Asian Journal of Agriculture and Rural Development
Volume 11, Issue 1 (2021): 113-119

http://www.aessweb.com/journals/5005

THE FUTURE OF SAUDI ARABIA'S DATE EXPORTS USING A COINTEGRATION MODEL

Mohamad Alnafissa[a]
Mahmoud Alderiny[b]
Yosef Alamri[c]
Jawad Alhashim[d]

[a,b,c,d]*Department of Agricultural Economics, College of Food and Agricultural Sciences King Saud University, Saudi Arabia.*

malnafissa@ksu.edu.sa *(Corresponding author)*

Article History
Received: 6 January 2021
Revised: 29 January 2021
Accepted: 15 February 2021
Published: 3 March 2021

Keywords
Agricultural marketing
Future structure market
Export forecasting
Dates market
Comparative advantage
ARDL model
Cointegration model
Saudi Arabia.

ABSTRACT
Dates represent an important export crop for Saudi Arabia that attracts foreign exchange. There is an opportunity for Saudi Arabia to extend its date exports to the international market due to production exceeding consumption and comparative advantage in date production. This paper explores the future export market for Saudi dates by analyzing the factors that affect Saudi date exports and highlighting this crop's comparative advantage. Also, the paper uses autoregressive and distributed lag methodology with data from 1980 to 2017 to predict the future for exported dates between 2020 and 2025. The relationship between the export of dates and other exogenous variables shows there are significant effects from domestic production, domestic consumption of dates, and the price of exported dates in both the long and short term. In contrast, the comparative advantage of Saudi dates shows a significant effect only in the short term, because there has been no active program to promote Saudi dates in global markets. The explanatory variables predict that 2019 Saudi date exports will increase by 3.8-fold in 2025, with the total export amount over 700 thousand tons. Thus, there is an opportunity to develop more programs that target the international market in support of date farms and exporters, and to support market research directed at satisfying the international market.

Contribution/Originality: This study analyzed the future structure market of date export and highlights the comparative advantage of this crop for Saudi Arabia. It then predicts the future for date exports between 2020 and 2025.

DOI: 10.18488/journal.ajard.2021.111.113.119
ISSN(P): 2304-1455/ ISSN(E): 2224-4433

How to cite: Mohamad Alnafissa --- Mahmoud Alderiny --- Yosef Alamri --- Jawad Alhashim (2021). The Future of Saudi Arabia's Date Exports Using a Cointegration Model. *Asian Journal of Agriculture and Rural Development*, 11(1), 113-119. 10.18488/journal.ajard.2021.111.113.119
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1. INTRODUCTION
Dates are one of Saudi Arabia's major food crops and thus represent an important export crop attracting foreign exchange. Furthermore, Saudi Arabia has a comparative advantage in date production, which makes it worthwhile to study Saudi date exports to various importing markets. Saudi Arabia's average date exports represented 5% of total agricultural exports during the period 1990–2016 (FAOSTAT, 2020).

Al-Abdulkader, Al-Kahtani, Ismaiel, Elhendi, and SaadIi (2016) showed that increasing the marketing efficiency of Saudi dates will lead to an increase of up to 30% of return for the agricultural sector. Therefore, the Saudi government intends to use dates as one of its strategic agricultural commodities in global markets due to its comparative advantage in date production. Because date production is increasing year by year, with an average annual rate of growth of 4.6 tons per year during the years 2000–2018, increase in production must be accompanied by a competitive ability to access external markets.

The economic importance of date production and the market environment for dates has recently resulted in an extensive literature that discusses different marketing aspects and issues. For instance, Dawood and Kinnucan (2018) estimated the world market demand for dates and price elasticity. Intezar, Abdallah, and Rao (2016) studied the opportunities and difficulties for farmers and traders in marketing dates, while Dhehibi, El Awar, Ben-Salah, and Aw-Hassan (2018) studied competitiveness in the date trade for Gulf Cooperation Countries (GCC). Also, value chain analysis and marketing opportunities for date palms in GCC countries were studied by Dhehibi., Salah, and Frija (2018) while the efficiency of date marketing was investigated by Ismaiel, Al-Abdulkader, Al-Kahtani, and Saad (2017), Alabdulkader, Elhendy, Al Kahtani, and Ismail (2017) and Al-Abdulkader et al. (2016). Al-Shreed et al. (2012) investigated export markets for Saudi dates and potential opportunities. The comparative competitive advantage for the export of dates was studied by Ali, Fahad, and El-Habbab (2014). Ali, Al-Mulhim, and El-Habbab (2014) revealed the demand for the export of Saudi dates.

This research extends previous literature exploring the future export market for Saudi dates. The study analyzes factors that impact Saudi date exports and highlights the comparative advantage of this crop. It then predicts the future for date exports in the period 2020–2025.

2. METHODOLOGY

Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990) developed methods used to test cointegration, assuming the variables are stationery to the same degree. However, this assumption is not achieved in many applied aspects because the variables could integrate to different degrees. In this case, it is challenging to perform the analysis using these methods. Therefore, Pesaran, Shin, and Smith (2001) provided an appropriate model for treating this problem – the autoregressive and distributed lag model (ARDL) (Nkoro & Uko, 2016). The main concept of the methodology is to combine the autoregressive and distributed lag models to create a time series model. The dependent variable is a function of its lagged values and the values of the explained variables in the current and lag periods. Using ARDL methodology for the cointegration test has some advantages: First, determining the possibility of applying the model regardless of whether the variables under study are degree I(0), degree I(1), or both. They are used when the integration order is unknown or not uniform for all variables. The only condition for applying this test is that none of the variables can have an I(2) degree of integration. Second, it can be used if the sample size is small, which contrasts with most traditional cointegration tests that require the sample size to be large for efficient results. Third, the application of this methodology allows long- and short-run relationships to be estimated together using one equation.

Assuming that Y_t expresses the dependent variable in the period and that X_{1t}, X_{2t}, ..., X_{kt} represent k external explanatory variables in the period t, the relationship between the dependent variable and the set of explanatory variables is expressed in a multiple linear regression model:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} \dots + \beta_k X_{kt} + \varepsilon_t \qquad (1)$$

Equation 1 shows the estimation of a long-run relationship, while ARDL is applied to test the cointegration through Pesaran et al. (2001). According to ARDL methodology, the analysis is carried out in three steps:

1. A cointegration test using the unrestricted error correction model (UECM), this model is expressed as

$$\Delta Y_t = \alpha_0 + \gamma_0 Y_{t-1} + \gamma_1 X_{1t-1} + \cdots + \gamma_k X_{kt-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{k} \sum_{l=0}^{qj} \beta_{jl} \Delta X_{jt-l} + \varepsilon_t \qquad (2)$$

where $\gamma_0, \gamma_1, \dots, \gamma_k$ represent long-run relationship coefficients, while (α_i, β_{jl}), and $l = 0,1, \dots, q_j$ are short-run relationship coefficients; p expresses the length of the lag period for the dependent variable Y, while q_j expresses the length of the deceleration period for the interpreted variable X_j, $(j = 1, \dots, k)$, and the lagged times for the variables do not necessarily have the same number of lags $(p \neq q_j)$. The symbol Δ also indicates the first difference of the variable; ε_t indicates the random error terms and assumes that its mean is 0, that the variance is constant from one time period to another, and the errors are not correlated, $\{E(\varepsilon_t) = 0, E(\varepsilon_t^2) = \sigma_\varepsilon^2, E(\varepsilon_t \varepsilon_{t`}) = 0 \; for \; t \neq t`\}$.

In this model, the presence of a cointegration relationship test determines the extent of the statistical significance of the relationship between the variables in the long term by applying the bounds testing approach to cointegration, which depends on the Wald test. The null hypothesis is $H_0: \gamma_0 = \gamma_1 = \cdots = \gamma_k = 0$ and indicates that there is no cointegration relationship between the variables in Equation 1, whereas the alternative hypothesis is $H_1: \gamma_0 \neq \gamma_1 \neq \cdots \neq \gamma_k \neq 0$ and denotes the existence of a cointegration relationship between the variables in Equation 1. The F-test statistic depends on whether the variables included in the model integrate to degree I(0) or degree I(1), on the number of independent variables, on whether or not Equation 1 includes an intercept and trend, and on the sample size. Comparing the calculated F value with the tabular values of the lower and upper thresholds provided by Pesaran et al. (2001), a decision is taken regarding the null hypothesis where the lower bound was derived based on the assumption that the variables are integral to degree I(0).

In contrast, the upper limits are derived based on the assumption that the variables are integral to degree I(1). If the calculated F value is less than the critical value of the lower limit, the null hypothesis is not rejected. This indicates that there is no cointegration. However, if the F value is higher than the critical value of the upper limit, the null hypothesis is rejected and cointegration exists between the variables in Equation 1. This means that the model allows us to estimate the long-run relationship among the variables. However, if the calculated F occurs between the lower and higher limits, the result is that the cointegration is not conclusive.

2. Estimating the long-run relationship between the dependent variable Y and the explanatory variables is expressed in the following equation:

$$Y = \emptyset_0 + \emptyset_1 X_1 + \cdots + \emptyset_k X_k \quad (3)$$

where $\emptyset_0, \emptyset_1, \ldots, \emptyset_k$ represent long-term coefficients, and their estimates derive from the estimates of the long-term transactions shown in Equation 2 as follows: $\{\emptyset_0 = -(\alpha_0/\gamma_0),\ \emptyset_1 = -(\gamma_1/\gamma_0), \ldots, \emptyset_k = -(\gamma_k/\gamma_0)\}$. The lagged rank in the ARDL model is chosen by the Akaike information criterion (AIC) or the Schwarz Bayesian Criterion (SBC) standard. However, Pesaran et al. (2001) recommend that the lagged period be a maximum of two periods for annual data.

3. The third step specifies and estimates the dynamic ARDL by constructing an error correction model (ECM). The ARDL model is popular in economic studies of different aspects such as economic growth (Okafor & Shaibu, 2016), inflation forecasting (Ülke, Sahin, & Subasi, 2018), tourism demand forecasting (Zhu, Lim, Xie, & Wu, 2018), and forecasting U.S. commercial property price indices (Van de Minne, Francke, & Geltner, 2018). It is expressed in the following equation:

$$\Delta Y_t = \pi_0 + \sum_{i=1}^{p} \pi_i \Delta Y_{t-i} + \sum_{j=1}^{k} \sum_{l=0}^{q_j} \delta_{jl} \Delta X_{jt-l} + \psi ECT_{t-1} + v_t \quad (4)$$

The error correction term is represented by ECT_{t-1}. This variable represents the long-run relationship between the dependent variable and the independent variables, while its coefficient indicates the speed of adjustment from the short-run equilibrium. The value of the error correction coefficient falls between minus one (-1) and 0, where a large coefficient in absolute value indicates a higher speed of adjustment. If the coefficient has a 0 value, it means there is no long-run relationship. On the other hand, a significant coefficient means there are adjustments between the short run and long run.

3. MODEL SPECIFICATION

The study assumes that the future quantity of Saudi date exports, Y_t, is determined by a set of economic factors such as the domestic production of dates, denoted by X_{1t}, the amount of domestic consumption of dates, denoted by X_{2t}, the average export price X_{3t}, and the comparative advantage of date exports with respect other agricultural export products (X_{4t}). The Saudi date export model can be written as

$$Y_t = f(X_{1t}, X_{2t}, X_{3t}, X_{4t}) \quad (5)$$

4. DATA

This study uses aggregate data for dates, covering the period 1980–2019. The quantity of Saudi date exports and domestic consumption of dates is measured in tons, while the average export price is measured in U.S. dollars per ton. The study used secondary data collected from various sources: (1) The Ministry of Economy and Planning, General Authority for Statistics, and other official authorities in Saudi Arabia; and (2) the United States Department of Agriculture (USDA), U.N. Comtrade Database from United Nations Statistics Division and Food and Agriculture Organization (FAO) websites, as well as the World Development Indicators and the World Data Bank.

5. EMPIRICAL RESULTS

5.1. Order of Integration

The study used the augmented Dickey–Fuller (ADF) test to exam the null hypothesis of a unit root. It used the SBC to determine the maximum length of lags and used the *Eviews 11* program to obtain the results. Table 1 shows the ADF for the variables with standard variables and logarithmic form.

Table-1. Integration results of the study variables when taking into consideration natural and logarithmic values.

Variable	Normal values			Natural logarithm values		
	Integration degree I	Type	Lags	integration degree I	Type	Lags
Y	$I(1)$	Trend	3	$I(1)$	Intercept	2
X_1	$I(1)$	Intercept	2	$I(1)$	Intercept	4
X_2	$I(0)$	Trend	2	$I(1)$	Intercept	4
X_3	$I(0)$	None	5	$I(0)$	None	1
X_4	$I(1)$	None	4	$I(0)$	Trend	1

Table 1 shows that the forecast for Saudi date exports (Y), the domestic production of dates (X_1), and the comparative advantage of date exports with respect to other agricultural export products (X_4) are stationary at the first difference, then integrated at the level $Y, X_1, X_4 \sim I(1)$. On the other hand, the level of consumption of domestic dates (X_2) and the average export price (X_3) are stationary at $X_2, X_3 \sim I(0)$. As for the variables in their logarithmic form, the result shows that Ln(Y), (Ln X_1), and Ln(X_2) are stationary at first differences and I(1), while Ln(X_3) and Ln(X_4) are stationary at Ln(X_3), Ln(X_4) ~ I (0).

5.2. Cointegration Test

The test of stationarity gives the difference in the degree of integration of the study variables, as well as the absence of variables with the integration of I(2) or higher (Table 1). It is appropriate to follow the ARDL methodology to test cointegration between the variables. In this case, the UECM is used to test the cointegration among the variables. It is described in the following equation:

$$\Delta Ln(Y_t) = \alpha_0 + \gamma_0 Ln(Y_{t-1}) + \gamma_1 Ln(X_{1t-1}) + \gamma_2 Ln(X_{2t-1}) + \gamma_3 Ln(X_{3t-1}) + \gamma_4 Ln(X_{4t-1}) + \sum_{i=1}^{p} \alpha_i \Delta Ln(Y_{t-i}) + \sum_{j=0}^{q_1} \beta_{1j} \Delta(X_{1,t-j}) + \sum_{j=0}^{q_2} \beta_{2j} \Delta(X_{2,t-j}) + \sum_{j=0}^{q_3} \beta_{3j} \Delta Ln(X_{3,t-j}) + \sum_{j=0}^{q_4} \beta_{4j} \Delta(X_{4,t-j}) + \varepsilon_t \quad (6)$$

The equation is denoted by $ARDL(p, q_1, q_2, q_3, q_4)$, and is used to investigate the long-run relationships among variables. The long-run relationship exists if there is cointegration between the dependent variable and independent variables in Equation 6. The null hypothesis assumes cointegration does not exist (null hypothesis is $H_0: \gamma_0 = \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$), while the alternative hypothesis ($H_1: \gamma_0 \neq \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq 0$) indicates there is a cointegrated relationship between the variables. The study used SBC to determine the number of lags by using Microfit 5.0 (a program developed by Pesaran and Pesaran (2009), as well as the results from estimating the UECM model. The result shows the appropriate model is $ARDL(1,0,1,0,1)$, as shown in Table 2. A lag of one time period has been specified for the dependent variable, logarithm of exports $Ln(Y)$, and the independent variables X_4, independent variables $X_1, X_2, and\ Ln(X_3)$ have no lag.

Table-2. Results of the estimation parameters of date exports using ARDL.

Regressor	Coefficient	Standard error	*T*-ratio [Prob.]
$Ln(Y_{t-1})$	0.3402	0.0985	3.456[.001]
X_{1t}	0.0104	0.0019	5.580 [.000]
X_{2t}	−0.0102	0.0020	−5.121[.000]
$Ln(X_{3t})$	−0.1348	0.0736	−1.832 [.073]
X_{4t}	0.0020	0.0009	2.353[.023]
X_{4t-1}	−0.0030	0.0006	−4.847 [.000]
$intercept$	6.4489	0.9845	6.551[.000]
R^2	0.932	*F*-Stat. *F*(6,51)	115.81[.000]
AIC	−9.958	SBC	−17.170
DW-statistic	2.114	Durbin's *h*-statistic	−659[.510]

The results show that the R^2 is 0.932, which indicates that the independent variables under study explain 93.2% of the variation in the dependent variable. The value of the test $F - Stat = 115.81$ is significant at the 0.0001 level, so the model explains much of the variation in Saudi date exports. Also, the model does not suffer from the problem of autocorrelation between errors, as the value of the modified Durbin's *h*-statistic $Ad.DW = -0.659$.

The cointegration test is shown in Table 3. The results show that the model rejects the null hypothesis of no cointegration, while it accepts the alternative hypothesis. The *F*-statistic is 6.406, which is higher than the critical upper limit (4.323) at the 5% level of significance. Thus, there is cointegration among the variables at the 5% level of significance.

Table-3. Results of a cointegration test for model variables ARDL (1,0,1,0,1).

Test statistics	95% Lower bound	95% Upper bound	90% Lower bound	90% Upper bound
F-statistic = 6.406	3.044	4.323	2.578	3.706
W-statistic = 32.029	15.222	21.613	12.892	18.527

5.3. Estimating the Long-Run Relationship

In the previous step, the statistical test demonstrated the existence of cointegration among the variables of the export model; thus, there is a long-run relationship among these variables.

The long-run relationship mentioned in Equation 7 was estimated according to methodology of *ARDL* (1, 0, 1 ,0, 1) using Microfit 5.0. The results are as follows:

$$Ln(Y_t) = 9.8 + 0.016X_1 - 0.015\,X_2 - 0.20Ln(X_3) - 0.001\,X_4$$
$$(30.5)^{***}\ (7.3)^{***}\quad (-6.3)^{***}\quad (-1.9)^{*}\quad (-1.12)$$

The domestic production of dates (X_1) has a significant positive effect while the level of domestic consumption of dates (X_2) has a negative effect on exports in the long term at the 1% level of significance. This means that a 1,000-ton increase in domestic production leads to a 1.6% increase in exports in the long run. On the other hand, increasing the domestic consumption of dates by 1,000 tons leads to a 1.5% decrease in exports. The price of date exports (X_3) has a significant negative impact on exports. A 10% increase in export prices leads to a 2.04% decrease in date exports. This relationship does not match with the economic logic that might explain why the government of Saudi Arabia has been buying date surpluses from farmers at promotional prices that exceed market prices and presenting them as donations to other countries. This is in the form of aid that has been provided by the government for more than thirty years to friendly countries when they suffer from problems like natural disasters and famine conditions. In addition, this result explains the inelasticity of the quantity of date exports with a change in price. The comparative advantage of date exports (X_4) does not show a significant effect on exports in the long run.Thus, the model results confirm the positive impact of domestic production and the negative impact of domestic consumption on Saudi date export levels and export values, which matches with economic logic. In contrast, the comparative advantage of Saudi dates in the international export market did not have any relationship with Saudi export quantity. Even though Saudi Arabian date exports have a comparative advantage, the analysis does not reflect that export advantage. The main reason could be because there has been no active program to promote Saudi dates in global markets throughout most time of the study period (1980–2017). The National Center for Palms and Dates was established in Saudi Arabia in 2011, and one of its goals is to take advantage of Saudi Arabia's date production and to promote Saudi dates in global markets.

5.4. Estimating the ECM Error Model

The ECM describes the dynamic relationship between the dependent variable and the independent variables in the short run, where the model takes the following equation:

$$\Delta Ln(Y_t) = \pi_0 + \sum_{i=1}^{p} \pi_i \Delta Ln(Y_{t-i}) + \sum_{j=0}^{q_1} \delta_{1j} \Delta(X_{1,t-j}) + \sum_{j=0}^{q_2} \delta_{2j} \Delta(X_{2,t-j}) + \sum_{j=0}^{q_3} \delta_{3j} \Delta Ln(X_{3,t-j}) + \sum_{j=0}^{q_4} \delta_{4j} \Delta(X_{4,t-j}) + \psi ECT_{t-1} + v_t \quad (8)$$

The parameters of the short-term relationship model in Equation 8 were estimated as ARDL(1, 0, 0, 0, 1), and the results are summarized in Table 4. The short-run coefficient indicates the immediate impact of independent variable change on the dependent variable. For example, production $\Delta(X_1)$ has a positive and significant effect on log exports if production increases by 1,000 tons, and there is an immediate 1.04% increase in exports. Annual domestic consumption $\Delta(X_2)$ has a negative and significant effect on log exports if domestic consumption increases by 1,000 tons, and exports would decrease by 1.02%. If export price have a negative impact on date exports, a 1% increase in export prices leads to a 13.5% decrease in exports. The results also show that the change in comparative advantage variable has a significant positive effect on the increase of date exports, $\Delta Ln(Y)$, in the short term. Also, a one unit per year increase in the relative importance leads to a 0.2% increase in date exports.

Table-4. Estimates for short-term coefficients for the EC model.

Regressor	Coefficient	Standard error	T-ratio [Prob.]
$\Delta(X1)$	0.0104	0.0019	5.580[.000]
$\Delta(X_2)$	−0.0102	0.0020	−5.121[.000]
$\Delta Ln(X_3)$	−0.1348	0.0736	−1.832 [.073]
$\Delta(X_4)$	0.0020	0.0009	2.353[.022]
$ECT_{t-1}{}^*$	−0.6598	0.0985	−6.701[.000]
R^2	0.598	*F*-Stat. $F(5,25)$	15.158[.000]
AIC	−9.958	*SBC*	−17.170
DW-statistic	2.114		

Note: $^*ECT_{t-1} = Ln(\mathrm{Y}) - 0.0157(\mathrm{X}_1) + 0.0154(\mathrm{X}_2) + 0.2043\, Ln(\mathrm{X}_3) + 0.0014(\mathrm{X}_4) - 9.775$

The error correction factor has a value of −0.66, which is statistically significant. The negative sign confirms the convergence of the equilibrium from the short- to long-term equilibrium. It reveals the speed of the return of the variable of date exports toward its long-term equilibrium value after date exports deviate from equilibrium in the previous period (*t*-1). Two-thirds (66%) of this disequilibrium is corrected each year. The adjustment factor is relatively large because the correction in exports needs more than one year to return to long-term equilibrium.

5.5. Results of Diagnostic Tests of the Model

The appropriateness of the model was assessed through tests for serial correlation in the error term, model specification error, the normality of residuals, and the heteroscedasticity of residuals. Diagnostic tests were run on the data using Microfit 5.0, and the results are summarized in Table 5.

Table-5. Results of diagnostic tests for ARDL(1, 0, 0, 0, 1).

Test statistics	LM version	*F* version
A: Serial correlation	$CHSQ_{(1)}$ = .385 [.535]	$F(1,50)$= .334 [.566]
B: Functional form	$CHSQ_{(1)}$ = 9.823 [.002]	$F(1,50)$= 10.195 [.002]
C: Normality	$CHSQ_{(2)}$ = 36.806 [.000]	*Not applicable*
D: Heteroscedasticity	$CHSQ_{(1)}$ = .491 [.483]	$F(1,56)$= .478 [.492]
A: LM, Lagrange multiplier test of residual serial correlation		
B: Ramsey's RESET test using the square of the fitted values		
C: Based on a test of skewness and kurtosis of residuals		
D: Based on the regression of squared residuals on squared fitted values		

(1) The model tests the null hypothesis that there is serial correlation for the error term. The statistical result shows that the value of Chi-square was $\chi^2 = 0.385$, and its probabilistic value was $pr(\chi^2 > 0.385 = 0.535)$.

Thus, it is greater than the critical value and is significant at the 5% level. Therefore, the null hypothesis was accepted to reveal that there was no serial correlation between the error terms of the ARDL(1, 0, 0, 0, 1) model.

(2) Model specification error was tested through the Ramsey RESET test. This test examines the null hypothesis that there are no omitted variables. The *F*-statistic was $F(1,50) = 10.195$, and its probability value was $pr(F > 10.195 = 0.002)$, which was greater than 5%. Thus, the model does not suffer from omitted variables.

(3) The normality of residuals was tested through the Jarque–Bera test. The null hypothesis is that the error term data follow a normal distribution. The result rejected the null hypothesis that the error terms follow a normal distribution because the probability value of this test, $pr(\chi^2 > 36.806 = 0.000)$, was less than the level of statistical significance. Therefore, the model suffers from abnormal residual data problems but, because the sample size is large, the distribution of the residual data has an approximately normal distribution.

(4) The study examined the residuals for heteroscedasticity. The result shows the model did not suffer from heteroscedasticity because the probability value, $pr(F > 0.478 = 0.492)$, was greater than the 5% level of statistical significance. That means the model failed to reject the null hypothesis of homoscedasticity.

6. FORECASTING EXPORT OF DATES FROM 2020 TO 2025

One of the main objectives of this study was to predict the export of dates from Saudi Arabia for the period 2020–2025. The values of the independent variables were predicted using ARIMA(p,d,q) models, which are the domestic production of dates (X_1), the amount of domestic consumption of dates (X_2), the average export price (X_3), and the comparative advantage of date exports with respect to other agricultural export products (X_4). The Eviews 11 program was used with the ARDL(1, 0, 0, 0, 1) model to predict $\widehat{Ln(Y)}$, and then to predict export values. Table 6 presents the predictions of the explanatory variables and date exports according to the ARDL(1, 0, 0, 0, 1) model, which was calculated using Microfit 5.0.

Table-6. Prediction results using the ARDL model (1,0,0,0,1).

Year	(X_1) 1000 ton	(X_2) 1000 ton	(X_3)	(X_4)		
	$\Delta Ln(X_1)$	$\Delta Ln(X_2)$	$\Delta(X_3)$	$\Delta Ln(X_4)$	$Ln(y)$	Y
	$ARMA(3,0)$	$ARMA(3,0)$	$ARMA(2,0)$	$ARMA(1,1)$	Predict.	Predict./ton
2019	1285*	1129*	1.261*	41.846*	12.114*	182317*
2020	1338	1182	1.115	34.446	12.338	228091
2021	1405	1234	1.039	30.499	12.605	297896
2022	1472	1284	0.891	28.078	12.897	399233
2023	1507	1315	0.785	26.395	13.071	474872
2024	1558	1359	0.644	25.092	13.232	557769
2025	1622	1411	0.526	23.996	13.459	700185

Note: *Actual values.

Table 6 shows the model expectations from 2020 to 2025. The results show an increase in the quantity of export by 700,000 tons between 2020 and 2025. Thus, the prediction shows that exports would increase by 3.8-fold in 2025 compared to 2019. The average annual export level of dates in Saudi Arabia from 2020 to 2025 is expected to be about 443,008 tons, with a standard deviation of 172,910 tons. These expected export levels are restricted by the effects of the four factors that built this prediction model. Saudi Arabia has the opportunity to multiply its date exports at a high level of production, stability of consumption, and to increase returns by targeting the appropriate world market.

7. CONCLUSION

Saudi Arabia has an opportunity to extend date exports to the international market because its production exceeds consumption. The government of Saudi Arabia is interested in increasing the competitiveness of dates in global markets as a strategic agricultural commodity, because the country has so many farms that produce the crop. This research analyzed the future market structure for Saudi date exports, highlighting this crop's comparative advantage by using a cointegration model for the period 2020–2025. The study used the ARDL model with data covering the period 1980–2017. The estimated results of the relationship between Saudi date exports and other exogenous variables showed a significant effect from domestic production, domestic consumption of dates, and the price of exported dates in both the long and short term. In contrast, the comparative advantage variable for Saudi dates showed a significant effect only in the short term. The explanatory variables predict an expected increase in Saudi date exports in 2025 by more than 3.8-fold that of 2019 exports. Thus, dates have an export comparative advantage over other agricultural products in Saudi Arabia. Accordingly, there is an opportunity to develop further programs targeting the international market in support of date farms and exporters, and to support market research directed at satisfying the international market.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Contributors/Acknowledgement: All authors contributed equally to the conception and design of the study.

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