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Research Article

Analysis of the Economic Dynamics of the Territory and Their Links with the Infrastructures of Opening Up in Algeria

Djamal Dahmane[1], Komi Apédo Atchemdi[2]
[1] *Doctoral student, Laboratory of Exploitation and Valorization of steppe Ecosystem (EVSE), Faculty of Natural and Life Sciences, University of Djelfa-P.O. Box 3117.Djelfa 17000. Algeria*
[2] *Professor, Agricultural Economics/Capacity Building Consultant. Faculty of Natural and Life Sciences, University of Djelfa P.O. Box 3117.Djelfa 17000.-Algeria. Email: a.aboubkomi@univ-djelfa.dz*
Corresponding author: d.dahmane@univ-djelfa.dz

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ABSTRACT

In a context in which the openness of rural areas is at the heart of development concerns in Algeria, the municipality of Ksar Chellala benefited from this interest by building infrastructure to combat its isolation, which resulted in economic and social problems represented by the spread of unemployment, poverty, and migration from the countryside to the cities to search for job opportunities. It is interesting to measure the impact of these projects on economic dynamism and enhancing access infrastructure (building roads, connecting to electric power and communications). The study we propose addresses this issue and highlights the importance of openness and justifies the importance of investing in infrastructure to achieve sustainable economic development. The study relied on building a predictive model that uses annual agricultural production covering the period between 2000-2020. Using the double exponential smoothing method or Holt method to track the development of agricultural production until 2030, The study revealed that breaking isolation and renewing the region by developing and establishing infrastructure projects for openness has a close relationship with creating economic dynamism related to agricultural production, and that the processes of openness are considered a fundamental point that must be taken into account to achieve future development.

Keywords: Opening up, Impact measurement, Sustainable development, Economic dynamics, Algeria.

1. INTRODUCTION

International organizations tend to establish positive impacts of infrastructure on growth and consider that infrastructure is effective in achieving economic reforms and contribute to the achievement of sustainable development goals (Sawada, 2015; Sari-Selka, 2018; Sheriff et al., 2021; Du et al, 2022; Foster et al., 2023). Algeria has chosen rural development policy as one of the priorities of its development plans, and this is evident Algeria's development strategy underwent a new orientation during the period 1999 and 2019, characterized by a focus on the implementation of infrastructure projects (Racham & Kaschi 2022; Mouloud & Lalali, 2022) due to the increase in revenues from hydrocarbon exports due to the sharp rise in world prices, the availability and flow of oil revenues allowed the implementation economic infrastructure (Atchemdi, 2008; Nshue, 2014; Hasni & Azzaoui, 2022) which made the issue of openness a priority in development programs. Therefore, local authorities implement projects that put the well-being of local communities at the heart of their concerns. Ensure social and economic safety conditions for rural areas and reduce inequality revitalize isolated rural areas to reduce poverty and promote sustainable and balanced development. (Ministry of agriculture and rural development, 2008)

Now, It is currently necessary to know the impact of these projects on economic dynamics. In this context, analyzing the impact of major infrastructure projects and evaluating the effects of infrastructure construction at the economic level becomes an absolute necessity and constitutes a tool for directing development policy in favor of the most deprived and marginalized localities and setting the basic points that must be taken into account for future development expectations. Socio-economic assessment of transport infrastructure is a widely used practice today, at all levels of major project management: some author like Azemenari al,. (1999) and Berion et al. (2007) believe that impact evaluation evaluates the extent to which a program has caused changes in the target audience; it is interested in the net impact of an intervention on households and institutions, attributable solely and exclusively to this

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intervention; thus, impact evaluation consists of evaluating the results and, therefore, development in the short or medium term. Other authors believe that "Impact evaluations can also explore unintended consequences, either positive or negative on the same beneficiaries" (Baker, 2000; cited by Delaru, 2007).

In a context where the opening up of rural areas is at the heart of development challenges in Algeria, it is interesting to measure its economic impact and promote access infrastructure (roads, electrical energy and telecommunications). The study that we propose addresses this issue and highlights the importance of opening-up infrastructure on the dynamics of the economy and to justify the importance of investment in infrastructure to achieve sustainable economic development. The objective of this study is to examine the impact of transport infrastructure on the growth of production in Algeria and examine the existence of a relationship between transport infrastructure and economic growth and know the forecast impact of transport infrastructure on the growth of production. The central question that arises is that of the revitalization of rural areas through the establishment of infrastructure, can they be the engine of long-term economic growth, as economic theory thinks?

To answer our problem, we have put hypotheses on which our study will be based:

Hypothesis 1: This hypothesis consists of assuming that infrastructure has a positive impact on economic development and has a stimulating effect on production growth in the long term.

Hypothesis 2: This hypothesis assumes that transport infrastructure has no effect on economic growth.

The different parts of the article are organized as follows: After the introduction, the second section deals with Study concepts then the topic of the economic theory of development and its relationship with infrastructure operations. The forth section presents the test specifications and analysis of the results, finally the conclusion, which includes a summary of the results.

2. Study concepts

Opening up: The concept of opening up constantly intervenes in the transport economy as well as in geography and territorial planning. Opening up consists of carrying out operations with a view to removing the isolation of a territory, in the sense of encouraging the accomplishment of the activities of economic agents, namely production, transformation, distribution and consumption included in the primary, secondary and tertiary economic sectors. Opening up infrastructure generally includes the construction of roads, the opening and improvement of damaged tracks, the connection of electricity, the evacuation of wastewater, the connection to drinking water and natural gas, etc.

Impact: The concept "impact" is rarely defined in isolation; but it emerges from the literature inherent in several fields, especially economic that it is most often the variation of an indicator chosen to reflect the achievement of the objectives of a program or a project. The word impact can refer to possibly undesired or indirect consequences of the intervention, for example, the effects of agricultural price instability (Ouali et al., 2022; Belkhiri & Atchemdi, 2021; Atchemdi, 2008a). Therefore, we retain the following definition for impact evaluation, which is a component of program evaluation: "Impact evaluation is intended to show whether the program has produced desired effects on communities, households and institutions and whether these actions taken are attributable to the execution of the program.

Economic dynamics: Economic dynamics is expressed through several parameters that can be examined all at once and they are more or less relevant depending on the problem established, the data available and the tools used. This dynamic can be expressed according to the evolution of employment or the overall and sectoral employed population. According to Keita (2004), the dynamics of economic activity leads to the mechanism of transformation of raw materials into processed materials which are desired either for final use or for intermediate use and which are the subject of free and voluntary transactions on the market.

Economic development: Hugen (2004) in Parturel (2007) defines the concept of economic development. "Economic development as a long-term endogenous and cumulative process characterized by progress in productivity and equitable sharing thereof. It has acceptable human and environmental costs and allows a growing number of people to move from a situation of precariousness, vulnerability and insecurity to a situation of greater control over these difficulties and the satisfaction of basic needs. This is only probable through the acquisition of rights, the implementation of organizations and institutions and modes of regulation favoring the management of complex systems.

3. Theories guiding the study

Transport as a growth-stimulating factor finds its origin in the theory classic, ADAM Smith highlighted the

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effective role of roads, bridges and ports in the dynamics of growth in his book Wealth of Nations: Smith preached the obligation to establish infrastructure to break the isolation of places to facilitate the transport of goods (Dahmane & Atchemdi , 2024). The insight of Nicolas (2017) and Nshue (2014) on the role of infrastructures is that the model of neoclassical growth and endogenous growth like that of Barro assimilates infrastructures to public expenditure by introducing them into the production function by considering them as public expenditure, This makes it possible to generate externalities which lead to growth thus making it possible to obtain the optimal size of infrastructures.

Public spending maximizes the growth obtained when the proportion of resources devoted to public investment equalizes its relative contribution to output. Drobinski (2021) admette que le modèle de Barro montre que les dépenses publiques exercent une influence positive sur le taux de croissance de l'économie admits that the Barro model shows that public spending has a positive influence on the growth rate of the economy. The same authors give a second explanation of the Barro model. "There is an optimal size of the State, it is also not a question of spending for the sake of spending beyond a certain level of expenditure and taxes."

4. Methodological procedures for the study

In fact, the double exponential smoothing or Holt method belongs to a set of tools called "exponential smoothing methods" (Djaider, 2022; Ngon, 2022; Goude, 2019). The exponential smoothing method was introduced by Brown in 1962, then generalized by Holt and Winters and used for its simplicity and the quality of its forecasts (Guasmi, 2019).

4.1. Definition of forecasting methods using exponential smoothing

Exponential smoothing methods are empirical methods for forecasting time series (Goude, 2019). The fundamental principle of these calculation methods consists of giving greater importance to the latest observations made. In other words, this consists of giving more importance to the most recent data compared to the oldest. They thus make it possible to calculate forecasts using the past of the variable, or the history. (Ngon, 2022). Since exponential smoothing is an extrapolation method, the study of the forecast is carried out by assuming that the phenomenon only depends on these past values of a time series of N observations (X1, ...X10...Xn) at a horizon h. By the way, the exponential smoothing method includes three variations depending on the objective. Each of the variants depends on one or two exponential smoothing parameters between 0 and 1.

- Simple exponential smoothing: concerns time series characterized by non-seasonality and non-trend;
- Double exponential or Holt smoothing: It is also called (Holt exponential smoothing). It examines time series that are characterized by non-seasonality and exhibit a trend;
- Holt-Winters exponential smoothing: This variant concerns time series with seasonality and which have a trend.

4.1.1. Overview of the chosen double exponential or Holt exponential smoothing method

In this case, the forecast is based on modeling using the double exponential smoothing method over a 10-year horizon. It uses the Eviews software as an extension of other tools previously used for the demonstration including the same agricultural speculations considered as "the most recent data compared to the oldest" (Ngon, 2022). That said, the data represented by the time series of strategic potato and onion production and the third series are formed from the sum of production of the two crops (table 38). The forecasting process follows the following steps:

- **Step 1. Statistical analysis of the time series**

Statistical analysis allows a statistical description of the data series for this purpose, the coefficient of variation indicates the homogeneity of the dispersion of the series. The symmetry of the series can be determined by the position of the mean value relative to the median. The probability provided allows the user to test whether the series follows a normal law as well as the asymmetry coefficient (Skewness) is the kurtosis coefficient (Kirtosis) which informs whether the series follows a normal law or not (Djaider, 2022; Ngon, 2022; Goude, 2019).

- **Step 2. Trend and seasonality test**

The Hodrick-Prescott filter offers the possibility of graphic illustration of the cyclical components and the trend of the series. To do this, it is important to use the quadratic deviation of the square of the difference between the trend values and those observed according to the formulation (Henider, 2020):

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$$\text{Min}\sum_{t=0}^{T}\left(y_t + y^*_t\right)^2 + \lambda \sum_{t=0}^{T-1}\left((y^*_{t+1} - y^*_t) - (y^*_t - y^*_{t-1})\right)^2$$

T: The number of observations;
λ : The smoothing parameter;
y^*_t : Trend production in t.

The smoothing parameter λ takes positive values: 14400 for monthly data: 1600: for seasonal data 100 for annual data.

- **Step 3. Forecast by double exponential or Holt smoothing**

Double exponential or Holt smoothing is a forecasting method that adapts to time series with a trend and without seasonality (Djaidar, 2022). This amounts to performing smoothing on a series on which we have already performed simple exponential smoothing:

$$X_t'' = \alpha X_t' + (1-\alpha)X''_{t-1}$$

The forecast for time t+1 is as a weighted average of:

- The last observation calculated by the double exponential smoothing method X_{t-1}"
- The current value of the series calculated by the simple exponential smoothing method X_t'

The smoothing constant α is between 0 and 1. Using the simple exponential smoothing method we obtain:

$$X_t' = \alpha X_{t-1}' + (1-\alpha)X'_{t-1}$$

This results in the transcription of the formula for the double exponential smoothing method as follows:

$$X_t'' = \alpha X_t' + (1-\alpha)X''_{t-1}$$

For t=1 : $X_t' = \alpha X_0 + (1-\alpha)X'_0$ and $X_1'' = \alpha X_1' + (1-\alpha)X''_0$
X_0 , X'_0, et X'_1 not known, not available
Considering this unknown and its unavailability, we cannot sketch the calculation.
For t=2, we have:
$X_2' = \alpha X_1 + (1-\alpha)X'_1$ and $X''_2 = \alpha X'_2 + (1-\alpha) X''_1$
X'1, et X"1 not known, not available, while X1 known
X'_1, X''_1 not known, not available, while X1 known.

In practice, we begin the calculation from the moment when t=2
For the calculation of X'_2, we pose $X_{1=} X'_1$ and for the calculation of X''_2, we pose $X_{1=} X'_{1=} X''_1$ with :
$a_t = 2X'_t - X''_t$ et $= \alpha/1-\alpha\ (X'_t - X''_t)$
$bt = \frac{\alpha}{1-\alpha}(X_t' - X_t'')$
Finally, the forecast values are given by the following relationship:
$X^p_t = a_t\ b_t$ t=2, n+1 $X^p_{t+h} = a_{n+1}\ b_{n+1}$ x h h=1, 2,..., etc.

At the end of these three successive steps resulting from its principle, the chosen double exponential smoothing or Holt method allows measurements to be made. It effectively leads to calculating first the quantities of onion and potato separately, then the combined volumes of onion and potato (onion–potato) expected in the future as an impact of opening-up operations, all over a period of 10 years (2021 to 2030). In this way, actors can use it to individually make rational decisions.

4.1.2. Choice of parameters for the production forecast study

Algeria belongs to the largest onion producers in Africa according to the ranking in descending order: Egypt, Algeria, Morocco and Nigeria. At the same time, the country is among the top consumers in the world. Annual consumption is actually close to 40 kg/inhabitant in Algeria, 25kg/inhabitant in Morocco, 10kg/inhabitant in France compared to 6 kg/inhabitant worldwide. (Dinissia et *al.*, 2021). As an important producing country among others worldwide (Dinissia et al., 2021), onion production is initially limited to certain production areas (Mascara, Skikda, Boumerdes, Blida). For potato cultivation, the leading producing regions are respectively Ain Defla, Mostaganem, Boumerdes and Biskra (Sahali, 2021). Onions and potatoes appear naturally in market gardening crops, widely cultivated in the region of Ksar Chellala. The region thus appears as a new growing area thanks to the effect of opening up.

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4.2. Forecasting production using the double exponential smoothing method until 2030

To analyze production and arrive at relevant conclusions regarding the impact of opening up in the more or less long term, statistics of the two speculations are presented from here following the 3 successive stages. As a reminder, the two products are obviously onions and potatoes, making up the database for specific periods giving more importance to the most recent data compared to the oldest, for which we study developments over time (2021 to 2030). On this subject, the results of the developments are for onion, potato and onion-potato.

Table 1. Presentation of potato and onion time series data for double exponential smoothing, unit: 10^3 q

year	Onion	Potato	Onion – Potato
2000	16.500	3.500	20.000
2001	17.600	3,400	21.000
2002	17.875	2,125	20.000
2003	17.050	0.950	18.000
2004	27.500	3.685	31.185
2005	24.750	6.643	31.393
2006	22.000	11.486	33.486
2007	25.200	9.326	34.526
2008	27.600	7.763	35.363
2009	30.000	5.572	35.572
2010	36.000	17.000	53.000
2011	46.200	13.000	59.200
2012	50.400	23.100	73.500
2013	52.500	17.500	70.000
2014	53.200	20.518	73.718
2015	56.000	38.500	94.500
2016	59.500	37.900	97.400
2017	73.600	30.055	103.655
2018	56.000	25.000	81.000
2019	60.000	36.240	96.240
2020	80.000	41.800	121.800

Source: Departement of agricultural services of Tiaret; Agricultural subdivision of Ksar Chellala agriculture (2023)

4.2.1. Forecasting onion production with the double exponential smoothing method

- **Step 1. Statistical analysis of onion time series**

The coefficient of variation (0.48) indicates that the time series is not homogeneous and the series is therefore characterized by dispersion. The minimum value of the series is equal to 16.5 while the maximum value of the series is equal to 80. The average value (40.45) is far from the median (36); which indicates that the onion production series is not asymmetrical. We observe that the asymmetry coefficient (Skewness) is equal to 0.37 and the flattening coefficient (Kirtosis) is equal to 1.93; this provides the information that the series does not follow a normal law. For a threshold of 5%, the probability provided is equal to 0.47 which is greater than 0.05 we accept the hypothesis of normal dispersion (figure 1).

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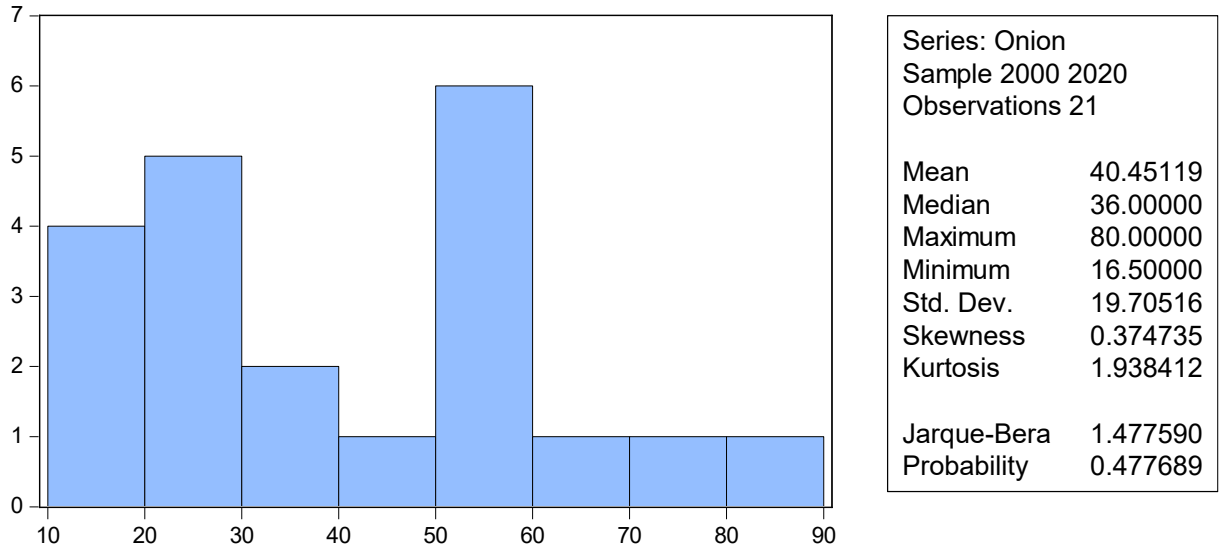

Figure 1. Statistical analysis of the onion series by double exponential or Holt smoothing
Source. Double exponential smoothing results by Eviews 12 (2024)

▪ **Step 2. Trend and seasonality test of the evolution of the onion**

It is important to study the trend and seasonality before proceeding with the analysis. This study is broken down into:

• **Trend test**

Hodrick Prescott's graph analysis filters production. It thus makes it possible to extract some results concerning the trend in the onion time series over the period selected. According to the graph (figure 2) of the orientation of the time series of onion production, it appears from the test that the series has an upward trend.

Cyclical component (Cycle) : The cyclical analysis of the time series of onion production notes that the evolution is generally not constant, but it fluctuates over 10 years (2021 to 2030). The composition of the cycle actually breaks down into several small cycles with a much larger trough between 2016 and 2019 (figure 2).

Seasonality test

The graphical analysis indicates a strong presence of cyclical disturbances. This strong cyclical disruption indicates that the onion production series is characterized by multiple seasonality.

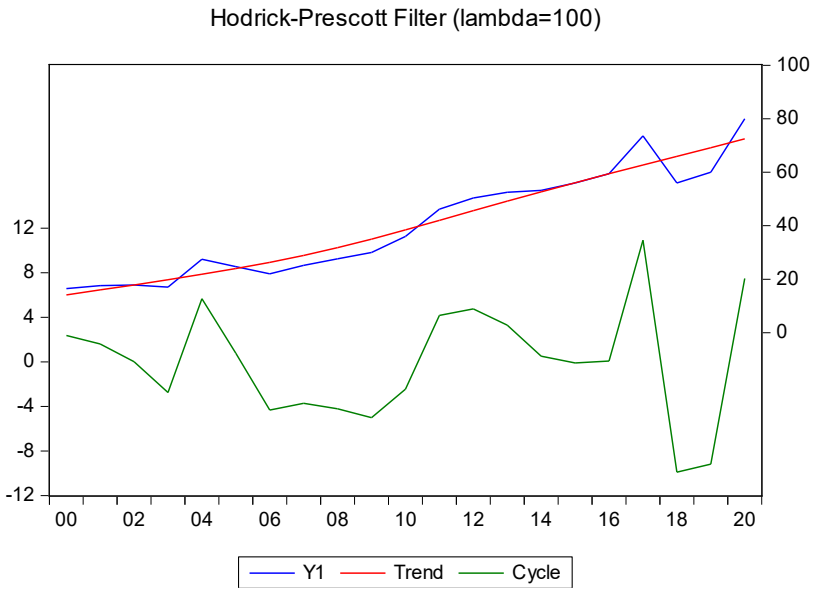

Figure 2. Series trend of onion production by Hodrick Prescott filter
Source. Results produced by the authors by Eviews 12 (2024)

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▪ **Step 3. Modeling and forecasting of onion production**

The time series of onion production is characterized by non-seasonality and shows a trend. In this case, the appropriate method for forecasting is arguably the Double Exponential Smoothing method. Taking into account the results presented, it can be distinguished that the analysis of onion production by the double exponential smoothing method with the smoothing parameter α=0.3, gives the sum of the residual squares 897.04.

It's a low root mean square error (6.53), therefore, makes it more practical. The method that is suitable for studying the forecast of onion production is then the double exponential smoothing method (table 2). The results show that at the end of the forecast period set at 10 years, a net increase in production will reach 103.79 thousand quintals. Figure 28 provides the results of forecasting onion production from 2021 to 2030.

Table 2: The double exponential smoothing model

Sample : 2000 2020 Included observations: 21 Method: Double Exponential Original Series: Onion Forecast Series: OnionSM		
Paramèters : Alpha		0,2160
Sum of Squared Residuals		897,0474
Root Mean Squared Error		6,535790
End of Period Levels::	Mean	72,16934
	Trend	3,162082

Source: Done by the authors using Eviews 12 double exponential smoothing method (2024)

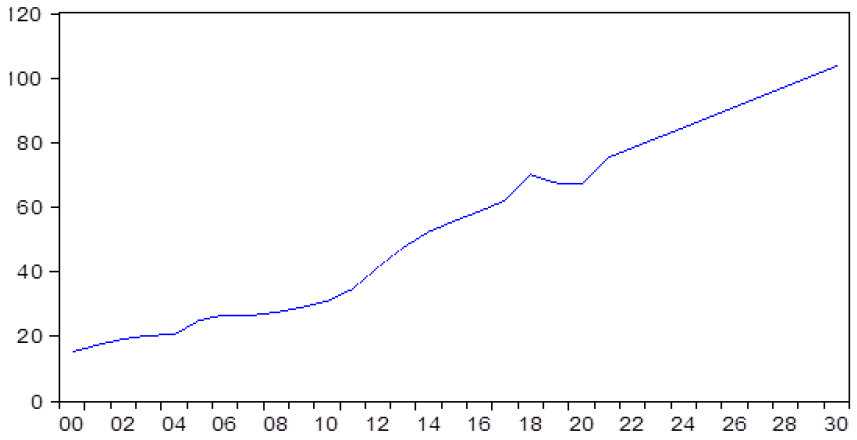

Figure 3. Graphical evolution of onion production over 10 years using the double exponential smoothing method

Source: Done by the authors using Eviews 12 and double exponential smoothing methods (2024)

4.2.2. Forecasting potato production with the double exponential smoothing method

With reference to the previous case, the forecast begins with a static description of the components of the time series of potato production.

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▪ **Step 1. Statistical description of the potato time series**

The minimum value of the series (0.95) is very far from the maximum value of the series (41.80). We can also distinguish that the average (16.90) is far from the median 13; which means that the potato production series is not asymmetrical. For the 5% threshold, the provided probability of 0.37 is greater than 0.05; For this, we reject the probability of the normality of the distribution.

Likewise, the asymmetry coefficient (Skewness) is equal to 0.55 which indicates that the series is asymmetric. The probability of 0.35 being greater than 5%, we therefore accept the null hypothesis of normal dispersion (figure 4).

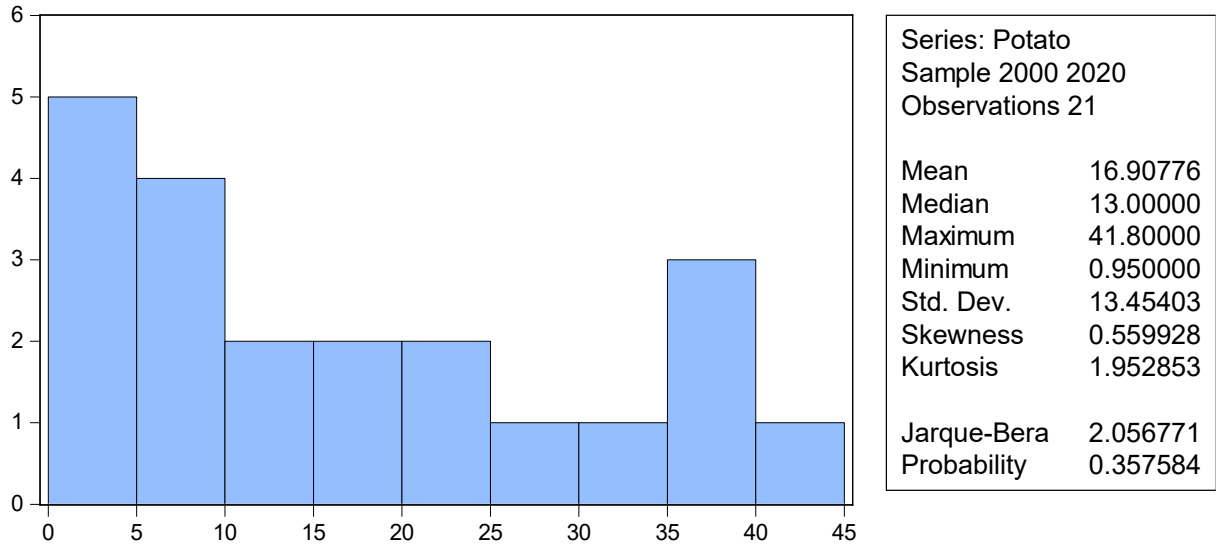

Figure 4. Statistical description of the potato series
Source. Results by Eviews 12 (2024)

▪ **Step 2. Trend and seasonality test**

Trend test

The results visible in Figure 5 show that the potato production series marks an upward trend in general. Indeed, the analysis of the cycle, in red line, has an increasing trend; some conclusions can be drawn, including that potato production clearly exhibits two distinctive cycles. More clearly, analysis of the curve in blue shows that potato production experienced a first period of decline (2006-2010) and a second during 2018-2019.

Seasonality test

The graphical analysis indicates a lesser presence of cyclical disturbance; consequently, the potato production series is characterized by weak seasonality (figure 5).

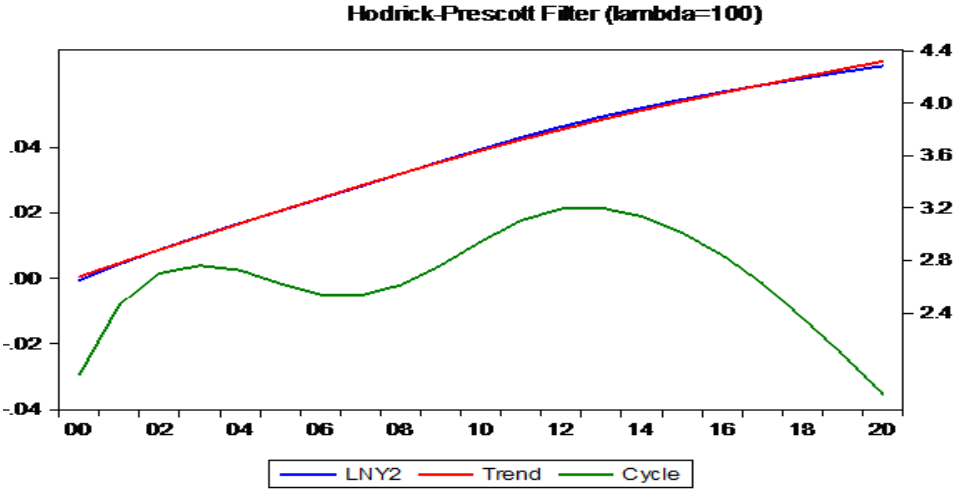

Figure 5. Series trend of potato production by Hodrick Prescott filter
Source. Results of Eviews 12 (2024)

▪ **Step 3. Modeling and forecasting potato production from 2021 to 2030**

The potato production time series is characterized by non-seasonality and shows a trend. In such circumstances,

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the appropriate method for forecasting is the double exponential smoothing method.

From the results, it can be concluded that the analysis of potato production by the double exponential smoothing method has a low root mean square error (5.94) with the sum of squares of the residuals of 743.35 and this makes it more practical (Table 3).

The forecast of potato production over 10 years using the double exponential smoothing method appears in table 44. It can be noted that the forecast is in continuous progress. It reaches 59.13 thousand quintals at the end of the period fixed at ten years (2030).

Table 3: The double exponential smoothing (LED) model

Sample: 2000 2020 Included observations: 21 Method: Double Exponential Original Series : Potato Série de prévision : Potato SM		
Paramèters : Alpha		0,1880
Sum of Squared Residuals		743,3500
Root Mean Squared Error		5,949590
End of Period Levels::	Mean	38,19590
	Trend	2,093878

Source: Results obtained using Eviews 12 (2024)

Table 4: Potato production volume forecast over the next 10 years using the Double Exponential Smoothing method

Year	Forecast
2021	40,28
2022	42,38
2023	44,47
2024	46,57
2025	48,66
2026	50,75
2027	52,85
2028	54,94
2029	57,04
2030	59,13

Source: Results obtained using Eviews 12 (2024) software

4.2.3. Forecasting onion-potato production with the double exponential smoothing method

In this last phase of the demonstration, the future impact of opening-up operations in the Ksar Chellala region is considered for the onion-potato combination overall. It similarly conforms to the principle of Holt's exponential smoothing method in successive stages.

- **Step 1. Descriptive statistics of the onion-potato time series**

The coefficient of variation (0.566%) allows us to conclude that the series is characterized by dispersion. The minimum value of the onion-potato series is equal to 18; while the maximum value of the series is equal to 121. The average value (57.36) is far from the median (53); which indicates that the onion-potato production series is not asymmetric. The asymmetry coefficient (Skewness) confirms this with a value equal to 0.40. At the same time, for a

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threshold of 5%, the probability provided is equal to 0.44 which is greater than 0.05. In any case, we reject the probability of the normality of the distribution (figure 6).

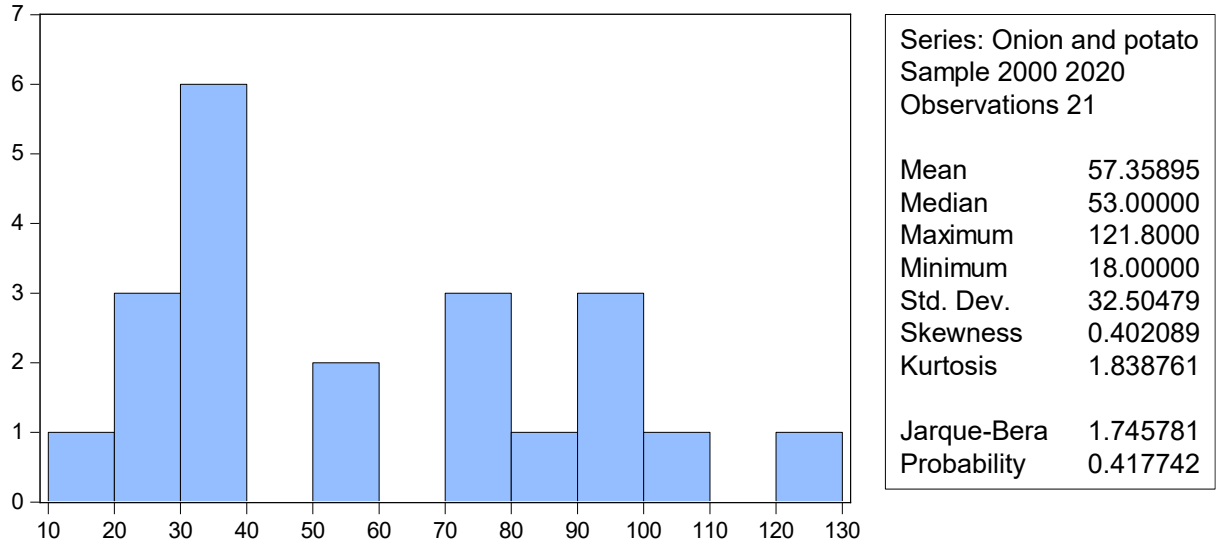

Figure 6. Statistical description of the onion-potato series
Source: Results obtained using Eviews 12 (2024) software

- **Step 2. Test for trend and seasonality of onion-potato progression**

Trend test

It appears from the test that the series observes characteristics during the forecast period 2020-2030. At first glance, the results show that the combined onion-potato production series has an increasing trend overall (red line in Figure 7).

The trend is additive; this allows us to draw the conclusion that onion-potato production is generally not constant; it is in flux. Careful observation of the blue evolution curve shows that production actually experiences drops from time to time during the periods 2002-2003, 2007-2009, 2019 (figure 7).

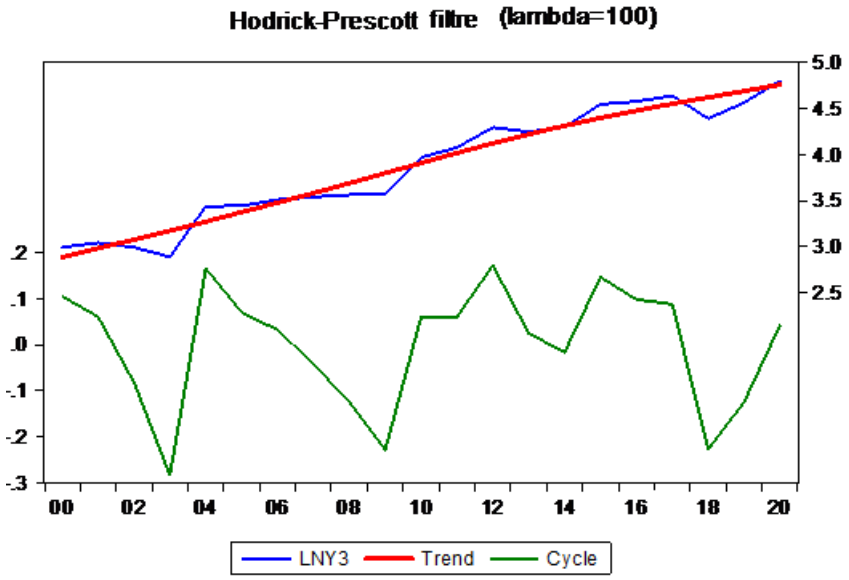

Figure 7. Serial trend of Onion-Potato production by Hodrick Prescott filter
Source. Results obtained using Eviews 12 (2024)

- **Seasonality test**

Regarding the seasonality test, there is the absence of cyclical disturbance. This indicates that the onion-

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potato production series is characterized by the absence of seasonality.

▪ **Step 3 . Modeling and forecasting of onion-potato production**

The production forecast by the double exponential smoothing method is given in table 5. These results lead to the conclusion that the analysis of the forecast of onion-potato production by the double exponential smoothing method with the smoothing parameter (α=0.2) and the low sum of residual squares (613.10) makes it more practical for making the forecast.

Table 5: The Double Exponential Smoothing model

Sample: 2000 2020 Included observations: 21 Method: Double Exponential Original Series: Onion-Potato Forecast Series: d'Onion-Potato SM		
Paramèters : Alpha		0,2420
Sum of Squared Residuals		2089,326
Root Mean Squared Error		9,974553
End of Period Levels::	Mean	111,2349
	Trend	5,496646

Source: Results from data processing by the Eviews 12 software (2024)

By analyzing the results presented in Figure 8, it clearly appears that the increase in production reached 145.8 thousand quintals at the end of the period set at ten years.

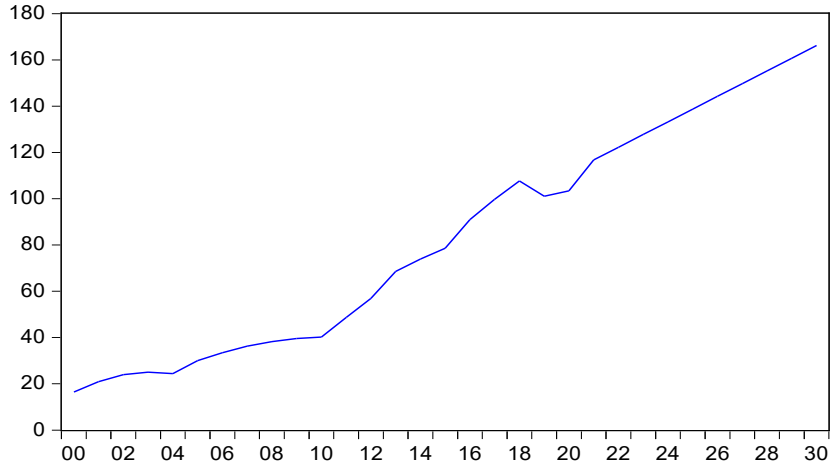

Figure 8. Forecast of onion-potato production using the double exponential smoothing method over a 10-year horizon

Source: Results using Eviews 12 software (2024)

At the end of the modeling, we can emphasize that the operations of opening Ksar Chellala to the outside world are changing the economic and social landscape. This leads us to mention that the positive impact of opening-up actions is not only economic. It is also more energy and telecommunications services for agricultural production units and their third parties and more exchanges with neighboring regions which have resulted in individual and collective well-being

5. Discussion of research results

In seeking greater clarity in general and in particular easily understandable conduct, the debate on the results

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obtained is split into two distinct parts depending on the approach to defending the thesis retained. In doing so, part of the discussion addresses the case of the long-term forecast impact (2020-2030) of the opening operations of Ksar Chellala to the outside world.

Modeling expected production in the future using the double exponential smoothing method makes it possible to determine more or less long-term production objectives and to improve the infrastructure investment strategy from this perspective. This modeling allows us to act better and if the forecasts are reassuring, they make it possible to improve farmers' production. Monitoring the evolution of production made it possible to diagnose the future economic situation of production in the study area, considered as a miniature sample, to reveal the results of interest and to draw some observations and conclusions.

5.1. Discussion of the onion production forecast

Onions are easily and almost daily included in all meals in the Ksar Chellala region, like the entire country where the average Algerian consumes almost 7 times the world's annual average quantity (6 kg/inhabitant/year) (Dinissia et al., 2021). This partially provides the explanation for the interest given to this vegetable by other regions and which is spreading to Ksar Chellala benefiting from the opening to the outside world, outside the first producing areas (Sahali, 2021)**.** The growth in onion supply is assessed in line with the intensity of demand, not only in the experimental zone of 255,000 km2 and rich in natural and human resources in elevation; but as much in the entire country of 2,382 km2 and 45,106 inhabitants (ONS, 2024) and at the height of its emerging connectivity. The encouraging productive phenomenon seems to confirm the conclusions of the Ministry of agriculture and rural development, 2019), Plannification Department, (2022), Sahali et al., (2021) and the High Commission For Step Development, (2012) that onion production is considered a strategic crop.

The future evolution of the onion for a threshold of 5% presenting the probability of 0.47, which is greater than 0.05, leads to accepting the hypothesis of normal dispersion (Ngon, 2022). The forecast production is floating over the study period, as demonstrated by the decomposition of its cycle into several small cycles with a much greater dip between 2016 and 2019. In addition, onion production is therefore characterized by multiple seasonality, the future average increase is very high (72.17 thousand quintals) with an orientation of 3.16, increasing from 75.33 to 103.79 thousand from 2021. quintals in 2030. The forecasting process showed that the estimated onion production will increase over the next ten years. It is explained by the stimulation of production attributable to an increase in demand imposed by that of the population, but also by the facilitation of the increase in investments, which is mainly due to transport and the availability of energy. Nor is it hypothesized that the role of roads in facilitating the movement of workers and the role that roads play in the commercialization process are underestimated.

5.2. Discussion of the potato production forecast

Potatoes are widely consumed in the Ksar Chellala region, but in relatively much larger quantities than onions. The 3 stages contributing to the prediction of the potato supply differ from those of the first agricultural speculation. Indeed, for a threshold of 0.05, the probability is only 0.35 but greater than 5%, making us accept the hypothesis of nullity of normal dispersion. (Ngon, 2022 ; Goude, 2019).

From 2021 to 2030, the future growth of potatoes occurs clearly following two identified cycles (first cycle with fall (2006-2010) and second with drop 2018-2019), but with weak seasonality. However, the average future production is lower (38.19 thousand quintals) leading to an orientation of 2.09, increasing potato production from 40280 q (2021) to 59130 q (2030).

Potato production maintains progression throughout the study period, reflecting the close relationship between open infrastructure (roads, electricity, communications) and production growth. The nature of the potato economy and the status of the link between the means of openness (roads, electricity, communications) and potato production in the study area, are the factors that draw attention to the speculative choice and which are all the more dependent on market conditions and the state of infrastructure (Redding & Turner, 2014; Aschauer, 1990; Stenason & Bandeen, 1965).

5.3. Discussion of the onion-potato production forecast

It is important to emphasize that other more or less determining parameters can modify this planned production either upwards or downwards; but are not inappropriately supported by the forecast model, especially the exponential smoothing method. These are specifically endogenous and exogenous factors in the approach to the intrinsic functioning of agricultural markets (Ouali et al., 2022 ; Belkhiri & Atchemdi, 2021 ; Atchemdi, 2008a ; Atchemdi, 2008b). This could constitute a disadvantage by limiting the precision of the simulation. (Organization for Economic Cooperation and Development /Food and agriculture organization of the united nation , 2022 ; Henider,

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2020).

As for agricultural policy, beyond the sectoral one of opening infrastructures in the region and in the rest of the country, market gardening, including onions and potatoes, has not benefited from a specific support policy for its development. A regulatory system is nevertheless put in place with a view to better stabilization of production for products selected under the criterion of "widespread consumption"(Sahali et al., 2021).

But the future of these crops depends above all on price stability, the result of the permanent balance between supply and demand on local markets. Because agricultural markets are closer to the perfect situation and climatic, political, etc. conditions, exogenous to the proper functioning of these markets, act in a secondary manner (Atchemdi, 2008a).

In this sense, the biophysical aspect including meteorological parameters, soil analysis, state of the crop, phenological data, etc., appear as parameters that can limit the precision of the volumes calculated from 2020 to 2030. Otherwise, studies conclude that the increase in cultivated area has a greater impact on the production of these crops than the improvement in productivity, especially since Ksar Chellala is considered a new frontier for these large-scale consumption speculations (DSA, 2023 ; Sahali et al., 2021 ; Atchemdi, 2008b).

CONCLUSION

Due to these forecasts and this proven impact of the operations to open up Ksar Chellala, the results highlight the fundamental economic and social trends which influence the agricultural and agri-food sector everywhere. Thus, the conclusions to be made justify the fact that the results stick to the main hypothesis that the end of isolation is an element of the economic renewal of the territory, with a strong correlation between the development of infrastructure for opening up and the economic dynamics linked to agricultural production. However, the same demonstrations are secondarily reinforced by the hypothesis that they stick to endogenous and exogenous factors and will not undergo significant transformations (OECD/FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATION, 2023; Atchemdi, 2008a).

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