African Journal of Advanced Studies in Humanities and Social Sciences (AJASHSS)
المجلة الإفريقية للدراسات المتقدمة في العلوم الإنسانية والاجتماعية
Online-ISSN: 2957-5907
Volume 5, Issue 2, 2026
Page No: 166-175
Website: https://aaasjournals.com/index.php/ajashss/index
Arab Impact factor 2025: 0.83 **SJIFactor 2024: 6.856** **ISI 2025: 1.191**

An analytical study of some factors affecting barley imports in Libya using the NARDL model methodology

Fouzi Salih Faraj *
Faculty of Agriculture, University of Benghazi, Benghazi, Libya

دراسة تحليلية لبعض العوامل المؤثرة على واردات الشعير في ليبيا باستخدام منهجية نموذج ناردل

فوزي صالح فرج *
كلية الزراعة، جامعة بنغازي، بنغازي، ليبيا

*Corresponding author: salehfarag1981@yahoo.com

Received: January 13, 2026	Accepted: April 05, 2026	Published: April 23, 2026

Abstract
This study aimed to analyze some of the factors affecting barley imports in Libya using the NARDL model methodology, employing time series data spanning from 1980 to 2024. The study concluded that there is a cointegration between the variables. Regarding short-term estimates, the results showed that negative changes in the international barley price (X2) had a negative impact, while the first difference had a positive impact on barley imports, with this effect being statistically significant for both variables. Negative changes in the rainfall variable (X3) also had a positive impact. Similarly, exchange rate fluctuations had a positive impact on imports, as did positive changes in the initial exchange rate differential. Conversely, negative exchange rate fluctuations had a statistically significant negative impact. The results also showed no symmetry among the variables with significant effects. Regarding the long-term coefficients of negative and positive variables, the results indicate that negative changes in the global barley price were the only variable with a negative impact on barley imports. Furthermore, the model exhibited no problems and demonstrated effective predictive power.

Keywords: Barley Imports, Influencing variables, NARDL model, Libya.

الملخص
هدفت هذه الدراسة إلى تحليل بعض العوامل المؤثرة على واردات الشعير في ليبيا باستخدام منهجية نموذج NARDL، وذلك بتوظيف بيانات السلاسل الزمنية الممتدة من عام 1980 إلى عام 2024. وخلصت الدراسة إلى وجود تكامل مشترك بين المتغيرات. وفيما يتعلق بالتقديرات قصيرة الأجل، أظهرت النتائج أن التغيرات السلبية في سعر الشعير العالمي (X2) كان لها تأثير سلبي، بينما كان للفرق الأول تأثير إيجابي على واردات الشعير، وكان هذا التأثير ذا دلالة إحصائية لكلا المتغيرين. كما كان للتغيرات السلبية في متغير هطول الأمطار (X3) تأثير إيجابي. وبالمثل، كان لتقلبات سعر الصرف تأثير إيجابي على الواردات، وكذلك التغيرات الإيجابية في فرق سعر الصرف الأولي. في المقابل، كان لتقلبات سعر الصرف السلبية تأثير سلبي ذو دلالة إحصائية. كما أظهرت النتائج عدم وجود تناظر بين المتغيرات ذات التأثيرات الهامة. وفيما يتعلق بمعاملات المتغيرات السلبية والإيجابية على المدى الطويل، تشير النتائج إلى أن التغيرات السلبية في سعر الشعير العالمي كانت المتغير الوحيد ذو التأثير السلبي على واردات الشعير. علاوة على ذلك، لم يُظهر النموذج أي مشاكل وأثبت قدرة تنبؤية فعالة.

الكلمات المفتاحية: واردات الشعير، عوامل مؤثرة، نموذج ناردل، ليبيا.

Introduction

Agriculture is a vital productive activity in Libya, aiming to utilize natural and human resources to produce agricultural goods to meet the needs of its citizens. Furthermore, the annual production of agricultural products is a significant factor in economic growth, and its contribution to GDP Approximately 7.01% of Libyan's GDP (AOAD, 2025)[1]. Besides that, the agricultural sector plays a vital role in providing raw materials to the industrial sector. What is more, agriculture contributes to foreign trade by exporting agricultural products which was equivalent to 0.16% of total exports (AOAD, 2025)[1]. Together with that, the agricultural sector is a source of

employment opportunities, reaching 15.55% of the Libyan workforce (AOAD, 2025)[1], as they depend on agriculture for their livelihood, whether directly or indirectly. Additionally to this, agriculture plays a significant role in supporting and developing other economic activities.

Barley is a crop essential for both humans and animals. It has been cultivated for 10,000 years. Its importance comes after wheat, corn, and rice, respectively (Tricase et al, 2108)[2]. It is also one of the crops that require the least management and production inputs compared to other crops (ALFisi, 2024)[3]. Its importance lies in its use as biofuel, food, animal feed, and alcoholic beverage (Ajanovic et al , 2011)[4]. In terms of production, its global output reached approximately 14 million tons in 2017, and its yield increased to 3 tons per hectare in 2017, after being around 1.4 tons per hectare in 1960 (Tricase et al, 218)[5].

Barley is a crop cultivated in Libya due to its suitability to local environmental conditions, its drought tolerance, and its early maturity. It is primarily used as animal feed and secondarily for human consumption (Mahmoud, 2008)[6]. According to 2024 FAOSTAT data at Food and Agriculture Organization (FAO), the total area harvested with barley reached 126,688 hectares (FAO, 2026a)[7]. The data also indicates that domestic production may reach 65,000 tons (FAO, 2026b)[8], while imports amounted to approximately 400550 tons (FAO, 2026c)[9].

Research Problem

Despite the improvement witnessed by the Libyan agricultural sector following the discovery of oil and its impact on agricultural development and interest in it, as it carried out extensive land reclamation and agricultural development operations in pursuit of diversifying production and sources of income to reduce dependence on oil as the sole source of income, and the agricultural policy aimed to achieve self-sufficiency in agricultural products through the implementation of various economic and social transformation programs and plans, during which massive sums were spent to invest in multiple areas to advance this sector to the required level.However, despite the agricultural sector's contribution to meeting the required barley crop, a deficit remains, covered by imports. Self-sufficiency is still hampered by insufficient domestic barley production as a feed ingredient, coupled with increasing domestic demand amidst an unstable economic and climatic environment. The severity of this problem varies depending on its underlying causes, such as low rainfall and high domestic prices. Consequently, barley imports, used for livestock feed to support farmers, put pressure on the trade balance, tipping the balance in favor of imports and depleting foreign currency reserves, especially given rising global prices and increased import costs due to the devaluation of the local currency.

The Importance of the Research

The importance of this research lies in the fact that barley production is a vital agricultural commodity for livestock breeders and food security. Therefore, studying the import reality of this commodity through experimental studies aims to find solutions and proposals to reduce imports and increase production. This will be achieved by providing empirical evidence using new standard methodologies to support and understand the asymmetric relationships between the variables affecting barley imports. This understanding will contribute to the development of appropriate policies by policymakers that reflect these relationships.The study also seeks to contribute to enriching experimental studies and raises many points for researchers to investigate and study through the use of new methodologies.

Research Objectives

This study aimed to conduct a descriptive analysis of the factors affecting barley imports and to estimate the asymmetric relationship between the variables under study using the NARDL methodology to determine whether positive or negative shocks have different effects, within a single framework in the short and long- run.

Previous Studies

Numerous agricultural studies have been conducted on barley production in Libya, covering various disciplines including production functions and production costs. These studies have also employed various research methods and techniques. This research builds upon previous studies on barley imports and the factors influencing them, such as the Al-Ramli (2003)[10] study, which focused on barley production functions. This study aimed to analyze and examine trends in barley production in Libya, revealing that rainfall is one of the most significant factors affecting production, impacting both the cultivated areas and the implementation of the project. Another study by Al-Jadi (2006)[11] focused on the supply response to barley in Libya, revealing that self-sufficiency in barley remained below the required level. Furthermore, it found that the most significant influencing factor was supplemental irrigation in many regions during the period (1970-2002), compared to rain-fed agriculture. A study done by Al-Zawam (2007)[12] examined cereal production and consumption, indicating that barley production

capacity during the period (2000-2004) reached approximately 77,000 tons. It also revealed that the projected future barley production gap amounted to (63, 35,114) thousand tons during the years (2007-2010-2015) respectively.

The study of Al-Bidi and Mahmoud (2015)[13] identified the impact of climate change on production and productivity, considering rainfall scarcity as a limiting factor for agriculture in Libya. The study concluded that there is no causal relationship between rainfall and barley production. Furthermore, Ahmed and Al-Sallai (2023)[14] used multiple regressions to study barley consumption in Libya during the period (1990-2012). The results of the study indicated that barley imports during 2012 reached 101,400 tons to meet the local market, indicating an imbalance in the production relationship. This led to an increase in the food deficit problem and a rise in the import bill. The study also demonstrated that the quantity of barley imports has a significant impact of 5% on barley consumption. In Like manner, Al-Dakhli and Daw (2025)[15] sought in their study to analyze the variables that determined the food gap for the barley crop in Libya and its impact on the food security (2000, 2021) .Results found that there is an inverse impact relation between the food gap and local production of barley . In Iraq Farhan et al (2012)[16] empirically examined the supply response of barley supply during 1980 - 2009, and employed Nerlove dynamic mode. The study finding indicates to that the rainfall is one of the variables affecting the rain-fed area, and it has an elasticity of 0.481 and a positive and significant effect at the 1% level, which confirms the effect of rainfall on area and production. Moreover, in Same Context , Jnod et al (2017)[17] studied the reality of barley production in the Sewida rejoin used a questionnaire distributed to 172 barley farmers.The most prominent result of this study concluded that there is a weak, positive correlation between the annual rainfall average, the rainfall average for the studied season, and the production rate. Furthermore, Al-sahwan et al (2022)[18] in his study of the impact of pricing policies on irrigated barley production in Hama Governorate in Syria during the period 2005-2018. The study results revealed that the amount of irrigated land during the study period was found to be 19,398 tons, ranging from a minimum of 9,195 tons in 2005 to a maximum of approximately 42,273 tons in 2018. Meanwhile, the average productivity during the study period was 2,125 kg/ha, ranging from a minimum of approximately 1,374 kg/ha in 2010 to a maximum of approximately 3,172 kg/ha in 2009. Mohmoud (2023) [19] Analyze the effect of changes in the exchange rate on the most important Crops in Egypt. The study sought to analyze the exchange rate on the most important imported crops in Egypt during the period 2001-2020 for foreign trade data. The study found through its results that there is a direct impact on agricultural imports, contrary to what economic theory expects from the assumption of an inverse relationship between the exchange rate and imports, as it was found that the increase in the exchange rate led to an increase in agricultural imports (10.7%).

Aliabadi and Fakar (2024)[20] in his study used the Markov-Switching model and Johansen cointegration using monthly data from August 2009 to September 2023. The results of the study indicated that the real exchange rate was a key and determining factor for local barley prices .Kakhki et al (2019) [21] examined how fluctuations in global barley prices affect the local market using the shock transmission method and price fluctuations between the local and global markets. The study indicated that the transmission of price fluctuations occurs from global prices to local markets, which were more volatile and clearly affected by the exchange rate as one of the factors affecting it. On the other hand, Lui (2023) [22] focused on trade changes in barley imports in China. Using a partial equilibrium model, the study showed that the shift in import sources and the decrease in imports resulted from rising global prices or tariffs.

Material and methods

Research Data

To achieve the purpose of the study, it adopted its objective and relied on data from the Arab Organization for Agricultural Development, in addition to data from the Food and Agriculture Organization (FAO) covering the period from 1980 to 2024.

Model Specification

Given the numerous problems facing production and the reliance on imports to cover the deficit of this commodity, this research employs a descriptive and quantitative approach to analysis, relying on econometric analysis of time series during the period (1980-2024) to determine the asymmetric relationship based on the Nonlinear Autoregressive Distributed Lag (NARDL) model as follows:

$Y = F(X1, X2, X3, X4)$…….(1)

The equation shows that barley imports are the dependent variable, influenced by domestic barley production (X1), International price of barley (X2), rainfall (X3), and the exchange rate (X4), which are the independent

variables. Therefore, the Nonlinear Autoregressive Distributed Intervals (NARDL) model can be formulated as follows Faraj (2026) [23]:

$$\Delta Y = \mu - \rho y_{t-1} + \theta^{+} x_{t-1}^{+} + \theta^{-} x_{t-1}^{-} + \sum_{j=1}^{\rho-1} a_j \Delta y_{t-j} + \sum_{j=0}^{q-1} (\pi_j^{+} \Delta x_{t-j}^{+} + \pi_j^{-} \Delta x_{t-j}^{-}) + \varepsilon_t \ldots\ldots\ldots (2)$$

where:

θ^{+}; θ^{-} Represents the long-term information for the symmetric relationship in the model, and π_j^{+}; π_j^{-} represents the short-term Asymmetric coefficients.

Results and discussion

Descriptive Analysis of the Study Data

This part of the analysis aims to organize, summarize, and describe the study data to uncover facts using statistical measures and indicators to verify the general characteristics of the data distribution. The study data indicated that the highest value of the variable (Y), which was 1,198,027 tons of imports as a dependent variable, and its lowest value was 21,000 tons, with a median of 405,993.6 and a standard deviation of 309,723.1. This indicates that the majority of the units are located below the distribution, and this in turn made the arithmetic mean rise more than the median because of its high units, which led to the data having twisted towards the right (positive deviation).

As for the variable domestic barley production X1, the maximum value was 203,000 tons and the minimum was 23,000 tons. The arithmetic mean was greater than the median and the standard deviation, but the median was greater than the standard deviation, indicating that the data, despite the presence of extreme values, are homogeneous. Regarding the values of the International price variable for barley X2, it was shown that its highest value was $260, its lowest value was $97.81, its arithmetic mean was $152.2635, and its median was $140 with a standard deviation of 43.97, which shows that the items of this variable are close to each other with less dispersion and are centered around the median, meaning that the skewness is positive.

Respecting the X3 Rainfall variable, its data indicates that its maximum value was 299 millimeters, and its minimum value was 31 millimeters, while its mean was greater than the median and the standard deviation, and accordingly, its values are more scattered and skewed to the right. While X4 exchange rate variable, which data revealed that its maximum value was 5.40 dinars and its minimum value was 0.2820 dinars. The results also showed that its standard deviation was higher than its mean and median, and therefore the arithmetic mean had extreme values due to the lower values that pulled them out, making it left-skewed.

Unit Roots Test

Understanding the nature of time series data is crucial to determining whether the data is stationary or nonstationary before conducting the analysis and thus avoiding spurious regression Al-Sawai (2012) [24]. Furthermore, when the mean and variance of a time series remain constant over time, the series is at a stationarity case. The distance, gap, or lag between two times also influences the value of the variance between those periods Gujarati (2004) [25]. For this purpose, the Augmented Dickey-Fuller test is used. The test results show that the calculated absolute values of the dependent variables, imports (Y) and domestic barley production (X_1) and (X2) International price of barley, are greater than the tabulated values at confidence intervals of 1% , 5% and 5% respectively, and are therefore stationary at the level. Consequently, the assumption of a unit root is rejected. However, the results also showed that the two variables, rainfall (X3) and (X4) exchange rate, are not stationary at the level, and therefore the null hypothesis is accepted, and they are stationary at the first difference as seen in Table 1.

Table (1): Unit Root (ADF) Test Result

Variables	At level		First differences		Decision
	t-Statistic	Prob	t-Statistic	Prob	
Y	- 4.19	0.0019	-	0.00	1(0)
X_1	- 3.53	0.0116	-	0.00	1(0)
X_2	- 3.30	0.0208	-	0.00	1(0)
X_3	- 1.82	0.3619	-10.21	0.00	1(1)
X_4	- 0.41	0.9816	-6.43	0.00	1(1)

Eviews 12 Analysis Results Output; Note: Y = Barley import; X_1 = Annual domestic barely production; X_2 = International price of barley; X_3 = Annual rainfall amount; X_4 = Exchange rate.

Selection the Optimal Lag Length

In this context, Akaike has been used because of its widespread use in scientific practices. Cribari-Neto (2023) [26] explains that its values can be more easily transformed using Akaike weights, which helps in interpreting the results of procedures when compared to models of the Akaike Information Standard (AIC) Wagenmakers (2004) [27]. In light of the results of the AIC criterion at its lowest value, it appeared that the best model was (1, 1, 0, 1, 2, 0, 1, 2, and 1) with an optimal lag order of 2 , as shown in table 2 and Figure1**.**

Table (2): VAR Lag Order Selection Criteria

Lag	AIC
0	18.8060
1	20.3467
2	18.3676*

Eviews 12 Analysis Results Output; * indicates lag order selected by the AIC criterion; AIC: Akaike information criterion.

Bound Test Approach

The Bound Test is a powerful analytical tool used in applied economic analysis. It is a statistical test employed to determine the existence of a long-run cointegration relationship between the variables under investigation by comparing the F-statistic with its lower and upper bounds at a significance level of 0.05. This allows for confirmation that the coefficients of the study variables move together over the long-run it can also differentiate between short-te and long-run relationships within the same model Pesaran (2001) [28]. Analysis of the test results revealed that the calculated F-value of 2.2216 lies midway between the two tabulated F-values (Bounds) of 2.11 and 3.15 respectively, at a significance level of 5%. This does not necessarily imply the absence of cointegration between the variables, as a more accurate cointegration test exists using the error correction term coefficient (-1) Bahmaini-Oskooee (2001) [29]. Resulting from the fact it is a more accurate method for verifying cointegration (Kremers et al., 1992) [30], Banerjee et al. (1998)[31], and Faraj (2020) [31] emphasized its reliability as a more effective method for proving cointegration. As mentioned, the result of ECT-1 was used when the F-value falls between the lower and upper bounds which ECT(-1) was found to have a negative - 0.638455 and significant value at 1% in the analysis results.

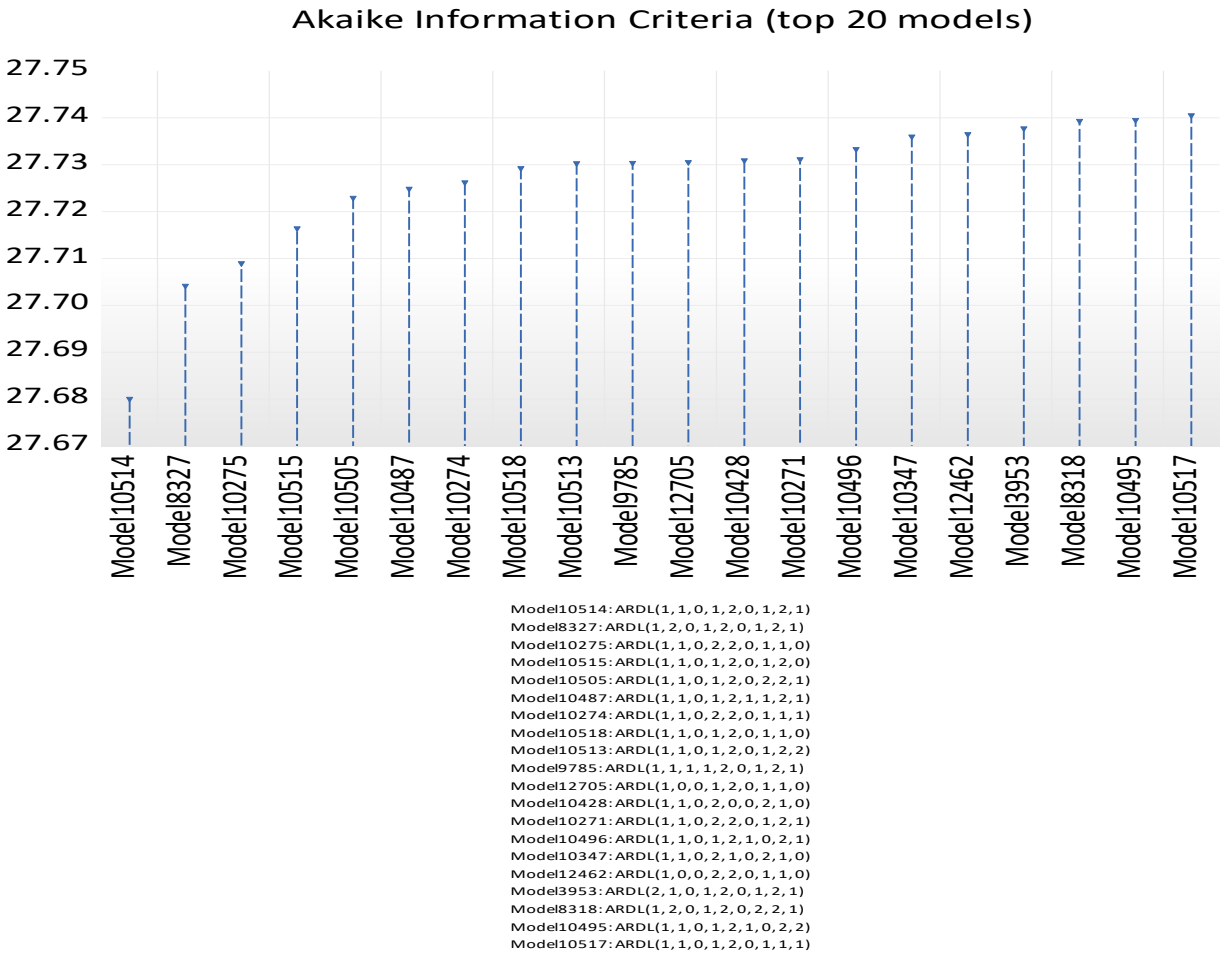

Figure1. Optimal model selection

Estimating the Short and Long-run Parameters for the Nardl

Based on the results of the Ardl estimation, from which the positive and negative coefficients of change for the study variables can be derived after dividing them into positive and negative values for each, the Nardl model estimates were obtained. The study's short-run results showed that negative changes in the international price of barley variable X2 had a significant negative impact on barley imports (1%) This means that when there is a decrease in the international price of barley, there is a decrease in imports of barley. This is due to the decrease in global demand for barley, and thus this is reflected in imports, or there is a commodity stock of this material, or for the purpose of maintaining local production. In the same context, its value in the first difference had a significant positive impact (5%), and this is due to the imposition of administrative and economic restrictions on the completion of contractual deals, the purchasing process, delays in imports, and the adoption of storage policies. Negative changes in the rainfall variable X3 also had a significant positive impact (5%), because there is an improvement in local production through the existence of projects that follow the process of supplementary irrigation and fertilization to increase production, or this result may be attributed to the processes of reducing the import process and the storage policy.

As for the change in the exchange rate, it had a significant positive impact on imports (0.01). This resulted from fears of rising international prices and a higher exchange rate in the future, or from the provision of assistance by import authorities through support for barley imports, thus increasing imports. The same applied to positive changes in the first difference as a result of avoiding higher future import costs. While its negative changes value in the first difference had a significant negative impact on barley imports (5%), this is due to reliance on the non-local currency and the postponement of import shipments of barley, which is a current effect at a significance level of 5%. The results also showed that there is no short-run symmetry because the value of positive changes is not equal to the value of negative changes in both international barley price and the exchange rate variables. The next result shows that the ECT (-1) was negative and statistically significant (-0.6384) at 1 % in the NARDL model, which indicates that after a deviation, the variables tend towards long-term equilibrium in the past time, making the system return at a high rate of 63% after exposure to a short shock as shown in Table 3.

Table (3) : Nardl Model Coefficients in the Short- Run

The short-run **coefficients**			
Variables	**Coefficient**	**t-Statistic**	**Pro.**
D(X1POS)	219720.5	1.383012	0.1836
D(X2POS)	-255897.0	-0.947934	0.3557
D(X2NEG)	-1243070.	-4.716681	0.0002
D(X2NEG(-1))	785464.4	2.540154	0.0205
D(X3NEG)	189742.1	2.133455	0.0469
D(X4POS)	504741.6	3.058431	0.0068
D(X4POS(-1))	312241.3	2.034112	0.0569
D(X4NEG)	-1425539.	-2.782038	0.0123
CointEq(-1)*	-0.638455	-5.772795	0.0000

Eviews 12 Analysis Results Output; X_1pos refer to positive changes in domestic barley production, X_1neg refer to negative change in domestic barley production, X_2pos refer to positive changes in international barley price, X_2neg refer to negative changes international barley price , X_3pos refer to positive changes in rainfall, X_3neg refer to negative changes in rainfall, X_4pos refer to positive changes in exchange rate, X_4neg refer to negative changes in exchange rate.

On another note, the long-run findings indicated that negative changes in the international price of barley was the only variable with a significant and negative long-run impact on Libyan barley imports. The negative impact of negative changes in the global price of barley and its negative impact on barley imports can be attributed to the decline in barley prices in the long- term. Because of the possibility of producing it locally and improving productivity, which is reflected in the continuous changes in global prices and its reflection in the decisions of the import authorities to move towards local production instead of imports. However, no long-run symmetries were observed in the negative and positive changes.

Table (3) : Nardl Model Coefficients in the Long- Run

The Long-run **coefficients**			
Variables	**Coefficient**	**t-Statistic**	**Pro.**
X1POS	-206443.9	-0.352385	0.7286
X1NEG	-820724.8	-1.670031	0.1122
X2POS	1094399.	0.994157	0.3333
X2NEG	-3747263.	-2.963485	0.0083
X3POS	-811081.2	-1.120629	0.2772
X3NEG	-131656.6	-0.284362	0.7794
X4POS	-424527.0	-0.552996	0.5871
X4NEG	-3196953.	-1.359696	0.1907
C	143584.5	0.689890	0.4991

Note: X_1pos refer to positive changes in domestic barley production, X_1neg refer to negative change in domestic barley production, X_2pos refer to positive changes in international barley price, X_2neg refer to negative changes international barley price , X_3pos refer to positive changes in rainfall, X_3neg refer to negative changes in rainfall, X_4pos refer to positive changes in exchange rate, X_4neg refer to negative changes in exchange rate.

Turning to the diagnostic tests in Table 5, these tests demonstrate the model's quality and the absence of any normative issues affecting the accuracy of its estimates, as detailed in Table 5. The Ramsey test also revealed that the model is well-specification, contains relevant variables, and exhibits stable coefficients over time, with the test statistic remaining within the specified limits throughout the model's duration at a significance level of 5%.

Table (5):NARDL Model Estimation Diagnostic Tests

Test Statistics	**Value**	**Prob.**
Ramsey Test	1.7895	0.1988
Serial Correlation LM Test	3.1965	0.0679
Heteroscedasticity (Breusch-Pagan Godfrey)	13.7006	0.6882
Heteroscedasticity (Arch test)	0.9523	06212
Normality test	1.4710	0.4792

Eviews 12 Analysis Results Output

.

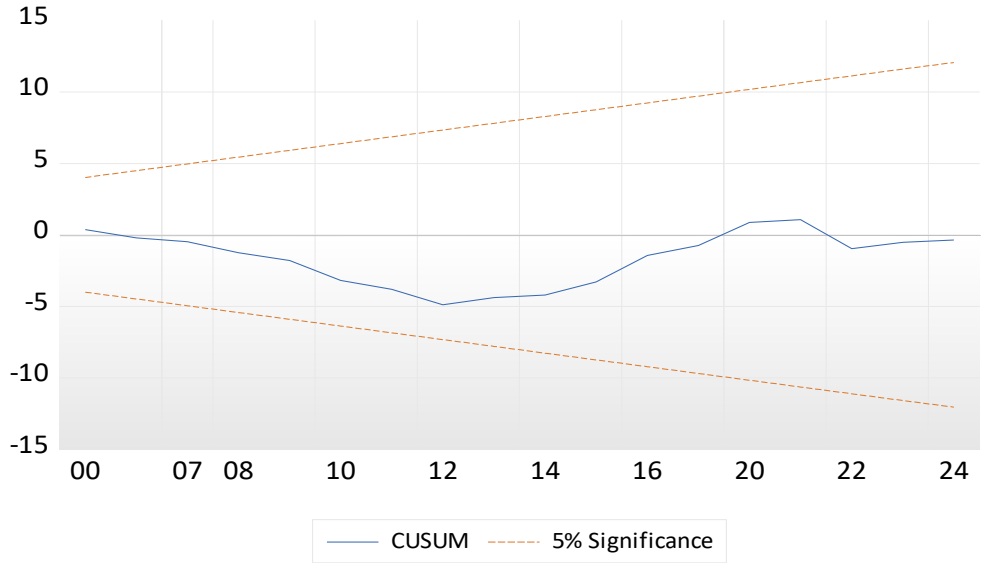

Figure2. CUSUM test for Stability of coefficients

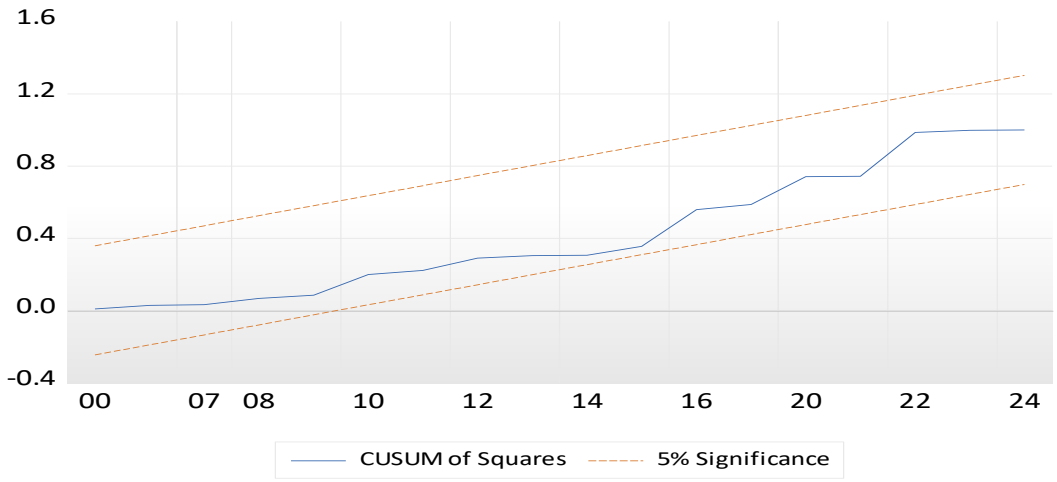

Figure3. CUSUMSQ test for Stability of coefficients

Regarding the predictive performance of the Nardl model, indicating good predictive power, it was satisfactory and effective, with a variance proportion (0.0375) less than one. For Theil's and bias proportion were 0.1707 and 0.00003 respectively

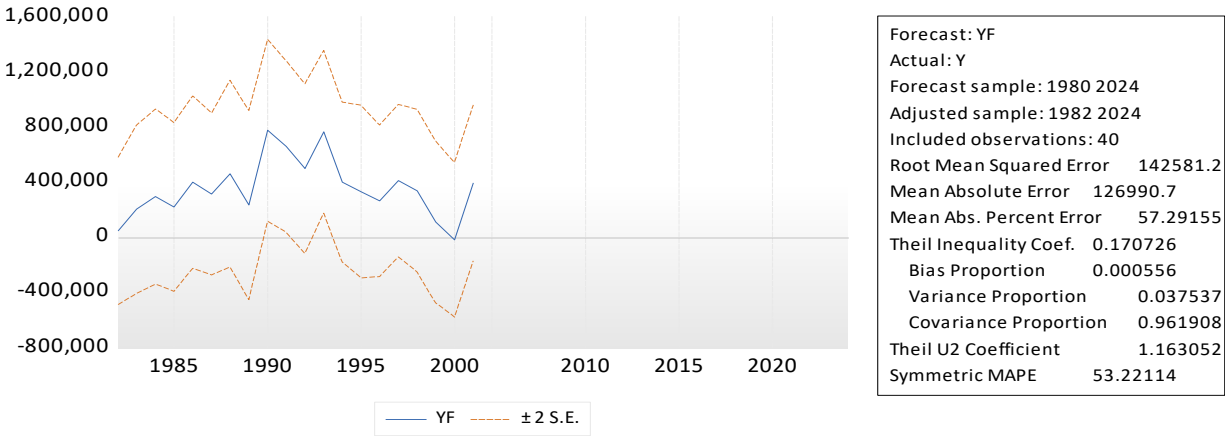

Figure4. Predictive performance of the Nardl model

Conclusion

This study focused on the importance of factors influencing barley imports, given their significance in human and animal production. It compiled the variables most impactful on imports to support and understand the asymmetric relationships between these variables. The research aimed to estimate the asymmetric relationship between the variables under study and employed the NARDL methodology to assess whether positive and negative shocks have different effects within both short and long-run frames using the NARDL model methodology, employing time series data during (1980-2024). The study concluded that there was a long-term relationship between the variables. In addition, the short-term results showed a negative impact of negative changes in the global barley price (X2). This also had a negative impact on barley imports, while the initial difference had a positive impact, and this effect was statistically significant for both variables. Negative changes in the rainfall variable (X3) had a positive impact. Similarly, exchange rate fluctuations had a positive impact on imports, as did positive changes in the initial exchange rate difference. Conversely, negative exchange rate fluctuations had a statistically significant negative impact. The results also indicated a lack of symmetry between the variables with significant effects. Regarding the long-term negative and positive variables, the results confirmed that negative changes in the global barley price had a negative impact on barley imports. In terms of model validity testing, the model was found to be sound and effective in its prediction.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

References

[1] Arab Organization for Agricultural Development 2025. Agricultural statistics yearbook. (Vol. 44). Arab Organization for Agricultural Development.

[2] Tricase, C., Amicarelli, V., Lamonaca, E., & Rana, R. L. (2018). Economic analysis of the barley market and related uses. Grasses as food and feed, 10, 25-46.

[3] ALFisi, F. S. F. (2024). The Causal Relationship Among Barley Production and Some Variables in Libya Using The Toda-Yamamoto Causality Test. Journal of the Advances in Agricultural Researches, 29(2), 255-262

[3] Ajanovic, A. (2011). Biofuels versus food production: does biofuels production increase food prices. Energy, 36(4), 2070-2076.

[5] Mahmoud, M. M. M. (2008): Economics of Barley Production in the Green Mountain Region (Unpublished Master's Thesis). Omar Al-Mukhtar University.

[6] Food and Agriculture Organization (2026 a). Area Harvested indicator. (Faostat database). United Nations. Retrieved March 6.

[7] Food and Agriculture Organization (2026 b). Food and Agriculture Organization of the United Nations.(2026b). Barley Production indicator. (Faostat database). United Nations. Retrieved March 6, 2026.

[8] Food and Agriculture Organization (2026 c). Barley Import indicator. (Faostat database). United Nations. Retrieved March 6, 2026.

[9] Al-Ramli, H. M. A. (2003). Estimating the Barley Supply Function in Libya. (Unpublished Master's Thesis). University of Tripoli.

[10] Al-Jadi, A. A. (2006). An Economic Study of Barley Supply Response in Libya. Al-Jami'i Journal,11, 47-65.

[11] Al-Zawam, A. A. A.(2007). An Economic Study of the Factors Affecting the Production and Consumption of the Most Important Crops in Libya.(PhD Thesis). Alexandria University (Saba Pasha).

[12] Al-Bidi, K.R. , & Hamouda , A. M. (2015). Climate Change and its Impact on Agricultural Output in Libya for the Period (1980-2010). Journal of Marine Sciences and Environmental Technologies, 1(2), 58-69.

[13] Ahmed, Y. M. M., & AL-Sallai, A. A.(2023) Standard study of barley consumption in Libya: A study from 1990-2012. Al-Bayan Scientific Journal, 14, 69-80.

[14] Al-Dakhli, O. S. and Daw, A. A. (2025). Estimating the most important factors determining the size of the food gab for barley crop in Libya and its impact on the food security: A study from 2000-2021. African Journal of Advanced Studies in Humanities and Social Sciences (AJASHSS), 4 (1), 471- 480.

[15] Farhan, M. O. & Al-Omairi, S. A. H. & Zahra H. M. (2012). An economic study of the supply response of barley crops in Iraq for the period 1980-2009. Rafidain Agriculture Journal, 40(4), 104-113.

[16] Jnod, G. D, Abu Assaf, S. M, Al-Atallah, Bassam F.& Sap. R. S. (2018). The Reality of Agricultural Operations Management and the production of the Rain-Fed Barley and its Production Costs in Sewida Province. Al-Quds Open University Journal of Administrative and Economic Research, 2(8).166-181.

[17] Al-sahwan, A., Darwich, C., & Nerouz, F. (2022). An Economic Assessment of Irrigated Barley Production and Price Policy Effect in Hama Governorate. Syrian Journal of Agricultural Research –SJAR 9(2): 127-139.

[18] Mahmoud, M. I. (2023). The effect of changes in the exchange rate on the most important import crops in Egypt. Journal of the Advances in Agricultural Researches, 28(1), 177-192.

[19] Aliabadi, M. M. F., & Fakari, B. (2024). Economic sanctions and barley price regime change in Iran. Bio-based and Applied Economics, 13(2), 161-170.

[20] Kakhki, M. D., Farsi, M. M., Fakari, B., & Kojori, M. (2019). Volatility transmission of barley world price to the domestic market of Iran and the role of Iran Mercantile Exchange; an application of BEKK model. New Medit, 18(3), 97-107.

[21] Liu, J., Li, X., & Sun, J. (2023). China-Australia Trade Relations and China's Barley Imports. Agriculture, 13(8), 1-13.

[22] Faraj, F. S. (2026). Impact of Climate Changes on Sheep Production in Marsa Matrouh Governorate in Egypt, using the Nardl Model Methodology. *AlQalam Journal of Medical and Applied Sciences*, 9(2),410-415.

[23] Al-Sawai, K. M. (2012). Fundamentals of Economic Measurement Using EViews Software. Dar Al-Kitab Al-Thaqafi. Irbid, Jordan.

[24] Gujarati, D. N. (2004). Basic Econometrics (4th ed.). New York, NY: McGraw-Hill, p. 797.

[25] Cribari-Neto, F., Scher, V. T., & Bayer, F. M. (2023). Beta autoregressive moving average model selection with application to modeling and forecasting stored hydroelectric energy. International Journal of Forecasting, 39(1), 98-109.

[26] Wagenmakers, E. J., & Farrell, S. (2004). AIC model selection using Akaike weights. Psychonomic bulletin & review, 11(1), 192-196.
[27] Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics,16 (3), 289-326.
[28] Bahmani- Oskooee, M. (2001).How stable is M2 Money Demand Function in Japan? Japan and the world Economy. Elservier, 13(4), 455-461.
[29] Kremers, J. J. M., Ericsson, N. R., and Dolado, J. J. (1992). The power of cointegration tests. Oxford Bulletin of Economics and Statistics, 54, 325-348.
[30] Banerjee, A., Dolado, J. J., and Mestre, R. (1998). Error-correction mechanism tests for cointegration in a single equation framework. Journal of Time Series Analysis, 19, 267- 283
[31] Faraj, F. S., Ismail, F., & Ab-Rahim, R. (2020). Determinants of wheat production in Libya. International Journal of Academic Research in Business and Social Sciences, 10(12), 178-191.

