek, 2022).

Despite the efforts made by the public authorities to promote date exports, the sector is not exempt from challenges and constraints. Despite its potential, it faces technical and economic obstacles that hinder its exploitation. One of the major challenges is the prevalence of informality in many activities along the date value chain, particularly among date collectors. These collectors largely operate in the informal sector, and their numbers are estimated to be between 2500 and 5000 (PASA, 2020). Additionally, exports through border routes evade governmental oversight, contributing to a lack of product traceability, a crucial requirement for exports. Additionally, Water scarcity remains a significant concern, affecting production and imposing restrictions on the sector's growth (Cheriet & Benziouche, 2012, for details on these aspects).

This study sets out to comprehensively explore the structure and dynamics of Algeria's date export sector, relying on data sourced from various official organizations covering the extensive time frame of 2000 to 2018. The primary objective is to identify and analyze the key determinants that exert influence over trade patterns, unraveling the factors that drive Algeria's date export performance. In pursuit of this goal, the study harnesses the gravity model, a widely recognized and well-established econometric tool commonly employed in international trade analysis[1]. The gravity model has demonstrated its effectiveness in understanding the impact of crucial factors, including distance, cultural similarities, partner country GDP per capita, and the distance between trading partners, on the volume and direction of trade flows. Results by studies of Matallah *et al*. (2021) and Matallah & Benmehaia, (2019) for the Algerian case corroborated the gravity model approach. Several research works have utilized the gravity model to explain and analyze the determinants of exports and foreign trade in the agricultural sector (Hatab *et al*., 2010; Natale *et al*., 2015; Jagdambe & Kannan, 2020).

2. Research Methodology

In this study, a gravity model of exports is presented using as a dependent variable the exports of dates from Algeria (all varieties combined) to the world. The data used is a balanced panel that covers all importing countries (70 cross-sectional units) and for the period from 2000 to 2018 (19 years).

Dates export data was obtained from the National Center for Information and Statistics (CNIS, 2020) database in quantity and value (constant 2010 USD). The Gross Domestic Product per capita (GDP) variables between

[1] See Arfaoui *et al*. (2022) for other approaches applied to the olive exports sector in the Tunisian case.

2000-2018 are obtained from World Bank reports (2018). The distance between the importing country and Algeria comes from the official website[2] of distance between cities and places.

To put it as simply as possible, the formulation of the gravity model in economics can be generalized from Newton's law of gravity in terms of trade between countries as follows: trade between the two countries is determined positively by the size of each country and negatively by the distance which separates them. It follows the basic formula (Anderson, 1979; Harris & Mátyás, 1998; Eaton & Kortum, 2002; Anderson & van Wincoop, 2003; Head & Mayer, 2014):

$$X_{ijt} = g \cdot Y_i^{\alpha} \cdot Y_j^{\beta} \cdot D_{ij}^{\delta}$$

where X_{ijt} is the flow of date exports to country j from country i, Y_i and Y_j are the sizes of country i and country j, D_{ij} is the geographical distance between the countries, g is the gravity constant, and α, β, δ are parameters to be estimated.

The gravity model of trade states that the volume of exports between pairs of countries, X_{ij} is a function of their sizes (in terms of income), and their distance (as a proxy for transport costs). Nevertheless, the augmented version of the gravity model implies that additional variables could be added to improve the basic formulation of the selected gravity equation (Martínez-Zarzoso & Nowak-Lehmann, 2003; Nawrot, 2023). However, a set of variables could be included that could facilitate or restrict trade between them or relevant to the country's bilateral trade.

In order to construct appropriate explanatory variables in our model, we use country GDP (Y) as a measure of country size. For the spatial dimension, we use the distance (D) between countries (in kilometers). We also add a set of dummy variables (Z) to reflect factors that influence trade: first, the existence of a common border as commonly measured by a dummy variable. Second, a dummy variable for a common culture. In the empirical literature, this is frequently captured by the use of the same language only. In our case, unlike previous studies, we measure the common culture by a binary dummy variable referring to the same official language or the same majority religion insofar as they both represent essential components of the culture of the nations. Using a multiplicative error term, the simple empirical expression of the augmented gravity model is:

$$X_{ijt} = g \cdot Y_{it}^{\alpha} \cdot Y_{jt}^{\beta} \cdot D_{ij}^{\delta} \cdot Z_{ij}^{\omega} \cdot e^{\mu_1+\mu_2+\varepsilon}$$

The modeling of Algerian date export flows will be based on the log-linear form of this equation. In our estimation, we used a balanced panel regression, where the time effect (μ_1) and the individual effect (μ_2) are included in the regressions. From the structure of the data and preliminary estimations, it was suggested that panel regression with fixed effects is the appropriate model for our study (through the Hausman test).

In order to gauge the flow intensities, this study uses propensities coefficients. The propensities are obtained from panel regression between exports and an index of cross-sectional units (i.e. importing countries). Thus, the estimates of the coefficients for each country represent the propensity to export from Algeria to this country over 19 years. Moreover, another panel regression is performed on a time trend to extract the coefficients of the overall propensity of the dates sector of the country.

3 Results and Discussion

In this section, we will undertake the empirical verification of the hypotheses by processing the data at hand. Our analysis will encompass data counting, presentation, and thorough examination. Furthermore, we will apply the specified econometric model to extract some insights from the collected data.

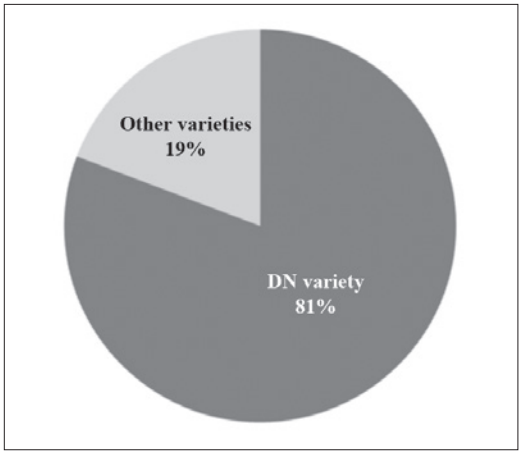
3.1. *Overview of the Algerian Date Sector*

Figure 1 provides a comprehensive overview of the structure of Algerian date exports in the year 2018. Notably, the data highlights the prominent role of the *Deglet Nour* variety, often referred to as the "fine date" or "noble date",

[2] From www.distancefromto.net.

which dominates the export market, accounting for a substantial 81% of the total Algerian date exports. The *Deglet Nour* variety's widespread representation underscores its exceptional popularity and desirability among consumers both domestically and internationally. Often hailed as the "queen of dates", *Deglet Nour* is renowned for its luscious sweetness, juicy texture, and unique translucency. These exceptional attributes have propelled it to the forefront of the date industry, making it the most sought-after and preferred date variety in the global market. The global reputation of *Deglet Nour* as a premium date variety has significantly contributed to its extensive demand, both locally and worldwide. Its unique combination of delightful flavors and appealing appearance has solidified its position as the epitome of high-quality dates. Consequently, *Deglet Nour* enjoys robust demand in various industries, including the confectionery, bakery, and health food sectors, further driving its status as the preferred date choice among consumers. While *Deglet Nour* enjoys unparalleled popularity, it is important to recognize that other date varieties, such as *Ghars*, *Mech Degla*, *Tafezouine*, and *Degla Beida*, collectively constitute around 19% of the total Algerian date exports in 2018. These varieties possess distinct characteristics, offering diverse taste profiles and nutritional benefits. However, the exceptional fame and appeal of *Deglet Nour* have inevitably overshadowed the recognition of these other varieties, leading them to occupy a relatively weaker position in the market particularly in Europe. However, it is worth noting that the other varieties find their appreciation among consumers in African countries.

Figure 1 - Structure of exported quantity of dates in 2018.



Source: Established by authors based on CNIS (2020) database.

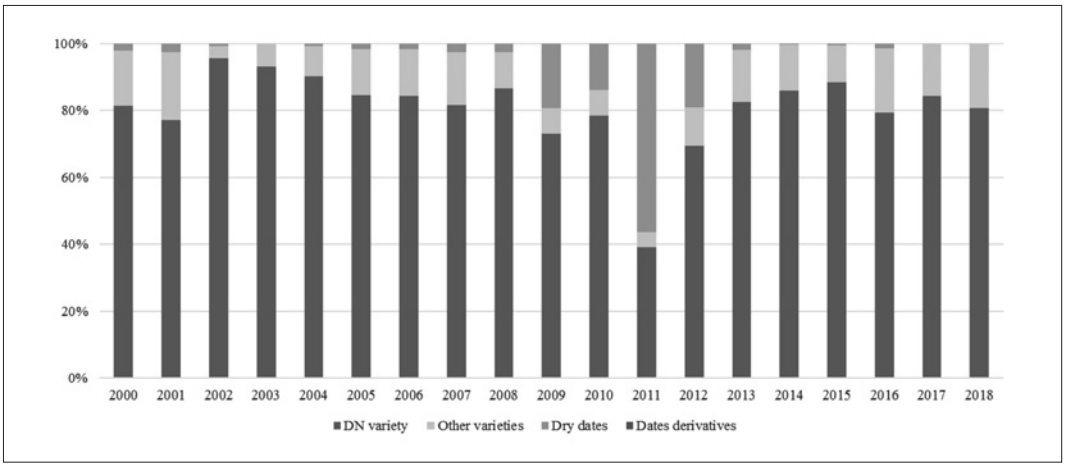
Despite the comparatively lower market share, it is worth noting that the production of these alternative date varieties has evolved in recent years. Algerian date producers have recognized the importance of diversifying their offerings to cater to varying consumer preferences and demands. As a result, efforts have been made to enhance the cultivation and production of these varieties, positioning them as valuable options for consumers seeking novel and unique date experiences.

Figure 2 provides a dynamic representation of the changes in the structure of Algerian date exports over the period from 2000 to 2018, expressed in percentage values. The data highlights the evolving trends in the export quantities of different date categories during this timeframe. Throughout the years, the *Deglet Nour* variety has consistently held the majority share in the evolution of Algerian date exports. This continued dominance reaffirms the significance of the *Deglet Nour* variety in the Algerian date export industry. Its enduring popularity and exceptional demand have sustained its prominent position as the primary contributor to Algeria's date export volumes. This can also be explained by the structure of date production and by variety, which reveals that the *Deglet Nour* variety accounts for 54% of the total production (MADR, 2018)

However, an interesting shift in the export landscape is observed during the years 2009, 2010, 2011, and 2012. During this period, the export of dry dates experienced a considerable surge, occupying a notable share of the total Algerian date exports. The substantial increase in the export of dry dates during these specific years indicates a growing global demand for this category of dates. The export of dry dates presents an opportunity for Algerian date producers to capitalize on the diverse applications of these products, such as in the confectionery, baking, and snacking industries.

Moreover, it is crucial to highlight that during 2017 and 2018, the export of processed date products began to emerge. While still negligible

Figure 2 - The dynamics of the exported quantity of dates in percentages.



Source: Established by authors based on CNIS (2020) database.

compared to other date categories, this development indicates a potential avenue for growth and value addition in the Algerian date export market. The emergence of processed date products signifies a strategic move by Algerian exporters to enhance the value and market appeal of their date offerings. By investing in processing technologies and diversifying their product range (date honey, date syrup, date paste…) Algeria can tap into new markets and cater to the preferences of consumers seeking convenience and innovation in date products. The dynamic changes observed in Figure 2 reflect the adaptability and responsiveness of the Algerian date export sector to changing global market trends. The ability to respond to shifts in consumer demand and preferences positions Algeria as a competitive player in international date trade. The continuous evolution of export trends, especially the increasing focus on dry dates and the emergence of processed date products, showcases the industry's capacity for innovation and growth.

Figure 3 provides some insights into the distribution of Algerian date exports among the top 10 importing partners from 2000 to 2018, presented in terms of cumulative quantities. The data reveals that Algerian dates enjoy a broad international market presence, with exports reaching several countries worldwide. Among the top importing partners, France stands out as the dominant recipient, monopolizing a substantial share of 50.36% of the total Algerian date exports during the specified period. This strong trade relationship between Algeria and France is a testament to the historical ties and well-established commercial relations between the two nations. Additionally, the presence of a significant Algerian diaspora in France further contributes to the robust demand for Algerian dates in the country. The combination of these factors has positioned France as the leading European destination for Algerian date exports. Following France, Russia holds the second-largest share with 8.27% of the total Algerian date exports. Niger and the United Arab Emirates (UAE) also command significant shares at 6.87% and 4.94%, respectively. These countries' interest in Algerian dates demonstrates the global appeal of Algerian date products and their ability to cater to diverse consumer preferences. Other notable importers include Morocco, the United States, and Spain, each accounting for shares between 3.92% to 3.38%. These figures indicate the demand for Algerian dates in various regions, including North America, Europe, and the Middle East.

Furthermore, Canada, Germany, and Belgium are also importers, with shares ranging from 2.82% to 2.09%. Their inclusion in the top 10 importing partners further underscores the broad international reach of Algerian date exports and reflects the country's successful efforts in diversifying its export destinations.

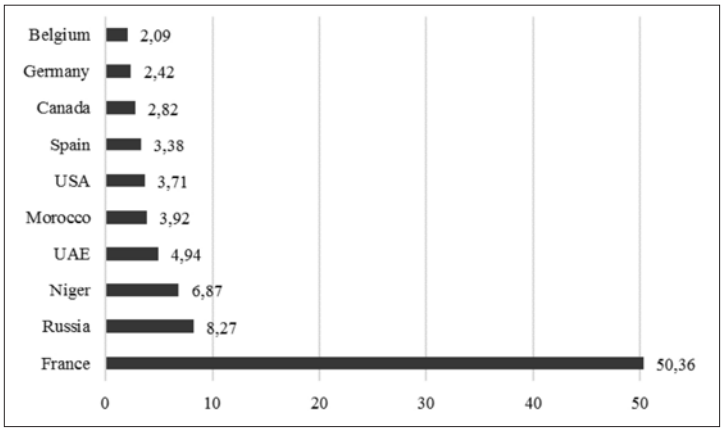


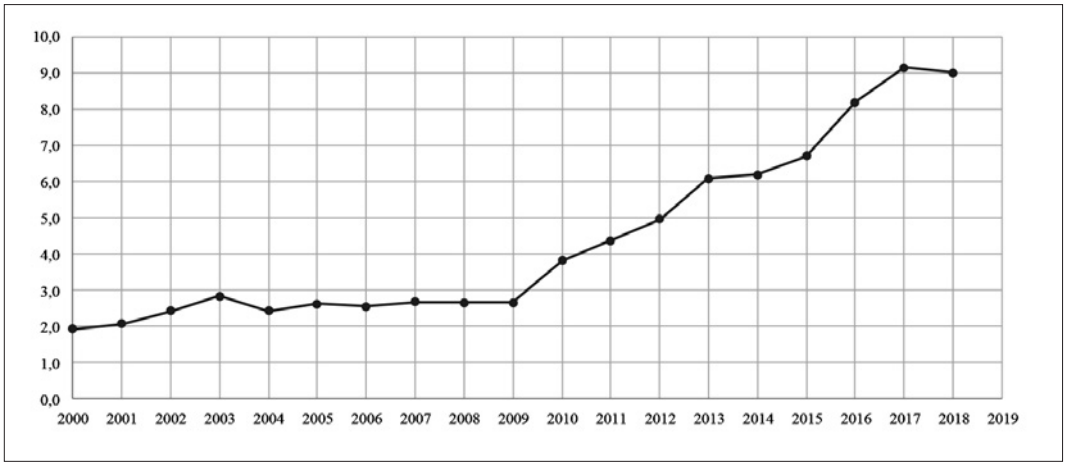
Figure 3 - The shares of 10 first partners in terms of cumulated quantities 2000-2018.

Source: Established by authors based on CNIS (2020) database.

3.2. *The Propensity of Export Dates in Algeria*

Figure 4 provides a compelling visual representation of the evolution of the propensity to export dates in Algeria over the period from 2000 to 2018. This unique analysis aims to confirm the presence of an upward trend in Algerian date exports, not solely in terms of absolute export values but in relation to the propensity to export over time. To validate this trend, a thorough panel regression analysis was conducted, revealing statistically significant estimated coefficients (with a statistical significance level of 1%). The presence of statistically significant coefficients strengthens the credibility of the findings and affirms the robustness of the analysis. The positive slope observed in the evolution of the propensity to export dates underscores the fact that Algeria's date export sector has experienced substantial growth over the years. This upward trajectory signifies an increasing interest in date exports and reflects the country's ability to leverage its agricultural expertise and product quality to cater to international demand. Moreover, the pronounced expansion of the attractiveness of the date export sector since 2010 is a notable highlight. The date industry's expanding allure suggests that Algeria has successfully captured the attention of international markets, positioning itself as a formidable player in the global date trade.

Figure 4 - Evolution of the export propensity of dates in Algeria.



Source: Established by authors based on CNIS (2020) database.

Table 1 - Top 20 partners in terms of dates export propensity 2000-2018.

Country	*Export Propensity Coefficient*	*Country*	*Export Propensity Coefficient*
France	16.039	Turkey	9.303
Morocco	13.132	Italy	9.121
Canada	13.025	UK	8.674
Spain	12.835	Niger	7.971
Russia	12.562	Germany	7.923
Belgium	12.401	Indonesia	6.763
USA	12.113	Malaysia	6.652
UAE	10.818	Equa Guinea	6.488
Sweden	10.062	Netherlands	6.131
Mauritania	9.375	Switzerland	6.130

Source: Established by authors based on CNIS (2020) database.

The positive evolution of the propensity to export dates also implies a favorable business environment and effective export promotion strategies. These factors play a crucial role in encouraging Algerian date producers and exporters to actively engage with international markets and explore new opportunities.

The analysis of export propensity serves as a valuable indicator of the trading relationships between Algeria and its partner countries. Table 1 presents a comprehensive list of the top 20 partners based on their propensity to export Algerian dates from 2000 to 2018. At the forefront of this group is France, displaying the highest propensity, signifying a strong and enduring trade partnership between the two nations. Following closely are Morocco, Canada, Spain, and Russia, further underscoring their significant roles as key partners in the export of Algerian dates. Additionally, Belgium, the United States, the UAE, Sweden, and Mauritania hold the second position in terms of their propensity to export Algerian dates. This indicates the importance of these countries as valuable trade partners, contributing substantially to Algeria's date export activity.

Moreover, the table reveals Algeria's trade engagement in exporting dates with other European countries, including Turkey, Italy, the United Kingdom, Germany, the Netherlands, and Switzerland. This diversification of export partners in Europe showcases Algeria's efforts to tap into various markets and broaden its export reach across the continent. The presence of export trade flow with Asian countries, such as Indonesia and Malaysia, further highlights Algeria's global outlook in date exports. This expansion into Asian markets signifies the country's willingness to explore new opportunities and cater to the preferences of consumers in these regions.

In terms of trade with African countries, the export propensity of the top 20 partner countries indicates relatively low trade ties with nations like Morocco, Niger, Mauritania, and Equatorial Guinea. The "neighborhood factor" is evident here, as countries close to Algeria benefit from the efficient export trade flow of Algerian dates. Furthermore, the trade relationships with these countries exemplify how geographic proximity plays a role in fostering trade collaborations. The convenience of logistics and reduced transportation costs in neighboring countries facilitate robust trading partnerships in the region.

3.3. Determinants of Dates Exports through Gravity Model

Table 2 presents the regression results for the augmented gravity model, which goes beyond the basic gravity model to incorporate additional factors that influence trade between countries. In this augmented version, crucial elements like

the common border factor and common culture are taken into account to provide a more comprehensive understanding of trade dynamics. The significance of all variables at the 1% level indicates that the augmented gravity model is highly robust and reliable in explaining the trade patterns of Algerian dates. The high level of significance strengthens the model's credibility, affirming that the factors considered have a substantive impact on the trade of Algerian dates with partner countries.

The coefficient of the Common Border variable (*FRONT*) is positive and statistically significant (*t*-ratio of 4.96). This suggests that countries sharing a border with Algeria tend to have higher date exports, supporting the neighboring country effect. The positive coefficient indicates that geographic proximity plays a crucial role in reducing logistics and processing costs, making trade of dates more feasible between neighboring countries.

The coefficient of the Common Culture variable (*CULT*) is also positive and statistically significant (*t*-ratio of 3.07). This implies that countries with shared cultural aspects, such as language and religion, are more likely to engage in higher date exports with Algeria. However, the coefficient value being below 1 (0.780) suggests that while cultural similarities contribute to trade, they have a relatively moderate impact compared to geographic proximity. Nevertheless, this can be explained by the presence of Arab and Muslim diaspora in importers countries (Hadjou *et al*., 2014).

The coefficient of the Algerian GDP per capita (*GDPPC_DZ*) is negative and highly statistically significant (*t*-ratio of -7.21). This negative coefficient indicates that a higher local Algerian date consumption has a detrimental effect on date exports. The larger the domestic consumption of dates, the less surplus is available for export, which could limit the quantity of dates sent to other countries and this is the case, as 95% of our production is consumed locally.

The coefficients of the Partner Country's GDP per capita (*GDPPC_PART*) and Distance (*DIST*) variables are positive and highly statistically significant, with t-ratios of 8.99 and 4.73, respectively. This implies that higher GDP per capita in partner countries positively influences date exports, while increased distance negatively affects trade. Higher GDP indicates greater purchasing power and demand, while distance affects trade by adding transportation costs and logistical complexities.

Table 2 - Regression results for the augmented gravity model applied to panel data of dates exports in Algeria 2000-2018.

	Estimation for export quantity	*Estimation for export value (USD 2010)*
const	220.33 (7.18)	237.83 (7.414)
GDPPC_DZ	−1.416 (−7.21)	−1.528 (−7.44)
GDPPC_PART	0.628 (8.99)	0.695 (9.47)
DIST	−0.883 (−4.73)	−0.981 (−4.99)
FRONT	2.894 (4.96)	3.015 (4.94)
CULT	0.780 (3.07)	0.875 (3.31)
CS unit	0.042 (8.09)	0.045 (8.10)
Time trend	0.835 (13.10)	0.894 (13.41)
Adjusted R-squared	0.346	0.355
F(7, 1322)	101.50***	105.88***

The coefficients of the Cross-sectional unit and Time Trend variables are positive and highly statistically significant, with t-ratios of 8.09 and 13.10, respectively, for the quantity exported, and 8.10 and 13.41, respectively, for the value in USD2010. These positive coefficients indicate a steady increase in both the quantity exported and the value of Algerian dates over time, reflecting the continuous growth and development of the Algerian date export sector.

Overall, the regression results provide important insights into the factors influencing the export of Algerian dates. The positive coefficients of the Common Border and Common Culture variables support the neighboring country effect and highlight the importance of geographic proximity and cultural ties in promoting trade.

The negative coefficient of the Algerian Population variable confirms that high local consumption limits the quantity available for export. The positive coefficients of the Partner Country's GDP per capita and the negative coefficient of Distance highlight the economic factors and transportation costs as significant influences on trade. These findings are corroborated by Matallah *et al*. (2021) and Matallah & Benmehaia (2019), for the exports in the Algerian case. The adjusted R-squared values indicate that the model effectively explains a considerable portion of the variance in date exports, making it a robust analytical tool for studying the dynamics of Algerian date trade over the years.

4. Conclusions

This study aimed to provide a comprehensive analysis of Algeria's date export sector by exploring its structure and employing a gravity model to reveal the determinants of date exports over 19 years (2000-2018). The data utilized in this research consisted of a balanced panel dataset, encompassing all importing countries (70 cross-sectional units), and was sourced from reputable databases such as the National Center for Information and Statistics (CNIS, 2020) for export data and the World Bank reports for Gross Domestic Product per capita variables. The gravity model served as the econometric tool to examine the factors influencing Algeria's date exports to destinations worldwide.

The main findings of this study revealed compelling insights into Algeria's date export sector. Notably, it was observed that there has been a clear upward trend in the propensity to export Algerian dates over the last decade. While France currently holds the largest share of date exports, its export trend has been showing a decline. Moreover, the gravity model provided a robust framework for analyzing trade patterns and demonstrated its usefulness in understanding Algeria's competitive position in the global date market.

Some policy implications for enhancing the date export sector emerge from the study's findings. Overall, policymakers should prioritize targeted initiatives to address the identified structural and institutional constraints faced by date producers. Correspondingly, public support organizations could play a prominent role in enhancing the performance of the dates sector, as Rouached *et al*. (2023) stressed for the Tunisian case. The results also highlight the importance of common borders and cultural ties in promoting the date trade. Thus, it is crucial for policymakers to consider policies to strengthen trade relations with border countries. This could be accomplished by facilitating trade and reducing tariff and non-tariff barriers. By fostering a more fluid and cooperative commercial environment with neighboring countries, Algeria could benefit from an increase in date trade and strengthen its position on the international market, while promoting commercial partnerships in the region, particularly within the framework of the African Continental Free Trade Area (ZLECAF). This approach could include the export of other date varieties outside of *Deglet Nou*r, which are extremely valued by neighboring countries.

Furthermore, given that the distance between Algeria and its trading partners negatively impacts the date trade by increasing transportation costs, it is crucial that policymakers consider investments in transportation infrastructure. These investments could include the development of roads and ports to reduce logistics costs and improve the competitiveness of Algerian date exports. Moreover, policymakers should focus on improving quality standards and certification processes for date exports to meet international market requirements. Additionally, endeavors in establishing and enforcing rigorous quality control measures, including certification for organic and fair-trade practices, can enhance the reputation of Algerian dates in global markets and command premium prices.

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