2026, Cilt 3, Sayı 4, 954-964

OPEN ACCESS
ISSN: 3062-262X

Akademik Eğitim ve Sosyal Bilimler Dergisi (AJESS Journal)

The Impact of Digitalization on Food Availability: An Econometric Study Using the ARDL Model in Jordan During the Period 2001–2024

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Article History
Received:05/08/2026; Accepted: 09/09/2026; Published: 13/10/2026

Abstract

This study aims to measure the effect of digitalization, proxied by mobile cellular subscriptions, on food availability in Jordan, measured by dietary energy supply, over the period 2001 to 2024. To this end, the autoregressive distributed lag (ARDL) model is employed, with agriculture value added and food imports included as control variables. After verifying the stationarity properties of the series, the bounds test indicates a cointegrating relationship among the variables. The long run results show a positive effect of digitalization and agriculture value added on dietary energy supply, while food imports have no significant effect. In the short run, the effect of digitalization strengthens gradually across lags, and the error correction term is negative and significant, implying that the Jordanian economy returns to its equilibrium path within a relatively short period after a deviation. The model passes the diagnostic tests for serial correlation, heteroskedasticity, normality, and functional form. The study recommends expanding digital infrastructure in agricultural areas, developing digital services that provide farmers with information, and strengthening domestic agricultural production.

Keywords: Digitalization; Food Availability Food security; Jordan; ARDL Model.
JEL Classification : Q18, O33, O53, C22

Introduction

For the past three years, the world has seen a gradual decline in hunger rates, yet this decline remains fragile and uneven across regions, with around 2.1 billion people still experiencing moderate or severe food insecurity in 2025, (FAO & al, 2026) this came after a series of shocks that disrupted food and energy markets and supply chains, and brought back to the forefront a persistent question in development policy: how can countries ensure that food reaches their markets regularly and in sufficient quantities? As a result, food availability has become more closely tied to the transformations taking place in food systems, driven by mounting pressure on natural resources, supply chain disruptions, and economic and environmental change. (Krupitzer & Stein, 2024) Amid these rapid transformations in food systems, strengthening food availability is no longer tied solely to increasing agricultural output. It now also depends on the capacity of these systems to harness recent technological advances across the various stages of the food value chain, as part of the shifts that have begun to reshape agricultural production methods, resource management, information exchange, and the organization of food supply chains. (Sridhar & al, 2023) The significance of digital transformation in advancing agricultural and food systems has become increasingly pronounced amid the widespread adoption of data-driven digital technologies across production processes, resource management, and decision-making. The applications of these technologies extend across the various stages of food systems, thereby positioning digital transformation as an emerging and potentially influential factor that warrants systematic consideration in the analysis of the determinants of food availability, (MacPherson & al, 2022) as their use has expanded across the various stages of agricultural and food activity, from production and resource management to information exchange and the organization of supply chains, thereby adding an increasingly prominent technological dimension to these systems , (Junior Choruma & al, 2024) against this background, examining the relationship between digitalization and food availability has become

increasingly important. This importance is particularly evident in countries facing constraints on their agricultural and water resources, and Jordan is one of the cases that display these characteristics. Its capacity to meet its food needs is shaped by limited water resources and a substantial reliance on international trade, which makes the study of the factors associated with food availability especially relevant. (Christoforidou & al, 2023) Jordan has likewise seen a growing orientation of its agricultural sector toward the use of digital technologies in services and activities related to agricultural production. In this context, the Food and Agriculture Organization (FAO), in cooperation with the National Agricultural Research Center (NARC), launched the platform "Ma' Al-Muzara' – NARC," which provides digital services covering the agricultural calendar, animal husbandry, harvesting and post-harvest operations, the agricultural market, and communication between experts and farmers, (FAO Digital Services Portfolio, 2021) furthermore, the FAO Country Programming Framework for Jordan, covering the period from 2024 to 2028, has made enhancing the productivity of smallholder farmers and their access to markets through digitalization one of its main priorities. (FAO, Jordan Country Programming Framework , 2024) This unfolds in a context marked by challenges related to natural resources, the agricultural sector, and food systems, which gives the study of digitalization in the Jordanian case particular importance. Jordan also offers a suitable example for tracing both pathways together. Limited arable land and water scarcity place the Jordanian economy under a strict constraint in producing its own food, to the point that the country imports more than 95% of its wheat and barley requirements, (Al Shahwan & Klein, 2025) nevertheless, the overall food self-sufficiency rate reached 61.4% in 2024, compared with 57.3% in 2020. In October 2024, the Kingdom also launched a national food security information management system that monitors 33 indicators. (Jordan News Agency , 2026)

Accordingly, the study poses a question about the nature of the relationship between the development of digitalization and food availability in Jordan, and seeks to examine it empirically over the period 2001 to 2024 using the Autoregressive Distributed Lag (ARDL) model, which allows the relationship to be assessed in both the short run and the long run. Therefore, the following research question can be posed:

What is the effect of digitalization on food availability in Jordan over the period 2001 to 2024, and does the nature of this effect differ between the short run and the long run?

To address the research problem, the following main hypotheses are formulated:

H_1: There is a statistically significant effect between digitalization and Food availability in Jordan during the period 2001–2024;

H_2: There is a statistically significant effect between Agriculture, forestry & fishing, value added and Food availability in Jordan during the period 2001–2024;

H_3: There is a statistically significant effect between Food imports and Food availability in Jordan during the period 2001–2024;

1- Literature Review

The literature on this topic begins from a general conception that views digitalization as a tool for linking the stages of the food system, and then branches into econometric studies that differ in their unit of analysis and in the food indicator they adopt. For instance, (Krupitzer & Stein, 2024) argued, in a conceptual review, that information technologies, such as the Internet of Things, artificial intelligence, and blockchain, can integrate the stages of the food chain, from farm to consumer, into a unified food system, while cautioning that this potential has not yet been fully realized and that trust and data standardization remain open challenges. The study by (Junior Choruma & al, 2024) is consistent with this view. Based on a review of 27 studies on smallholder farmers in sub-Saharan Africa, it found that the most widespread technologies are simple, phone-based ones, and that they improve access to information and markets. However, weak internet connectivity, low digital skills, high costs, and the gender gap limit the extent of their impact. Thus, both studies set out the conditions for benefiting from digitalization before establishing the magnitude of its effect, and they share the feature of not providing a statistical estimate of the effect of digitalization on a specific food indicator.

At the econometric level, (Wang, Dong, & Heng, 2024), using data from 30 provinces over the period 2011 to 2021, found that the digital economy raises grain productivity per unit of area by increasing total factor productivity and strengthening agricultural resilience, and that its effect becomes substantially larger once urbanization exceeds a certain level. (Zhu & al, 2024) examined the relationship between the digital economy and food-system resilience across the same provinces and over the same period, finding that industrial agglomeration plays a mediating role in this relationship, while also identifying a positive spatial spillover effect in neighboring regions. As for (Tian, Liu , & Ma, 2024) ,they measured the coordination between green agriculture and food security across 30 provinces over the period 2014 to 2021, and concluded that the digital economy has a positive effect, which is larger in plains, agricultural provinces, and major grain-producing regions. (Wei, 2026) then followed in the same direction, using data from 285 Chinese cities over the period 2011 to 2024 and a dynamic spatial Durbin model. The study found a positive effect of digital technology on per capita grain availability, together with an indirect effect in neighboring areas. The strongest transmission channels were community agricultural services, followed by the efficiency of land transfer and then the reduction of climate-induced production volatility, and the effect was larger in non-major grain-producing areas. The study itself acknowledges that its indicator captures the availability dimension alone, and that its city-level data conceal variation within cities. Three studies come closer to the design of the present study, as they relied on internet use indicators and a food production index as measures of food security or availability. (Chandio & al, 2025) used data from the seven emerging economies over the period 1995 to 2019 and found that mobile phones and the internet raise food

security in the long run by about 0.092% and 0.036%, respectively, and that the effect is clearer in the long run than in the short run, with bidirectional causality running between mobile phones and food security and unidirectional causality running from the internet to food security. (Li, Chandio, & al, 2025) likewise applied the ARDL approach to Vietnam over the period 1996 to 2022, supported by DOLS and FMOLS estimates. The results showed that internet users are associated with a significant improvement in food security in both the short run and the long run, whereas the effect of mobile phones was positive but statistically insignificant in the long-run estimates. The study also found that rising temperatures harm food security. (Jiahao & al, 2026) estimated the effect of digital connectivity, measured by internet users per 100 inhabitants, on food availability across 61 economies over the period 2002 to 2022 using an ARDL model. They found a positive and significant long-run effect with a coefficient of 0.106, and an insignificant short-run effect, which they explained by noting that the benefits of these innovations materialize gradually.

In the same context, (Sridhar & al, 2023) examine what digitalization adds to the agricultural and food sector. The study starts from the premise that rising demand, inequality, climate change, and pandemics threaten food security, and it reviews the main technologies: artificial intelligence, precision agriculture, big data analytics, sensors, drones, the Internet of Things, blockchain, and e-commerce. It concludes that digitalization improves production, food quality, supply chain management, and marketing, noting that reliance on digital technologies in agriculture reduces costs by at least 23% and moderately reduces the volume of losses by about 5%. The study also draws on (Fabregas & al, 2019) ,who reported that disseminating agricultural information via mobile phones raised yields by 4% in sub-Saharan Africa and India and increased the likelihood of using agricultural inputs by 22%. It further shows that the COVID-19 pandemic exposed the fragility of supply chains and accelerated digital transformation. It concludes that digitalization is still in its early stages, that infrastructure, resource constraints, and skills shortages hinder its benefits, and that the role of governments is decisive. (MacPherson & al, 2022) reviewed policies and legislation and complemented the review with a foresight analysis based on four scenarios for Germany in 2035, focusing on the European Union and Germany. The study classified the functions of digital technologies into three categories: monitoring, decision support, and communication. Its conclusions were threefold. Policies paid limited attention to the benefits of digitalization, mostly from the angle of resource use efficiency. The legal framework for digital agriculture was emerging and fragmented. And the adoption of digitalization and its use in the service of sustainability would depend on future data ownership regimes. The study also discussed barriers to adoption, such as high investment costs, a lack of training, and the digital divide between large and small farmers, and it made the success of digitalization conditional on fast broadband and mobile coverage in rural areas. It further noted that the visions of international institutions such as the World Bank, the Organisation for Economic Co-operation and Development (OECD), and FAO regarding digitalization focus on reducing food shortages by intensifying agricultural production.

As for Jordan, the reviewed studies are limited to (Christoforidou & al, 2023), which does not address digitalization but sets out the background against which any result should be read. Drawing on FAO data for the period 2000 to 2018, the study showed that Jordan relies on imports for about 95% of its grain, that the value of its food imports relative to its merchandise exports rose from 26% in 2004 to 2006 to 42% in 2015 to 2017, and that its capacity to absorb price shocks is declining.

This review shows that the findings mostly point to a positive effect of digitalization on food indicators, and that this effect varies by region and economic structure and appears more clearly in the long run than in the short run. However, most of the econometric evidence comes from Chinese data or country groups, and the only single-country study using the ARDL approach is the Vietnam study, an agricultural economy whose resources differ from those of Jordan, while the study on Jordan did not measure the effect of digitalization at all. Hence, this study examines the relationship between digitalization and food availability in Jordan over the period 2001 to 2024, in both the short run and the long run, in a resource-constrained economy that depends on external markets.

1-1- Key Concepts of the Study

Food availability: Food availability can be defined as the existence of sufficient and continuous quantities of appropriate food, in terms of both quantity and quality, to meet the dietary needs of the population, whether this food comes from domestic production, stocks, or imports, thereby ensuring that food supplies are present at the right place and time. Food availability is one of the core dimensions of food security, but it does not necessarily imply that individuals have the economic or physical capacity to access the food that is available, since availability relates primarily to the supply side of food at the national or regional level. (Riely & al, 1999)

Digitization: Digitization is defined as the process of converting physical or analog elements in processes and workflows into digital formats. The main objective of this process is to enable computer systems to use this digital data. In other words, it is the exploitation of digital technology and digitized files to transform a specific activity, procedure, service, or protocol from the tangible real world to the world of computers, the internet, and electronic devices. (Ben Ahmed & Ben A, 2025)

2- Methodology and Tools

2-1- Methodology and Variables Selection

Upon reviewing a number of previous studies, we found several variables, some of which we adapted, while others were selected for reasons relevant to the study. These are detailed in the following table:

Table (01): Study Variables and Reasons for Their Selection

Variable Type	Symbol	measuring variable	Reasons for Its Selection	Data Source

Independent	MCS	Mobile cellular subscriptions (per 100 people)	Used as an indicator of digitalization to measure the extent of mobile network connectivity in Jordan. This indicator is suitable for the present study because it is an annual quantitative measure that makes it possible to track the development of digital communication infrastructure over the study period. Moreover, the spread of mobile phones enables connectivity, information exchange, and access to digital services, including information, markets, and services related to agricultural and food activities.	(worldbank, 2026)
Dependent	DES	Dietary Energy Supply	Reflects the average amount of dietary energy available for human consumption per capita per day, which makes it a relatively direct indicator for measuring the food availability dimension. It also allows the evolution of food supplies in Jordan to be tracked over time, which suits the analysis of both the long run and short run relationships using the ARDL model.	(FAOSTAT, 2026)
Control Variable	AGVA	Agriculture, forestry & fishing, value added (% GDP)	Is included to capture the relative importance of primary productive activities in the Jordanian economy. The weight of these activities may be linked to domestic productive capacity and to the contribution to food supply. Including it also helps to distinguish the relationship associated with digitalization from the relationship that may reflect changes in the productive structure of the economy.	(worldbank, 2026)
Control Variable	FIMPO	Food imports, % of merchandise imports	Is included to capture the relative weight of food imports within Jordan's merchandise imports. Its importance stems from the fact that available food supplies may be shaped by external trade and by access to food from international markets, and not by domestic production alone. This variable also helps to control for one aspect of food-related trade exposure.	(worldbank, 2026)

Source: Prepared by the researchers based on previous studies

This study employs an econometric approach to examine the relationship between Digitization and Food availability. This is achieved by applying the ARDL methodology through a series of tests and analyses, following these steps :

- Testing time-series stationarity;
- Testing for cointegration using the Bounds Test approach;
- Estimating the long-run model using the ARDL framework. (Pesaran, Shin, & Smith, 2001)

2-2- Correlation Analysis of Explanatory Variables

A correlation matrix was constructed for the independent variables in order to verify that the study variables do not suffer from multicollinearity. The results are presented in the following table:

Table (02): Correlation Matrix between the Independent Variables

	DES	**MCS**	**AGVA**	**FIMPO**
DES	1.0000			
MCS	-0.0352	1.0000		
AGVA	-0.4724	0.7627	1.0000	
FIMPO	-0.7390	0.1083	0.5806	1.0000

Source: Prepared by the researchers using EViews 13 software.

As shown in the table above, the highest correlation coefficient is 0.7627, observed between AGVA and MCS. Several researchers have noted that multicollinearity becomes a concern when correlation coefficients exceed 0.9. Accordingly, the model does not suffer from multicollinearity, as there is no problem of linear dependence among the explanatory variables, and therefore no variable will be excluded.

2-3- Time Series Stationarity Test

Examining the stationarity of the study variables is a fundamental prerequisite for proceeding with the analysis, as it allows for determining the order of integration for each variable using the Augmented Dickey-Fuller (ADF) test. Table (02) presents the test results and model specifications; the variables must be integrated of order I(0), I(1), or a mixture of both.

Table (03): Augmented Dickey-Fuller (ADF) test results for the time series under study.

Serie	Level			1stdifference			
	ADF Calculated	ADF Tabulated	Proba	ADF Calculated	ADF Tabulated	Proba	
DES	-2.7013	-3.6908	0.2471	-2.9321	-1.9572	0.0054	I(1)
MCS	-1.8546	-3.6220	0.6447	-4.0176	-3.6328	0.0236	I(1)
AGVA	-2.0982	-3.6220	0.5197	-4.3829	-3.6328	0.0113	I(1)
FIMPO	-4.0379	-3.6449	0.0235	-4.2610	-3.6584	0.0159	I(0)

Source: Prepared by the researchers using EViews 12 software.

The table above reports the results of the Augmented Dickey-Fuller (ADF) unit root test. The results indicate that the time series of DES, MCS, and AGVA are non-stationary at level, as their p-values (0.2471, 0.6447, and 0.5197, respectively) exceed the 5% significance level, and the computed statistics do not allow rejection of the null hypothesis (H0) of a unit root. After first differencing, however, these series become stationary: the p-values (0.0054, 0.0236, and 0.0113, respectively) are below 0.05, and the absolute values of the computed statistics exceed the critical values. The null hypothesis is therefore rejected in favor of the alternative hypothesis (H1) that the series are stationary at first difference, I(1).

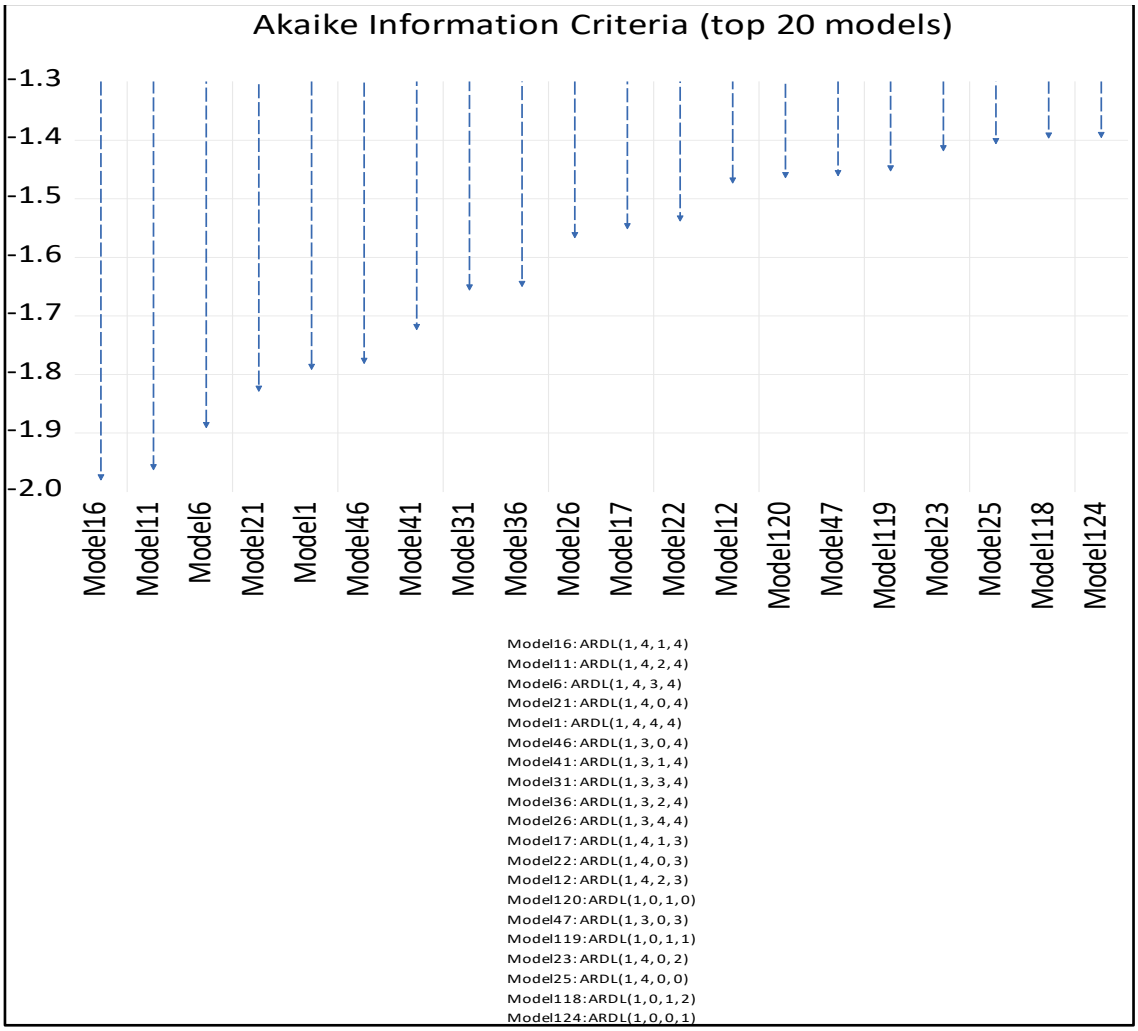
As for FIMPO, it is found to be stationary at level, with a p-value of 0.0235, which is below the 5% significance level. The computed statistic (Tcal = -4.0379) is more negative than the critical value (Ttab = -3.6449). We therefore reject the null hypothesis (H0) of a unit root and accept the alternative hypothesis (H1) that the series is stationary at level, I(0). The series also remains stationary after first differencing, with a p-value of 0.0159, below 0.05, which confirms its stationarity. Based on these results, we conclude that the series under study are integrated of different orders: DES, MCS, and AGVA are integrated of order one, I(1), whereas FIMPO is integrated of order zero, I(0).

Since the test results show a mix of I(0) and I(1) series, with no series integrated of order two, I(2), the use of the ARDL bounds testing approach to cointegration is justified. This allows us to proceed with the estimation of the ARDL model.

- **Selection of Optimal ARDL (p,q) Lag Lengths**

To determine the optimal lag lengths, the Akaike Information Criterion (AIC) was used. The results indicate that the optimal specification is ARDL(1,0,0,1), that is, one lag for the dependent variable DES. The following figure illustrates this :

Figure (01): Optimal Lag Length Test



Source: Prepared by the researchers using EViews 12 software.

2-4 Cointegration test using the Bounds Test approach

After determining the appropriate model specification, the long-run cointegration relationship is examined using the Wald test, as presented below:

Table (04): (Bounds Test)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	7.396729	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: EViews 12 program outputs.

The bounds test results show that the F statistic (7.3967) is greater than both the lower and upper critical bounds at the 10% and 5% significance levels, which indicates the existence of a relationship in the short run. Moreover, the error correction term (ECM) is negative and statistically significant (p = 0.0002), which supports the existence of a long run equilibrium relationship among the variables.

Furthermore, we estimated the long-run coefficients, yielding the following results:

Table (05): Long-run cointegration coefficient estimates

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MCS	**0.055811**	**0.053163**	**1.049807**	**0.0370**
AGVA	**0.113333**	**0.123334**	**0.918909**	**0.0425**
FIMPO	**0.057481**	**0.112365**	**0.511557**	**0.0642**
C	**7.302934**	**0.389476**	**18.75069**	**0.0003**

Source: EViews 12 program outputs.

Table (06): Short-run cointegration coefficient estimates

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MCS)	0.057134	0.009913	5.763233	0.0104
D(MCS(-1))	0.080604	0.009534	8.454395	0.0035
D(MCS(-2))	0.089065	0.009830	9.060808	0.0028
D(MCS(-3))	0.113661	0.012884	8.822151	0.0031
D(AGVA)	-0.004560	0.013392	-0.340474	0.7559
D(AGVA(-1))	0.030025	0.011558	2.597831	0.0805
D(AGVA(-2))	-0.014515	0.011039	-1.314910	0.2800
D(AGVA(-3))	-0.083793	0.009484	-8.835286	0.0031
D(FIMPO)	-0.154459	0.022075	-6.997023	0.0060
D(FIMPO(-1))	-0.152645	0.019831	-7.697295	0.0046
D(FIMPO(-2))	-0.041605	0.021172	-1.965081	0.1441
D(FIMPO(-3))	-0.091152	0.018601	-4.900483	0.0163
CointEq(-1)*	-0.657092	0.038955	-16.86813	0.0005

Source: EViews 12 program outputs.

The two tables above show that the p values of the constant and the explanatory variables are all below 0.05, which means the coefficients are statistically significant and supports the earlier finding of cointegration among the variables under study. The results also reveal a short run dynamic relationship among the variables. The estimated error correction term is negative and statistically significant (CointEq(-1) = -0.657, p = 0.0005, below the 5% level). It measures the share of disequilibrium in the dependent variable that is corrected from one period to the next, here 65.7%. This implies that, after a deviation from equilibrium, returning to the long run equilibrium takes approximately one and a half years.

2-5- Model Diagnostic Tests

Several tests were conducted to verify the performance quality of the selected model, as follows:

- **Error Autocorrelation Test (LM Test):**

To ensure the absence of autocorrelation, we employed the Breusch-Godfrey serial correlation LM test; the results are presented in the following table:

Table (07): Results of the Error Autocorrelation Test

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

F-statistic	1.370808	Prob. F(2,15)	0.2839
Obs*R-squared	3.554194	Prob. Chi-Square(2)	0.1691

Source: EViews 12 program outputs.

The table shows that the probability of the F-statistic (p = 0.2839) and the probability of the Chi-square statistic with one degree of freedom (p = 0.1691) both exceed the 5% significance level. We therefore fail to reject the null hypothesis of no serial correlation in the residuals, and conclude that the model does not suffer from an autocorrelation problem.

- **Test for Error Variance Stability:**

To detect heteroskedasticity, we use the ARCH Heteroskedasticity Test; the results are shown in the following table:

Table (08): Results of the heteroskedasticity test

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

F-statistic	0.585882	Prob. F(5,17)	0.7107
Obs*R-squared	3.380755	Prob. Chi-Square(5)	0.6415
Scaled explained SS	2.644523	Prob. Chi-Square(5)	0.7546

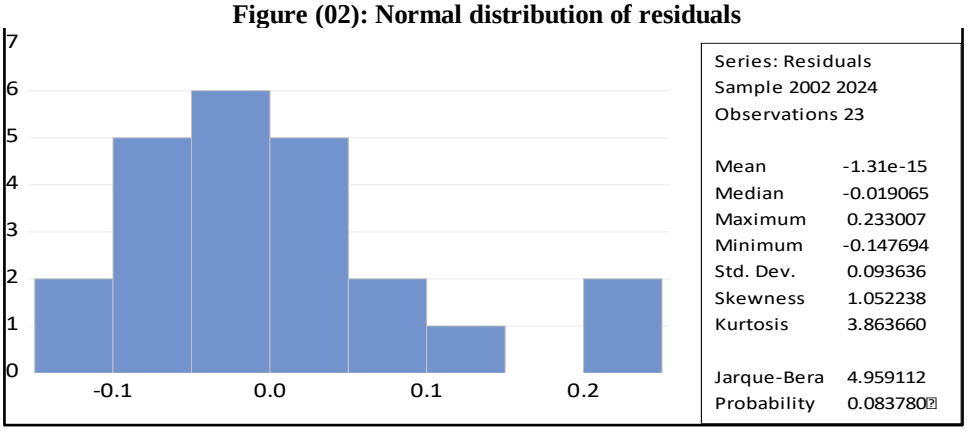
Source: EViews 12 program outputs.

The table above shows that the p-value of the F-statistic (p = 0.7107) exceeds the 5% significance level. We therefore fail to reject the null hypothesis of homoskedasticity, which indicates that the model does not suffer from heteroskedasticity.

- **Normal distribution of residuals:**

The Jarque-Bera test was used to check the normality of the residuals. The test result is statistically insignificant (p > 0.05), which indicates that the residuals are normally distributed. The Jarque-Bera statistic is 4.95 with a probability of 0.083, which exceeds the 5% significance level. We therefore fail to reject the null hypothesis of normality, as shown in the figure below:

Figure (02): Normal distribution of residuals



Source: EViews 12 program outputs.

- **Test for Functional Form Specification:**

The validity of the estimated model's specification and design (functional form validity) is tested using the Ramsey test. The null hypothesis states that the functional form is correctly specified.

Table (09): Ramsey Test Results

	Value	df	Probability
t-statistic	0.158772	16	0.8758
F-statistic	0.025208	(1, 16)	0.8758
Likelihood ratio	0.036209	1	0.8491

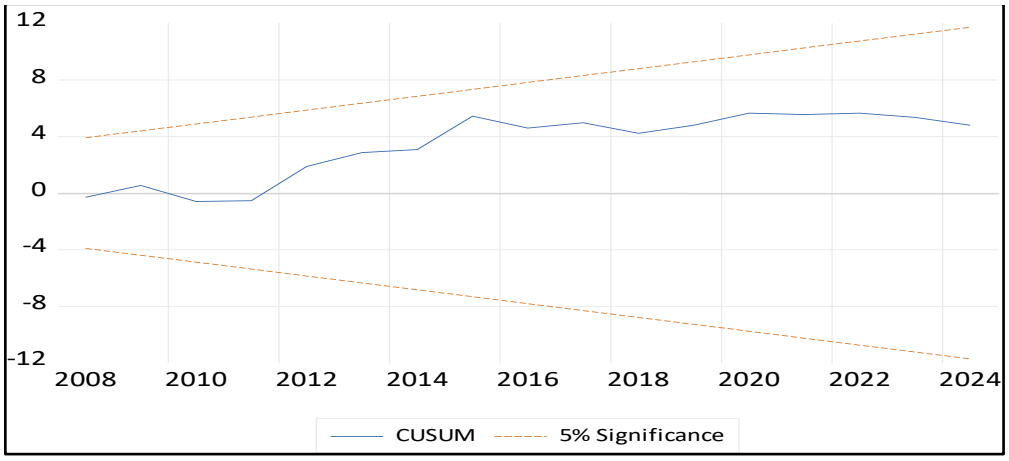
Source: EViews 12 program outputs.

The table shows that the p-value of the Ramsey RESET test (F-statistic, p = 0.8758) exceeds the 5% significance level. We therefore fail to reject the null hypothesis, which indicates that the functional form of the model is correctly specified.

- **Structural Stability Test for Model Parameters (CUSUM and CUSUM of Squares):**

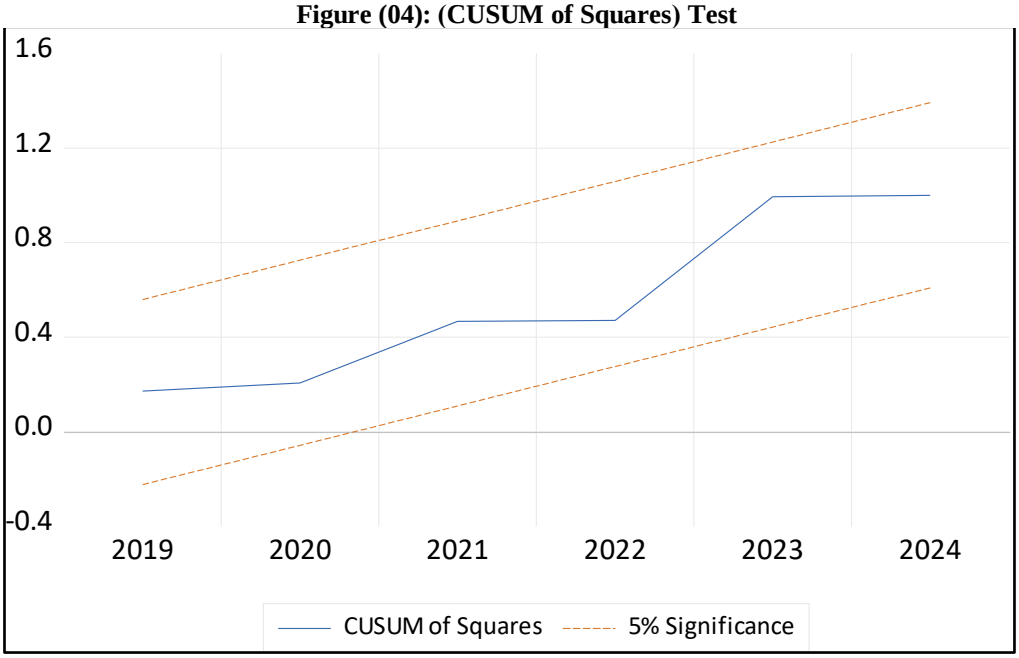
The model is observed to be stable, as the plots for both the CUSUM test and the CUSUM of Squares test remain within the critical bounds at the 0.05 significance level.

Figure (03) : CUSUM Test



Source: EViews 12 program outputs.

Figure (04): (CUSUM of Squares) Test



Source: EViews 12 program outputs.

Discussion of Results

In examining the effect of digitalization on food availability, the variable of mobile cellular subscriptions (MCS) stands out as an indicator of the spread of digital communication services. These services can improve the flow of information within the food system, make it easier for farmers to obtain information on prices, weather conditions, and markets, and strengthen coordination among producers, distributors, and consumers. Such mechanisms may enhance the efficiency of food supply chains and reduce some of the imbalances associated with food distribution.

The long run results show that mobile cellular subscriptions (MCS) have a positive and statistically significant effect on dietary energy supply (DES) in Jordan, with a coefficient of 0.0558 ($p = 0.0370$). That is, a one unit increase in mobile phone penetration is associated with a 0.0558 unit increase in dietary energy supply, holding other factors constant. This is consistent with the mechanisms through which digital communication operates: it improves information flows within the food system, helps farmers obtain information on prices, weather, and markets, and strengthens coordination among producers, distributors, and consumers, thereby raising supply chain efficiency and reducing food loss. In the short run, the effect of MCS is positive and significant in the current period and at all three lags, rising from 0.0571 to 0.1137, which suggests that the effect of digitalization accumulates over time.

Agriculture value added (AGVA) has a positive and significant long run effect (coefficient = 0.1133, $p = 0.0425$), confirming that the agricultural sector remains one of the main sources of domestic food supply and that improvements in its performance, through modern technologies and better management of water resources and farm inputs, translate into greater food availability. In the short run, the effect is insignificant in the current period but negative and significant at the third lag (-0.0838), which may reflect the sensitivity of agricultural output to climatic fluctuations and to adjustment and investment costs in the short term. This explanation requires further verification.

Food imports (FIMPO) have no significant long run effect, with a coefficient of 0.0575 and a p value of 0.0642, which exceeds 5%. There is therefore insufficient statistical evidence that the share of food imports affects dietary energy

supply in the long run. A plausible explanation is that Jordan, despite its reliance on external markets, uses imports to compensate for shortfalls in domestic production, so the import share alone does not determine the level of food availability. In the short run, the effect is negative and significant in the current period (-0.1545) and at the first and third lags, which may be linked to periods of high global prices and supply chain disruptions. This is a possible explanation rather than an established finding.

Finally, the error correction term is negative and significant (-0.657, p = 0.0005), indicating that about 65.7% of the deviation from long run equilibrium is corrected each year and that returning to equilibrium takes roughly one and a half years. Taken together, these results support a role for digitalization in improving food availability in Jordan, while distinguishing between statistical associations and causal effects.

Food imports (FIMPO), expressed as a percentage, represent one of the channels through which domestic demand for food can be met when local production is insufficient. Digitalization can help improve the management of food trade, provide information on prices and demand, and increase the efficiency of import and distribution operations. However, heavy dependence on imports may expose food availability to volatility in global markets and to supply chain disruptions. The effect of this variable should therefore be assessed in light of the econometric estimation results and the nature of the indicator used.

Accordingly, analyzing the relationships among these variables makes it possible to examine the potential channels through which digitalization may affect food availability, whether by improving information flows and supply chain efficiency or by supporting agricultural production and the management of food imports. Determining the actual effect of digitalization and its direction, however, requires relying on the coefficients of the econometric model and their p-values, while distinguishing between statistical associations and causal effects.

Conclusion

This study examined the effect of digitalization, proxied by mobile cellular subscriptions, on food availability in Jordan, measured by dietary energy supply, over the period 2001 to 2024 using the ARDL model. The results show a positive and significant long run effect of digitalization, as well as of agriculture value added, while food imports have no significant effect. The error correction term is negative and significant, indicating that the Jordanian economy returns to its equilibrium path in about one and a half years after a deviation.

Given that Jordan faces scarce water resources and limited agricultural land and relies on external markets for its food, digitalization can serve as a supporting tool by improving information flows and supply chain efficiency. The study recommends expanding communication infrastructure in agricultural areas, developing digital services that provide farmers with information on prices, weather, and markets, and strengthening domestic agricultural production. Future research could use additional digitalization indicators such as internet use, and longer samples to strengthen the robustness of the estimates.

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