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Resilient Agricultural Trade and Land System Sustainability: A Comparative Advantage Analysis of Iranian Pistachios and Dates

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Abstract

Iran's economic diversification strategy places significant emphasis on the development of non-oil exports, with agricultural products playing a pivotal role in this endeavour. Notably, pistachios and dates emerge as key contributors to Iran's export portfolio, underscoring their strategic importance in driving economic growth and rural development. This study delves into the comparative advantages of pistachios and dates and identifies the factors influencing their export performance within the Iranian context. Employing the Revealed Comparative Advantage (RCA) index, we assess the export position of these products, revealing a nuanced picture of Iran's competitive edge in international markets. Despite possessing a comparative advantage, our analysis uncovers a concerning trend of negative growth in the RCA index between 1970 and 2023, signalling potential challenges in maintaining export competitiveness over time. Leveraging time series analysis and the Vector Error Correction Model (VECM), we discern the underlying determinants shaping the comparative advantage of pistachios and dates. Our findings highlight the significant impact of price differentials between domestic and international markets, as well as exchange rate dynamics, on the long-term competitiveness of these agricultural commodities. To bolster Iran's comparative advantage in the agriculture sector, we advocate for the formulation of robust long-term export development plans and the adoption of flexible business policies. Implementation of support policies, dealing with currency fluctuations, supply of inputs, and development of production technology can help to strengthen sustainable agricultural trade in this sector. Furthermore, enhancing the business and marketing strategies for pistachios and dates necessitates the implementation of comprehensive plans grounded in evidence-based methodologies. Emphasizing the imperative of sustainable agricultural trade practices, our study underscores the need for targeted interventions aimed at fostering economic growth and improving livelihoods in Iran's agricultural sector.

Keywords: Pistachios and Dates, revealed comparative advantage, sustainable agricultural trade, Vector error correction model

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Introduction

In response to economic sanctions, oil market volatility, and structural dependency on hydrocarbon revenues, Iran has intensified efforts to diversify its economy through non-oil exports (Jafari & Faghihi, 2024). The agricultural sector—resilient, labour-intensive, and regionally dispersed—plays a pivotal role in this shift. Among agricultural exports, pistachios and dates are especially significant (Alizade et al., 2025).

According to the FAO report (2023), Iran is among the top three global producers of pistachios, with an annual output of approximately 200,000 metric tons, over half of which is cultivated in Kerman Province, particularly in Rafsanjan. Pistachio exports generate more than \$800 million annually. Iran also ranks third in global date production, with yearly output exceeding 1.3 million tons and exports surpassing 300,000 tons. Iran's pistachio production reached approximately 106,000 tons in 2023, with exports hitting about 160,000 tons in the first eight months of the 2023/2024 marketing year, marking a 68% increase compared to the previous year (Iran Pistachio Association, 2023). In terms of dates, Iran produced over 1.3 million tons annually and exported 389,000 tons valued at \$345 million to 82 countries from March 2023 to March 2024 (Statistical Center of Iran, 2024).

These products, known respectively as “green gold” and a cultural staple, are strategic for Iran's economy, not only as major sources of foreign exchange but also as key contributors to rural employment and poverty reduction. In 2023, pistachio exports to the EU dropped to €92 million—a 17% decrease from 2022—largely due to stronger competition (Central Bank of Iran, 2024). Several macroeconomic and trade-related factors explain this erosion: exchange rate volatility—with the unofficial rial rate increasing more than sevenfold between 2017 and 2023—widening domestic-global price gaps, and rising global competition, especially from the U.S., which produces over 600,000 tons annually with advanced technology, and Turkey, expanding market share through improved irrigation and processing infrastructure (Kurt, 2025).

Additional challenges include international sanctions and quality control issues, which threaten the export competitiveness of pistachios and dates. Competition from countries like Tunisia in the date market also intensifies pressure on Iranian exporters. The Iranian government has implemented policies such as export incentives and quality improvement efforts to support this sector (Karacan & Ceylan, 2020).

This study seeks to analyze the long-term trends in Iran's RCA index for pistachios and dates over 1970–2023. Using a Vector Error Correction Model (VECM), we assess whether fluctuations in macroeconomic variables—particularly the unofficial exchange rate, domestic-to-international price differentials, and agricultural GDP—have significantly affected Iran's export competitiveness. The objective is not only to quantify these impacts but also to develop a policy framework to restore and enhance Iran's strategic position in global agricultural markets. Evidence-based recommendations are proposed to strengthen export sustainability through improved marketing, price alignment, exchange rate management, and investment in production technology.

Materials and Methods

This study utilizes annual time-series data from 1974 to 2023, sourced from official and reputable institutions such as the Food and Agriculture Organization (FAO), the Iranian Customs Administration, the Central Bank of Iran, and Iran's National Statistical Yearbooks. The data capture key variables relevant to the export performance of Iran's agricultural sector, specifically pistachios and dates. The core variables include the log-transformed Revealed Comparative Advantage (RCA) index, the domestic-to-international price differential, the unofficial exchange rate, and the agricultural sector's gross domestic product (GDP). These indicators are selected based on their theoretical significance in trade competitiveness and their empirical application in prior economic studies.

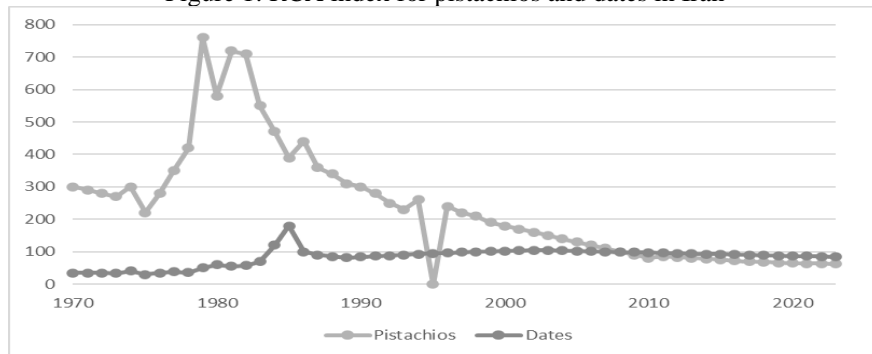
To measure Iran’s export performance in pistachios and dates, the study adopts the RCA index introduced by Balassa (1965). The RCA measures a country’s relative export strength in a given product by comparing the product’s share in national exports with its share in global exports. An RCA greater than one signals a comparative advantage, indicating that the country is relatively specialized in exporting that commodity. This index serves as a widely accepted metric in international trade literature for identifying patterns of specialization and competitiveness across time and markets.

To analyze the dynamic behavior of RCA and its determinants, a Vector Error Correction Model (VECM) was employed, which allows simultaneous estimation of short-run dynamics and long-run equilibrium relationships among the variables (Johansen, 1991). The Augmented Dickey-Fuller (ADF) test was first used to examine the stationarity of all series. Johansen’s cointegration test was then applied to confirm the existence of stable long-run relationships, and optimal lag length was selected based on the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The VECM includes an error correction term to capture the speed at which deviations from long-run equilibrium are corrected, offering robust insight into how macroeconomic fluctuations and pricing mechanisms affect Iran’s export competitiveness in the long term.

Results and Discussion

This study investigates the temporal dynamics and structural determinants of Iran’s comparative advantage in pistachio and date exports using the Revealed Comparative Advantage (RCA) index over 1970–2023 (Figure 1).

Figure 1: RCA index for pistachios and dates in Iran



Source: Research findings

The RCA for pistachios displays significant volatility with a peak in the late 1970s, followed by a sustained decline, reflecting external trade barriers and competition. Dates exhibit moderate fluctuations with a peak in the early 2000s, converging with pistachios’ RCA in recent years, influenced by historical disruptions and trade policy shifts.

The Vector Error Correction Model (VECM) reveals that the price differential (Lpirw) significantly enhances pistachio RCA long-run, with no notable exchange rate (Ler) effect, while both Lpirw and Ler positively impact date RCA, indicating Rial devaluation boosts competitiveness (Table 1).

Table 1: Estimated Equations for RCA Indices (Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$)

Variable	Long-Run Effects			ECT	F-Stat
	c	Lpirw	Ler		
Lrca (Pistachios)	4/64	*4.10 (2.56)	0.18 (0.63)	*-0.18 (-2.30)	*4.73
Lrca (Dates)	-7/80	***2.92 (4.60)	**1.71 (3.41)	** -0.65 (-3.77)	*6.22

Notes: Lrca = log RCA; Lpirw = log price differential; Ler = log exchange rate. ECT indicates adjustment speed (pistachios: ~5.5 years; dates: ~1.5 years); F-stat tests model significance ($p < 0.01$).

Source: Research findings

Short-run dynamics show that exchange rate volatility benefits pistachio RCA, while agricultural GDP negatively affects it; dates are more sensitive to macroeconomic variables. Error correction

terms suggest slower adjustment for pistachios compared to dates, with external shocks—exchange rates and price differentials—gaining influence over time, particularly for dates. Based on variance decomposition, initial RCA shocks dominate short-term variance for both pistachios and dates. Over time, however, exchange rate fluctuations and price differentials increasingly drive RCA variability, with a more significant impact on dates.

These results highlight the susceptibility of Iran's agricultural export sector to macroeconomic instability and market inefficiencies. They emphasize the critical need for targeted trade policies, exchange rate stabilization, and price regulation to bolster Iran's competitive position in global agricultural markets.

Conclusions and Outlook

This study highlights the structural erosion of Iran's comparative advantage in pistachio and date exports over the past five decades, driven by macroeconomic volatility, international competition, and institutional inefficiencies. Reversing this trend requires a multifaceted policy response grounded in economic rationality and long-term strategic planning. Key recommendations include adopting a managed floating exchange rate regime to mitigate currency-induced trade shocks; reducing transaction costs through streamlined customs procedures and harmonized export regulations; and introducing targeted subsidies or price stabilization mechanisms to narrow domestic-international price gaps. Quality assurance should be enhanced via aflatoxin control systems, compliance with international sanitary and phytosanitary (SPS) standards, and traceability protocols. In addition, product-specific export strategies are essential: pistachios require investments in branding, post-harvest processing, and quality differentiation, while dates—due to their supply responsiveness—benefit from agile marketing and diversified packaging. Export market diversification, especially toward South and Southeast Asia and North Africa, should be supported through trade diplomacy, improved logistics infrastructure, and trade intelligence systems. Finally, fostering resilience in the agricultural export sector demands alignment between trade and macroeconomic policies, coupled with investment in irrigation efficiency, cold storage, rural extension services, and value chain integration. Only through such an integrated approach can Iran revitalize its agricultural competitiveness and secure sustainable export-led rural development.

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