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Review Article

Forecasting the Added Value Generated by the Agricultural Sector in Algeria (1999-2021) Box-Jenkins Methodology

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Abstract

This study aims to predict the added value resulting from the agricultural sector in Algeria during the period between 2022-2026, and to achieve the goal, we shed light on the most prominent agricultural stations in Algeria, in addition to the relationship of the sector with the most important macro variables. By weighting, the model (0.1.4) is the most prominent for the forecasting process. As for the results obtained, the agricultural sector in Algeria will grow by 33.26% over the period 2026-2022.

Keywords: Agricultural Sector; Box-Jenkins; Gross Domestic Product; Forecast

Introduction

The agricultural sector is considered a crucial sector in most countries worldwide, as it plays a significant role in economic development. In Algeria, agriculture is a strategic sector that contributes significantly to the country's economic growth and is responsible for about 11% of the GDP [1]. It is a source of employment and income for about 27% of the population, particularly in rural areas. The Algerian government has implemented several policies and regulations aimed at enhancing the agricultural sector's productivity, such as land reform, irrigation, and modernization of agricultural techniques. The government has also invested heavily in the development of agricultural infrastructure and support services [2]. Despite these efforts, the sector has faced various challenges, such as climate change, drought, limited access to financing, and inefficient use of resources, which have hindered its growth and development [3].

Therefore, forecasting the added value generated by the agricultural sector in Algeria is essential to provide policymakers with insights on the sector's future prospects and to identify areas where improvements can be made. In this regard, the Box-Jenkins methodology can be utilized to forecast the agricultural sector's added value in Algeria for the period between 1999 and 2021. This methodology is widely used in time series analysis and forecasting, and it has been successfully applied in various economic sectors, including agriculture [4].

In conclusion, this paper aims to utilize the Box-Jenkins methodology to forecast the added value generated by the agricultural sector in Algeria between 1999 and 2021. This study is expected to contribute to the literature on agricultural sector forecasting and provide valuable insights into the sector's future prospects. Furthermore, the study's findings will be useful for policymakers and stakeholders in designing policies and strategies aimed at enhancing the agricultural sector's productivity and promoting economic growth.

In this context, we raise the following question: Will this type of attention to the agricultural sector achieve added value in the future?

Hypothesis: Based on the experience of several countries, the measures taken by the government towards this sector will positively contribute to the growth of the national economy.

The development of the agricultural sector in Algeria:

The agricultural sector in Algeria has gone through several stages since independence:

Self-management phase:

After Algeria gained independence, the government took over the abandoned farms and introduced a new model of agricultural management known as self-management. This approach involved granting the farms to the workers who would manage them collectively. The self-management approach was viewed as a revolutionary idea that would promote collective ownership and control of resources, as opposed to the capitalist model of individual ownership.

The concept of self-management was not new in Algeria, as it had been practiced in the pre-colonial era, where communities managed their resources collectively. The government's adoption of this model was seen as a way of returning power to the people and reducing the influence of foreign capitalists who had exploited the country's resources during the colonial era.

The self-management approach was not without its challenges. The government faced resistance from the former landowners who were unhappy about losing their land, and from workers who were not accustomed to the collective management approach. The government also struggled to provide the necessary infrastructure and resources to support the self-managed farms.

Despite these challenges, the self-management model was successful in some areas, particularly in the production of grains and livestock. The collective approach to managing resources promoted a sense of community and cooperation among the workers, which helped to increase productivity. However, the model was less successful in other areas, such as the production of fruits and vegetables, where individual expertise and knowledge were crucial.

In conclusion, the self-management model introduced by the Algerian government after independence was a significant departure from the capitalist model of individual ownership. While the approach faced several challenges, it promoted collective ownership and control of resources, which helped to increase productivity in some areas. The legacy of self-management in Algeria continues to influence agricultural practices in the country to this day.

The Agricultural Revolution, also known as the Agrarian Reform, was a significant phase in the history of Algerian agriculture. Before this phase, the majority of the land was owned by large landowners who often neglected the land and sometimes rented it out, relying on the hard work of the laborers. On the other hand, small farmers owned less than 10% of the total land, which was highly inequitable. In response to this, President Houari Boumediene implemented the Agrarian Reform law in 1971 under the slogan "land for those who serve it, and no one has the right to own the land except those who make it fruitful or invest in it."

The aim of this reform was to eliminate favoritism and promote equitable distribution in the agricultural sector. However, the state's failure to provide aid to farmers and to monitor the implementation of the agricultural policy was one of the primary reasons for the reform's failure. Additionally, the lack of proper infrastructure and investment in the agricultural sector further hindered its success.

According to research conducted by Salah-Eddine Ould-Ahmed in his article "Algeria's Agrarian Reform: A Critical Assessment," the Agrarian Reform did bring about some positive changes, such as the redistribution of land to small farmers and the introduction of collective farming methods. However, Ould-Ahmed also notes that the lack of technical assistance and training for the farmers and the absence of a clear legal framework led to the failure of the reform.

The Agricultural Revolution phase was a major turning point in the history of agriculture in Algeria. Before this phase, the majority of agricultural lands were owned by large landowners who often rented out the land and relied on the labor of farm workers. Small farmers owned less than 10% of the total land. This led President Houari Boumediene to pass the Agricultural Revolution law in 1971, which aimed to eliminate nepotism and establish fair distribution of agricultural land based on productivity and investment.

According to Boumediene, the Agricultural Revolution aimed to improve agricultural productivity by promoting efficient land use and increasing investment in agriculture. The law stipulated that only those who could cultivate or invest in the land would have the right to own it. This would help to redistribute land ownership and provide small farmers with the opportunity to increase their land holdings and productivity.

However, despite the initial success of the Agricultural Revolution, the policy ultimately failed due to the government's failure to provide support and assistance to farmers, as well as a lack of follow-up and monitoring of the implementation of the agricultural policy. This led to a decline in agricultural production and a return to large land ownership by a few elite individuals.

Several scholars have written about the Agricultural Revolution and its impact on Algerian agriculture. For example, according to F. P. McDowell, the Agricultural Revolution "reversed the traditional land distribution pattern by redistributing land to those who could use it most efficiently" [5]. Similarly, in her study of Algerian agriculture, Tassadit Yacine notes that the Agricultural Revolution "sought to increase agricultural production by encouraging investment and efficient land use." (Yacine,1993).

The Land Reclamation Law of Algeria gave a unique advantage in that the ownership of land was given to those who worked it, meaning that ownership was linked to cultivation. This law was introduced to encourage farmers to reclaim land. According to Abdelrazak (2010) [6], the purpose of this law was to eliminate nepotism and create a fair distribution of land. It aimed to make land ownership dependent on its cultivation, rather than on social connections or economic power. However, like the agricultural revolution, the success of this law was limited by the government's failure to provide assistance to farmers and to enforce the agricultural policies effectively. The lack of support and follow-up on the implementation of this policy was one of the main reasons for its failure.

Law 87-19, also known as the Agricultural Investments Law, was enacted in Algeria on December 8th, 1987. The law aimed to encourage agricultural development and diversification by granting beneficiaries the right to permanent and transferable use, as well as the ability to sell, reserve or lease agricultural land. The law was enacted in response to the energy crisis of 1986, which had a significant impact on Algeria's economy and highlighted the need to diversify economic activities. The Agricultural Investments Law aimed to create a favorable investment climate for the agricultural sector and stimulate private investment in agriculture. By providing a legal framework for agricultural investment, the law aimed to attract national and international investors to support the development of Algeria's agricultural sector.

During the 1990s, Algeria adopted market-oriented economic policies, which necessitated the restructuring of the agricultural sector to align it with the new economic system. As a result, the state reclaimed around 445,000 hectares of farmland during that period, and in response to the negative impact of lifting support for farmers, the state changed its policy towards providing direct support and increasing loans to farmers through the establishment of specialized funds, while also cancelling taxes imposed on farmers [7].

The policy of agricultural development during the 1990s aimed to improve agricultural productivity and promote rural development. The state implemented several measures to achieve these objectives, such as increasing investments in the agricultural sector, improving irrigation infrastructure, and promoting modern farming techniques. Additionally, the state provided support for farmers in the form of subsidies, technical assistance, and credit facilities to enhance their competitiveness and increase their income. The state also established programs to develop rural areas, such as building infrastructure, providing social services, and promoting small and medium enterprises (Benmamar, 2007).

The National Plan for Rural Development (PNDR)

Was launched by the Algerian government in 2000, with the aim of completing the previous stages of rural development policies. This plan focuses on building a modern and efficient agricultural sector through a specialized mechanism that aims to upgrade technical, financial, and regulatory frameworks. The main objective of PNDR is to promote sustainable development through the preservation, protection, and rational use of natural resources, such as land and water, as well as through land reclamation and better utilization of existing capabilities. This plan also seeks to enhance the living conditions of rural populations by improving infrastructure, promoting employment, and providing better access to social services. The PNDR has been implemented in several phases and has led to significant improvements in rural development in Algeria. (Jabbar, 2018).

The Agricultural Renewal and Rural Development Policy of the Five-Year Plan (2010-2014) aimed at achieving national food security while transforming agriculture into a driver of overall economic growth. This approach is among the methods to change the infrastructure in the medium term, ensuring food security in partnership with the public and private sectors, and involving all stakeholders in the development process. It also emphasizes the emergence of new governance for agriculture and rural areas.

The policy aimed to address the challenges of food security in Algeria by modernizing the agricultural sector and increasing productivity through sustainable use of natural resources such as land and water. It also focused on improving the quality of products and increasing their competitiveness through technology transfer, research and development, and market orientation.

Furthermore, the policy aimed at empowering small-scale farmers and improving their living conditions by providing them with access to credit and technical assistance. It also aimed at promoting local development and reducing regional disparities by creating jobs and income-generating activities in rural areas.

The Agricultural Renewal and Rural Development Policy of the Five-Year Plan (2010-2014) was part of Algeria's efforts to achieve sustainable development and reduce poverty in rural areas. The policy was implemented through a range of measures, including the creation of specialized funds, the provision of subsidies and tax exemptions, and the establishment of partnerships between the public and private sectors.

The reality of the agricultural sector in the national economy:

The agricultural sector holds a significant position in the Algerian economy due to its diverse economic resources. Algerian agricultural policies have consistently focused on optimizing the utilization of these resources. As a result, this sector has contributed to the gross domestic product (GDP) and generated extensive employment opportunities, particularly in rural areas, while providing foreign currency, which in turn boosts the manufacturing sector and capital formation (Benhassine & Brunschwig, 2021).

The agricultural sector and the gross domestic product:

1999	2000	2001	2002	2003	2004
%11,11	%8,40	%9,75	%9,22	%9,81	%9,44
2005	**2006**	**2007**	**2008**	**2009**	**2010**
%7,69	%7,54	%7,57	%6,59	%9,34	%8,47
2011	**2012**	**2013**	**2014**	**2015**	**2016**
%8,11	%8,77	%9,85	%10,29	%11,58	%12,22
2017	**2018**	**2019**	**2020**	**2021**	
%11,76	%11,87	%12,34	%14,13	%13,03	

Table 1: Percentage of the agricultural sector's output of Algeria's GDP, 1999-2021.

Source: World Bank

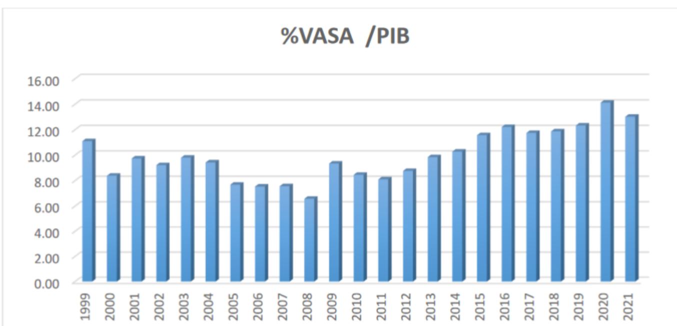


Figure 1: Shows the share of the agricultural sector's output of the GDP in Algeria from 1999-2021.

Source: prepared by the researchers using Excel

The production levels of the agricultural sector reflect the true picture of the agricultural sector. As the agricultural sector is one of the country's economic sectors, it undoubtedly contributes to the gross domestic product (GDP). The agricultural GDP has witnessed significant growth, particularly during the period from 1999-2021. It increased from DZD 359 billion in 1999, representing 11.11% of the GDP, to DZD 2869 billion in 2021, representing 12.03% of the GDP. The average agricultural GDP over the study period was DZD 1303 billion, or 8.04% of the GDP, while the standard deviation was DZD 841 billion, or 7.61% of the GDP, with a coefficient of variation of 64.03%.

The Agricultural Sector and Employment

The agricultural sector is a crucial component of the Algerian economy, contributing significantly to the Gross Domestic Product (GDP) and creating job opportunities, particularly in rural areas (Bougherara & Larue, 2018). However, the workforce in agriculture is heavily dependent on government policies and market conditions. In Algeria, the agricultural labor force is high in coastal and semi-arid regions, accounting for 32.34% and 29.15% of the total workforce, respectively. The mountainous and southern regions have a lower percentage of agricultural labor force at 21.38% and 17.21%, respectively (Office National des Statistiques, 2019).

This pattern is attributed to the concentration of agricultural activities in the northern regions of the country, where larger-scale agricultural projects have been implemented (Jabar, 2018). Despite efforts to develop massive agricultural projects in southern Algeria through government-led development programs, the impact on the labor force in these regions has been limited (Jabar, 2018).

In addition to government policies, the labor force in agriculture is also influenced by market forces and technological advancements. For example, the introduction of modern farming technologies and machinery has decreased the demand for manual labor in agriculture (Bougherara & Larue, 2018). This has led to a shift in the type of labor demanded in the agricultural sector, from manual labor to skilled labor that can operate and maintain modern farming equipment (Bougherara & Larue, 2018).

The agricultural sector and the trade balance:

The Algerian agricultural sector holds significant importance in the country's trade balance, as it provides a source of hard currency by reducing the import bill. Moreover, it serves as the primary source for most industries, which are major drains on the country's hard currency reserves. The Algerian government is betting on increasing exports of agricultural products to reach a value of $4 billion in non-hydrocarbon exports and opening new international markets for domestic agricultural products, in an effort to support and diversify the economy and achieve food security. During the first quarter of 2021, the country was able to export 50,000 tons of agricultural products, while the sector's exports exceeded 100,000 tons of vegetables and fruits in the previous year, despite the COVID-19 pandemic that forced several sectors to close.

The agricultural sector's contribution to the trade balance in Algeria has been highlighted in several academic studies. For instance, a study by Boumghar and Senouci (2017) [8] analyzed the impact of agricultural exports on the trade balance, and found that agricultural exports have a significant and positive effect on the trade balance. Moreover, the study found that agricultural exports have a more significant impact on the trade balance than oil exports. Another study by Chelouah et al. (2018) [9] emphasized the importance of increasing the competitiveness of the agricultural sector in order to enhance the trade balance and promote economic development.

Predicting the value added of the agricultural sector using the Box-Jenkins methodology

In this axis, we will address the prediction of the value added resulting from the agricultural sector in Algeria for the period between 1999-2026. To achieve this purpose, we relied on the Box-Jenkins methodology, where the variable for the study series is represented as follows:

VA_{SA} stands for "Value Added from the Agricultural Sector". It refers to the additional economic value generated by the agricultural sector.

The identification (diagnosis) stage of the value-added chain of the agricultural sector, based on local current prices for the period 1999-2021 in Algeria

The descriptive study of the value-added series for the agricultural sector (VASA)

Year	Added value in the agricultural sector (in current prices of local currency) / Vasa	Logarithm of value added in the agricultural sector (in current local currency prices) / Lvasa
1999	359 666	11,55,590
2000	346 171	11,53,929
2001	412 119	11,61,502
2002	417 225	11,62,037
2003	515 282	11,71,204
2004	580 506	11,76,381
2005	581 616	11,76,464
2006	641 285	11,80,705
2007	708 072	11,85,008
2008	727 413	11,86,178
2009	931 349	11,96,911
2010	1015259	12,00,658
2011	1 183 216	12,07,306
2012	1 421 693	12,15,281
2013	1 640 006	12,21,485
2014	1 772 202	12,24,851
2015	1 935 113	12,28,671
2016	2 140 305	12,33,048
2017	2 219 065	12,34,617
2018	2 421 568	12,38,410
2019	2 529 054	12,40,296
2020	2 598 512	12,41,472
2021	2 869 600	12,45,782

Table 2: The logarithm of the added value of the agricultural sector in Algeria 1999-2021. Unit: 10^6.

Source: World Bank

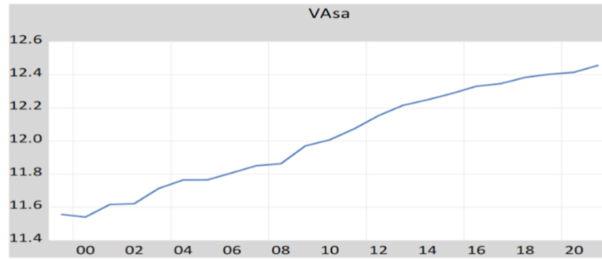


Figure 2: The graphic curve of the logarithm series of value added for the agricultural sector in Algeria 1999-2021.

SOURCE: Prepared by the researchers using the Eviews program.

The data used represents the logarithmic series of the value added of the agricultural sector in Algeria from 1999 to 2021, comprising 23 observations. The reason for using logarithms was to avoid standard errors. As shown in the figure above (02), the value added by the agricultural sector exhibited a noticeable development over the study period. The highest value was recorded in 2021 at 2,869,600,000,000 DZD, while the lowest value was 346,171,000,000 DZD in 2000. The arithmetic mean of the values over the study period was 1,302,882,478,261 DZD, and the standard deviation was 841,523,395,241 DZD, indicating a high degree of heterogeneity in the series' levels.

The time series stability test

Box and Jenkins have stipulated in their method that a time series is considered stable if its average and variation remain constant over time. In other words, a stable time series does not have a trend. There are several tests to determine whether a time series is stable or not. In our study, we adopt the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. A time series that contains a unit root is considered unstable.

Hypotheses:

$H_0 : Ø_1 = 1$

$H_1 : Ø_1 < 1$

If the p-value is greater than the significance level (usually 0.05), we accept the null hypothesis that the time series contains a unit root.

If the p-value is less than or equal to the significance level, we reject the null hypothesis and accept the alternative hypothesis that the time series does not contain a unit root.

The Phillips-Perron (PP)			The Augmented Dickey-Fuller (ADF)				variants
Without constant and time	constant and time	تباثلا	Without constant and time	constant and time	Constant		
7.097	-2	-0	6.2	-2	-0	Calculated	LVA_{sa}
-1.96	-3.6	-3	-2	-4	-3	critical	

variants		The Phillips-Perron (PP)			The Augmented Dickey-Fuller (ADF)		
		Without constant and time	constant and time	تباثلا	Without constant and time	constant and time	Constant
LVA_{sa}	calculated	7.1	-2	-0.4	6	-2	-0.4
	critical	-2	-4	-3	-2	-4	-3

Table 3: ADF and PP tests for stability.

Through table (3), which relates to the stability test of the series, by comparing the calculated values with the critical values at a significance level of 5%, and by relying on two tests, the augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP), we accept the null hypothesis (H0), which states that the series contains a unit root originally, meaning it is originally unstable.

Removing Non-stationarity of the Original Time Series

After taking first differences of the original time series, denoted as, we obtain a first-differenced time series represented in the following graph:

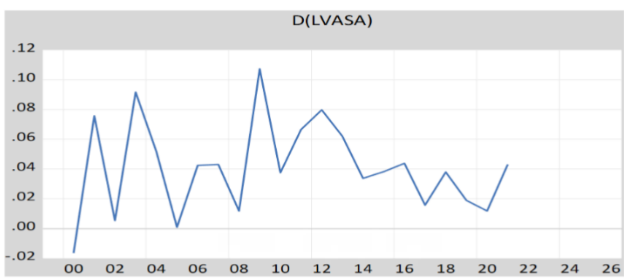


Figure 3: Curve for the series oscillates around the value of zero, which indicates that the series is stable.

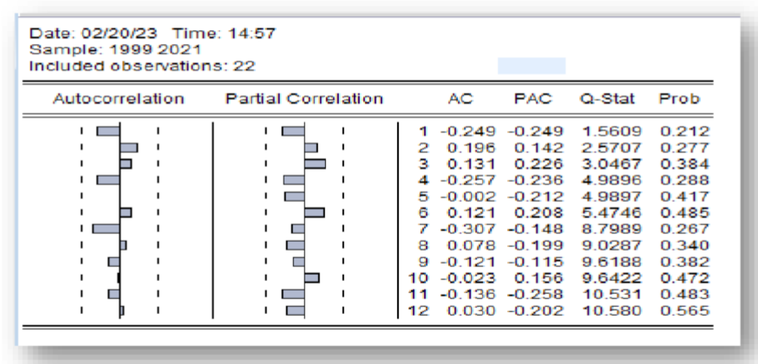
Source: Prepared by the researchers using the Eviews program.

From the above figure, we observe that the curve for the series oscillates around the value of zero, which indicates that the series is stable.

Based on the obtained result, we can conclude that the studied series tends towards a specific model, which is the "ARIMA" model.

Autocorrelation (ACF) and Partial Autocorrelation (PACF) Test for the Series

Autocorrelation and partial autocorrelation tests are considered to be the most difficult and important stages in building a time series model. After identifying the type of model through the stability of the series in the first difference, in this stage, the type and order of the model are identified through the autocorrelation and partial autocorrelation functions to determine whether the model is AR (p), MA (q) ARIMA (p,d,q) That is, specifying each of p, q.



Date: 02/20/23 Time: 14:57
Sample: 1999 2021
Included observations: 22

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.249	-0.249	1.5609	0.212
		2	0.196	0.142	2.5707	0.277
		3	0.131	0.226	3.0467	0.384
		4	-0.257	-0.236	4.9896	0.288
		5	-0.002	-0.212	4.9897	0.417
		6	0.121	0.208	5.4746	0.485
		7	-0.307	-0.148	8.7989	0.267
		8	0.078	-0.199	9.0287	0.340
		9	-0.121	-0.115	9.6188	0.382
		10	-0.023	0.156	9.6422	0.472
		11	-0.136	-0.258	10.531	0.483
		12	0.030	-0.202	10.580	0.565

Figure 4: Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) of a time series.

Source: Prepared by the researchers using the Eviews program.

From figure (4) above, which represents the autocorrelation and partial autocorrelation functions of the time series, we can observe that the correlation coefficients are statistically equal to zero.

However, we have:

ARIMA (0,1,4), ARIMA (0,1,2), ARIMA (0,1,3), ARIMA (2,1,2), ARIMA (1,1,0), ARIMA (0,1,1), ARIMA (1,1,4), ARIMA (1,1,2), ARIMA (2,1,3), ARIMA (3,1,2), ARIMA (2,1,0), ARIMA (1,1,1), ARIMA (3,1,0), ARIMA (2,1,4), ARIMA (4,1,1), ARIMA (4,1,0), ARIMA (2,1,1), ARIMA (4,1,3)

Criteria for comparison between the proposed models

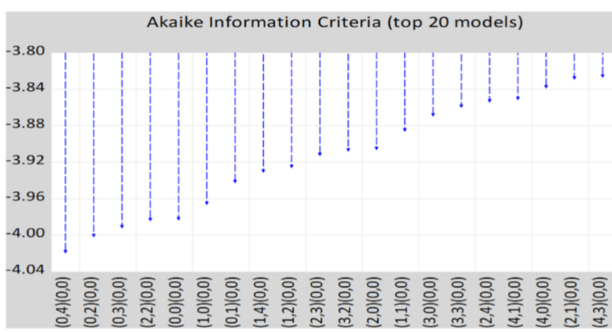


Figure 5: The proposed ARIMA models curve.

Source: Prepared by the researchers using the Eviews program.

Through the above figure (5), it is evident that the best model according to the mentioned criteria is ARIMA (0,1,4) as it has the highest value of the determination coefficient. As for the two criteria, they are relatively close, and this optimal model represents the added value resulting from the agricultural sector in Algeria. Based on this, we can formulate the model as follows:

$LVA_{sa} = C + MA\ (1) + MA\ (2) + MA\ (3) + MA\ (4)$

Estimation Stage

In this stage, we estimate the parameters of the model after identifying it through trial and the subsequent summary table summarizes the estimation results:

Coefficient covariance computed using outer product of gradients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.043893	0.002842	15.44343	0
MA(1)	-0.35863	327.4512	-0.0011	0.9991
MA(2)	0.392711	173.7106	0.002261	0.9982
MA(3)	-0.44691	763.581	-0.00059	0.9995
MA(4)	-0.5842	1464.348	-0.0004	0.9997
SIGMASQ	0.000468	0.389882	0.001201	0.9991
R-squared	0.485637	Mean dependent var		0.040996
Adjusted R-squared	0.324899	S.D. dependent var		0.030885
S.E. of regression	0.025377	Akaike info criterion		-4.01793
Sum squared resid	0.010304	Schwarz criterion		-3.72038
Log likelihood	50.19726	Hannan-Quinn criter.		-3.94784
F-statistic	3.021287	Durbin-Watson stat		1.779383
Prob(F-statistic)	0.041562			
Inverted MA Roots	1	-.03+1.00i	-.03-1.00i	-0.58

Table 4: Results of the estimated model ARIMA (0,1,4).

Based on the results presented in the table above, we can formulate the estimated model as follows:

D (VASA) = 0.0438926212238 - 0.358631789899 MA (1) + 0.39271134122 MA (2) - 0.446914082876 MA (3) - 0.584197774447 MA (4)

Model Diagnosis Stage

In this stage, we attempt to test the adequacy of the selected model, to ensure that the model is suitable for forecasting, by testing the model's characteristics and testing the stationarity of the residual series, as well as testing for normal distribution.

Comparing the original and estimated time series

Figure 6: A comparison curve between the original and estimated time series.

Source: Prepared by the researchers using the Eviews program.

The figure (6) reflects the comparison between the original and the fitted series, and it shows a kind of matching in some years between the actual and the fitted series. As for the residual curve, it wraps randomly around the horizontal axis, which indicates the absence of autocorrelation in the residuals.

Polynomial root

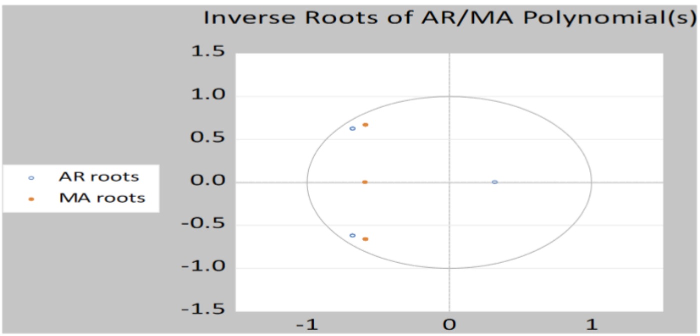


Figure 7: the root of polynomial characteristic ARIMA (0,1,4) model.

Source: Prepared by the researchers using the Eviews program.

From Figure 7 above, we observe that the Mahalanobis distance of the ARIMA (0,1,4) model falls within the unit circle, indicating the stability of the ARIMA (0,1,4) series.

What we notice from Figure 7 above is that the limit boundary polynomial of the ARIMA (0,1,4) model falls within the unit circle, indicating the stability of the ARIMA(0,1,4) process.

Testing the stability of the series of squared residuals

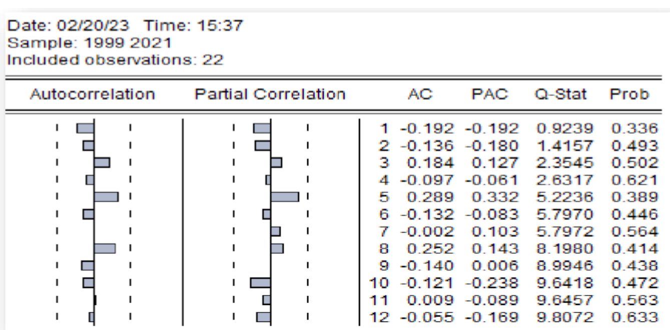


Figure 8: Autocorrelation and partial functions of the series of squared residuals.

Source: Prepared by the researchers using the Eviews program.

Figure 8 represents the autocorrelation and partial functions of the series of squares of residuals calculated for 12 lag variables. The figure indicates that the series of residuals is stable, as most of the autocorrelation coefficients fall within the confidence interval [-1.96/√T , +1.96/√T, and the probability ratio prob (0.633) is much greater than α = 0.05, indicating that the assumption of homogeneity of conditional variances is acceptable.

Normality test of residuals distribution

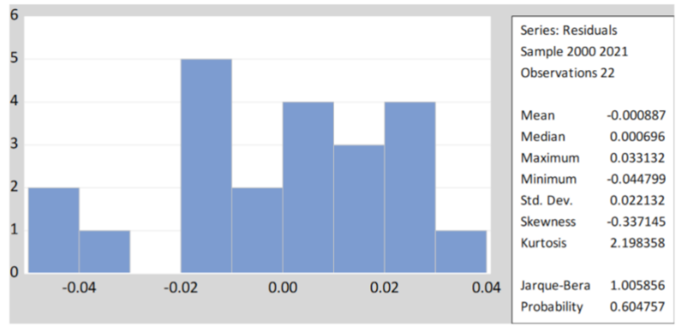


Figure 9: Normal distribution curve of the residuals series.

Source: Prepared by the researchers using the Eviews program.

From Figure 9 above, we observe that the estimated residuals series has a normal distribution. This is supported by the value of Prob (0.604), which is greater than α = 0.05, indicating that the null hypothesis of normality of the residuals is not rejected. Furthermore, the kurtosis value being less than 3 reinforces this. Additionally, the Jarque-Bera statistic value is much lower than the chi-square value, which further confirms the normality of the residuals distribution.

Test for Independence of Observations (BDS test)

BDS Test for VASA				
Date: 02/20/23 Time: 15:18				
Sample: 1999 2021				
Included observations: 23				
Dimension	**BDS Statistic**	**Std. Error**	**z-Statistic**	**Prob.**
2	0.184273	0.008932	20.63046	0
3	0.3085	0.014552	21.20008	0
4	0.389656	0.017772	21.92527	0
5	0.441352	0.019016	23.20979	0
6	0.481318	0.018848	25.53657	0

Table 5: Results of the BDS test for independence of observations.

Source: Prepared by the researchers using the Eviews program.

We can observe from the table (5) above that the BDS statistic is greater than the critical value of the normal distribution at a 5% significance level,so 1.96 for each lag m=6. Therefore, we reject the hypothesis of the independence of the random walk of the observations, indicating the presence of linear or non-linear correlation structure among the observations. This is also confirmed by the p-values, which are all less than 0.05. Hence, it can be said that the added value of the agricultural sector in Algeria is predictable in the short term.

Theil test

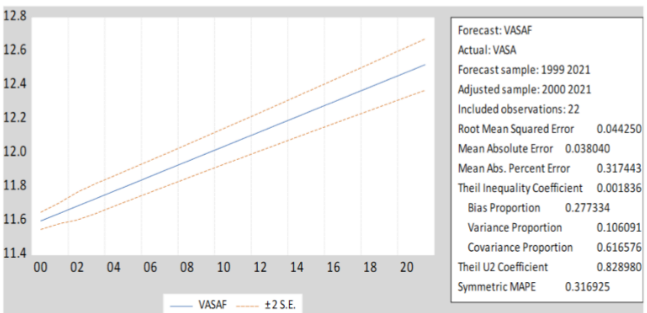


Figure 10: Coefficient of tail inequality.

Source: Prepared by the researchers using the Eviews program.

Based on the above Figure 10, we can observe that the value of the Tail coefficient is less than one and closest to zero. Therefore, we can say that the model has good predictive ability.

Prediction Phase

After identifying the appropriate model for prediction, we now proceed to predict the value of the added value generated by the agricultural sector in Algeria in the short term, for a period of five years until the end of 2026.

year	Added value to the agricultural sector (Vasa)
2022	3 676 377
2023	4 067 429
2024	4 499 740
2025	4 978 517
2026	5 508 077

Table 6: the predicted value of the added value of the agricultural sector in Algeria for the years 1999-2026, Unit/local currency: 10^6.

Source: Prepared by the researchers using the Eviews program.

Results Analysis

The prediction of the added value of the agricultural sector in Algeria for the period from 2022 to 2026 reflected results with the highest value of 5508077000000 billion Algerian dinars in 2023, and the lowest value of 3676377000000 billion Algerian dinars in 2022, i.e., a gap of 1831700000000 billion Algerian dinars. Compared to the original series gap, which was 2523429000000 billion Algerian dinars, the difference was 691729000000 billion Algerian dinars, indicating a semi-stability in the reform program. In order for the latest value to tend towards zero and for stability to remain, agricultural reform programs need to be developed.

Hypothesis testing

Regarding the hypothesis that extrapolating on a similar experience for several countries, the measures taken by the government towards this sector will result in positive growth that contributes to supporting the national economic growth, we found it to be true based on the results of the forecast. We noticed an increase in the value of the forecasted value added for the agricultural sector for the period between 2022-2026, from 3,770,000,000,676 DZD to 5,507,000,000,507 DZD, an increase of 33.26% over the forecast period. This can be attributed to the continuation of agricultural reforms and the stimulating environment for development pursued by the government, which is still insufficient. To continue the growth of this sector, the government should:

- Exploiting arable lands and expanding them through reclaiming lands in highlands and southern areas.

- Relying on research and development for agricultural products and focusing on modern technical aspects in the production process.

- Adopting modern irrigation technology to combat the problem of drought, which is considered a problem for the national economy.

- Expanding support to genuine farmers and avoiding opportunists.

- Deepening reforms related to agricultural land problems.

- Focusing on monitoring agricultural investments that have been established.

- Avoiding urban expansion on agricultural lands or lands suitable for reclamation.

Conclusion

Prediction plays an important and effective role in drawing future programs, requiring great attention from officials as it is a futuristic idea that is required by the relevant parties in light of changes and transformations. In this research paper, we conducted a predictive study of the value added from the agriculture sector in Algeria, specifically for the period between 2022 and 2026, and by relying on the EViews program, we identified suitable models after removing some of their instability and making them suitable for prediction, as we tested them. This study remains a reference for those who wish to continue studying this subject or a similar topic.

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