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Time Series Forecasting of Arrival Tourists in Southwest Algeria: Case Study of Bechar

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The aim of this work is to discuss and find the best and appropriate modeling of Seasonal Auto-Regressive Integrated Moving Average (SARIMA), and uses it as an element of forecasting of the number of arrival tourists to Bechar as a tourists destination in Algeria by considering the minimum of Akaike Information Criterion (AIC). The results of fitting were as follows: the best SARIMA Model for fitting arrival tourists is ARIMA(1,0,1)x(2,1,2)4 with a constant.

KEYWORDS: tourism, Time Series, SARIMA, Box-Jenkins, Forecasting and Algeria.

1. INTRODUCTION

Bechar town is situated western Algeria. It lies in the northern reaches of the Sahara. The town is named for nearby Mount Bechar, rising to 1,600 feet (488 metres). Bechar's former European quarter contains a military station and has modern buildings, while the aditional quarter has covered, narrow streets. Surrounded by date-palm groves watered by the Wadi Béchar, the town is noted for its leatherwork and jewelry. In Bechar there are many touristics places as Beni-Abbes, Thagit, Moughel, Igli, Knadsa, …etc.

In econometrics, the Box-Jenkins methodology, named after the statisticians George Box and Gwilym Jenkins, applies autoregressive moving average ARMA or ARIMA models to find the best fit of a time series to past values of this time series, in order to make forecasting. The Box-Jenkins methodology consists of a four-step iterative procedure: tentative identification, estimation, diagnostic checking and forecasting.[1]

Section two defines Tourism in the South West of Algeria, in Section three we define a Multiplicative Seasonal ARIMA Models and in Section four we deal with the forecasting results. Finally we discuss the results with a conclusion.

2. TOURISM IN THE SOUTH WEST OF ALGERIA

Most of the population in the South West of Algeria lives under a simple economic system. This system stands mostly on a slightly productivity force and depends on agriculture, Livestock trade and some handicrafts. These, in fact, characterize the South West regions by simplicity in both standards: economic and way of living. Generally, these regions are very large and are characterized by a lesser amount of population density. Nevertheless, tourism has got a great importance in transforming these regions into areas of reconstruction and attracting population, the reason why new urban productivity centers were created. Also, the development of tourism in these regions will improve its public services, especially if it is related to the provision of water, sewer, lighting, transportation and also educational services and Health. The impact of tourism extends to more than that, wherein the development of tourism in these regions will lead to their integration with the rest of the country and defrosts the sense of social economic class of the population. This situation was due to that persistent sense of feeling isolated from the rest of the country and that they are underprivileged or deprived from many requirements, in addition to the feeling that their regions are less providential concerning the economic development compared with the other places in the country.

In spite of this importance and what this region possesses of diverse tourism products, it combines between the nature of desert and its palaces, golden sands, green Oases and also its variant traditions and heritages, this product has remained until now absent, marginalized and

unexploited due to the lack of a clear marketing strategy which aims at developing and promoting the product in the region to respond to the tourists' requirements. Nevertheless, the existing tourism product subject to deterioration and neglect and starts to lose its tourism and aesthetic image. According to what was mentioned before, it becomes obvious that it is impossible to tourism product to stand by itself if it is not supported by strategies and politics. This later should be based on scientific study of the market and the tourist's behavior in order to determine his/her wants and needs and finally builds up the foundations to satisfy these needs and wants.

Within its own capacities and its own economic impacts, Tourism also gains a basic role to become an essential resource for the people of the region (the Folks). It participates in allowing the creation of a balance between the various parts of the country through developing these regions which have less opportunity in the social and economic development. This process leads to tackle the problem of migration of rural residents to the city (urban area). Following the spread of tourism extension over the different regions, the flow of people to these regions will rise and their investments and other activities which have a link to tourism will flourish especially traditional crafts. This change will create an appropriate atmosphere for caring about these traditional crafts, reviving the old and neglected crafts, training and qualifying the apprentices by offering suitable services. This in fact, will reflect positively on reviving the heritage and original culture which started for many reason to disappear slowly.

The impacts of the development of tourism on this region will extend to an overall development of the local desert communities by attracting much people in the activity of tourism. This process adds to the surrounding desert communities' new vision and new life experiences. The impact of development of tourism does not stop at this level, but it will extend to reach also the social aspect. This will lead to what is called the "cultural exchange" between the people of the region and the tourists and make them aware of new customs and traditions. Tourism will create, by all these, a different atmosphere, characterized by the exchange of knowledge and the gain of new experiences which will lead to break many obstacles that characterized the conservative desert community. Based on what was mentioned before, we observe that tourism development in the South West has got a central role in developing the local economic activity and gives a strong push to the

development of this part of the country by basing on the development of its local resources.

2.1. Tourism Product in the South West

2.1.1. Tourism Resources

Algerian Sahara (desert), this strange world and special entity, is not an arid region (Hamada) and sands but also a fusion of history and geography. The weather made of the Algerian South West, by its oases, mountains, rocks, and the way of living of its people, a flower of multi colors and light. These interrelated factors create a new type of region and a different kind of people with a mixed character in Africa, Middle East and the Mediterranean. All these outward shows embodied in the region and the historical and religious landmarks witness its existence.

The "Saoura" as it was called in the past, is considered as the south belt, where you can fly freely in the wide space in an eternal silence, where everything is imaginary and calm. The vast Oasis with its different palms, the palms that built up and gather the land, human, water, sand and the flame of the Sun adds to the region a high degree of beauty.

a) Bechar

In the middle of this romantic beauty the city of Bechar appeared. Its character is divided into two parts; first one which is related to the North and the second one to the South. It represents the most important agglomeration in the region and the capital of South West with the diversity in its beautiful landscapes which are covered by gorgeous Oases in a sandy sphere in the banks of "wadi Saoura" Saoura valley.

The Oases are the first invitation to the discovery of Bechar and its masterpieces passing through its old castles: the castle of Bechar and the castle of Ouakda which witness the strength of the culture and the civilization of this region. From Bechar and about 20 km west the city of Kenadsa appears.

b) Kenadsa

This place is considered as the first industrial pole in the region, and this has been since the discovery of coal in its land during last century. Its ruins and the structure of the ancient coal factory stand proud to nowadays to witness the greatness of this region and its generosity. The

city of Kenadsa is also proud of its religious schools (zaouia), which plays a religious, cultural, social and scientific role that make of this city target to the learners and all the people who want to educate themselves in different domains. The trip to Kenadza is a combination between the discovery of new natural views and a sight to cultures and history. This rigion consists of what is called the old castle (Elkasr Elkadim) with its reddish color which makes a harmony between the Eastern, Moroccan and African architecture in a beautiful harmonic shape. The castle and the city are surrounded by golden sands and green Oases obliges the visitor to move to another world, a world full of all the thing that the visitor needs to feel calm and relax. What attached you more in this city is the customs and traditions that are very old. The city of Kendza celebrates every year several festivals and religious celebrations, the most important are "Elmouled Anaboui" day of birth of our prophet and the festival of "Berkachou". This latter, is a local festival which is based on traditions and is combined with local songs. Also Kenadza is proud of its music group "Elferda" which has a great reputation outside Algeria especially in France, where it represented Algeria in France last year.

Near to Kenadza there is a Dam "sad jourf atourba" one of the greatest dams in Algeria, which plays an important role in the economic life and acquires a huge importance in the domain of tourism. Its huge surface makes of it a home land to different types of fish, birds, animals and plants. For that reason, it becomes a place to practice different hobbies such as: Fishing, camping, sailing.

c) Taghit

The city of Thaghit is situated in the South of Bechar, it is about 95km far from Bechar. The origin of the word "Taghilt" which is a word derived from the word "Aghil" which means a shield, this was because of the location of the castle which was built on eminence. There are two other stories which claim that the word "Taghit" is derived from the word "alghit" the rain, and the story claims that it is derived from a berber word which means stone. The city constitutes of six castles are:

- Zaouia Atahtania
- Bekhti
- Barbi
- Brika
- Zaouia alfoukania

- Taghit

These castles create beautiful scenery; its sudden appearance to the people creates to the visitor for the first time renewed trance by discovering the hidden side of nature and the real and deep sense of hospitality and generosity. Taghit has gain an important place among national and international societies; it's really a jewel and a pearl of Saoura which lays on the big west race with its golden and magic sands. This big west race is considered as the backyard basis, it goes in parallel with the palm Oases which are extended along the junctions of "Ouadi Zouzfana" Zouzfana valley about a distance superior than 16 km. The city of Taghit has got a great potential in tourism which combine between history and culture, the beauty of nature and Art. Among them are :

- The Oasis of taghit which is composed of more than 90000 different types of palms in the middle of a sandy stretch along the valley combining between the green of palms and the yellow of sands draws an oil painting that insists the viewers to keep looking.
- Rocks' samples of animals and birds in a place called Amrrouch Brothers" Alikhoua Amrrouch" which traced back it history to more than 12 thousand years. It witnesses that the region lived an era of history combined between human being and that animals and birds. This image makes the tourists swim in the deep side of history by exploring the depths of the past and stand on the glories of the ancient history.

The sandy summit goes above 732 meters, it is shaped as the sea waves, calling for the visitors to discover its secrets. It also built up a wide space for practicing skiing on sand.

- The lake of (Daiet Tyour), about 30 km, is a destination of migratory birds and a spectacular natural panorama.
- The region of Misshapen (mamssoukh) contains of some traces of fossilized forest which indicate that the region was dominated by thick forests.
- Caves of (Sidi Ayyash) in Zaouia Athtania, their secrets are not discovered yet and did not benefit from any appropriate

geological and historical studies. It contains also of various ancient palaces. The oldest one is the castle of Taghit center, which is characterized by unique architecture. This latter, took into account the climatic and environmental conditions of the folks. In addition to these castles, there are many vulnerable castles in the region.

For many years, the city of Taghit has started to organize a national festival named (Maoussim Taghit) "The Season of Taghit", on the occasion of harvest dates. This festival was a part of re-upgrade and restoration of the local ceremonies. Through this, the Directorate of Tourism attempts to publicize the city's tourism product, and promotes the cultural activities and the local ceremonies to get a national character, and may be an international character. The historical background of this ceremony is traced back to more than ten centuries. According to a Legend, this ceremony has it roots from an activity done by (Aba yazid ahfsùhkd) who was re-distributing the goods at the beginning of the season to all the poor (serfs) and persons along for the ride (passengers). In this way, the people celebrates their festival through three major consecutive days under the rhythm of (Abanndir) and (Goumbri) which are all types of ancient Saharian music instruments, in addition to choirs "group of singers" presenting different types of religious songs, which gives an other dimension to the scene, especially when it is mixed with the presentation of Knights and the demonstration of camel race with the opportunity to assist the show of skiing on sand.

d) Beni Abbes

The city of Beni Abess is located in the South of Bechar at about 240 km far and at a height of 495. Its reconstruction can be traced back to the pre-historic area and after the detonation of freshwater (Sakia) by Sidi Othman, the reconstruction of the Oases set up. In the late 15th century, Sidi Mohammed Ben Abdeslam arrived to the city and unified all the tribes and built up the old Castle (al kasr al kadim).

Beni Abbes is a bright Oasis located in the East of Saoura valley, on a small hill surrounded by golden sand dune of the great western race. Its Oasis is formed by 100000 palms forming a glamorous scorpion shape. In the center of this fabulous Oasis there are the old castle and the old mosque. In addition, the region has several ruins of old castles some are at the bottom of the Saoura valley forming a small hill which has got a

name of " Ghara Diba", She-wolf cave, and the other in the other side of the valley at the site called "Asas alil" night vigilante.

These Castles, according to the local legends, are related to Beni Hassan tribe. The city of Beni Abbas still saves the House of (the father Foukou) which is a range of rooms and a Chapel. This residence was considered as a place of isolation, pleading for brotherhood and love, as he claimed. The city has also various important tourism resources such as:

Patterns of different animals and traces of old drawings which exist in an area 50 km far from Beni Abbes. It has got also a unique area in the 30 km of the national road No.06, where you can find fossils of different animals which indicate that the region experienced an era of history where animals have accompanied human in this region. It is also characterized by having the greatest dunes in Algeria, which qualifies it to be a space for practicing skiing on sand and also using its sand baths for medical treatments. There is also a museum which contains all the types of plans and animals that live in this environment and also all the antiquities which have not been studied to show their importance. Beni Abbes has got a research center specialized in studying dry areas, but unfortunately this center recently closed its doors for reason that we could not understand.

The city celebrates every year and along its generations the birth of our prophet which is considered as the biggest religious ceremony in the region. This religious ceremony attracted both people from inside Algeria and outside. Like the other region of (Saoura), beni Abess possess different type of animals in danger of disappearance like gazelles and fish of sand and other types of bird. All this is a result of the lack of protected areas to protect these rare kinds of animals from unauthorized hunting. With all this diversity in tourism products, Ben Abess deserves to be one of the most attractive regions in the South.

At the end, the city of Bechar has got more than this; it has got a fabulous historical, archeological and natural landmarks which make of it one of most attractive tourism place. The city of Igli is an example of the regions that were not mentioned. It has got the castle of (Aghram anjah) which represents a sign of proud to the folks. This latter was manufactured by (Aghram Almakran) tribes and is considered as the oldest castle in this region. As the other regions, Igli possessed a vast surface of Oases which are located in the middle of the sand dune on an estimated area of 1500 hectares. Not so far from Igli there is a cave

called (magharat chaabet karkor). Tabelbala is also an example of beauty in the South West; it is characterized by its prehistoric graves. These graves are very long; it exceeds the length of two miters. We can summarize the existing tourism products and handicrafts (traditional industry) in the following tables.

3. MULTIPLICATIVE SEASONAL ARIMA MODELS

Often, the dependence on the past tends to occur most strongly at multiples of some underlying seasonal lags. Natural phenomena such as arrival tourists also have strong components corresponding to seasons. Because of this, it is appropriate to introduce autoregressive and moving average polynomials that identify with the seasonal lags.

The resulting pure seasonal autoregressive moving average model, say, , then takes the formṇ p, qARMA

$$\Phi_p\left(B^s\right)x_t = \Theta_Q\left(B^s\right)\omega_t\,, \tag{1}$$

With the following definition.

The operators

$$\Phi_p\left(B^S\right)x_t = 1-\Phi_1 B^S - \Phi_2 B^{2S} - \cdots - \Phi_P B^{PS}\,, \tag{2}$$

and

$$\Theta_Q\left(B^S\right) = 1+\Theta_1 B^S + \Theta_2 B^{2S} + \cdots + \Theta_Q B^{QS}\,, \tag{3}$$

Are the seasonal autoregressive operator and the seasonal moving average operator of orders P and Q, respectively, with seasonal period S

The multiplicative seasonal autoregressive integrated moving average model,or SARIMA model, of Box JenKins is given by

$$\Phi_p\left(B^S\right)\phi(B)\nabla_S^D\nabla^d x_t = \alpha + \Theta_Q\left(B^S\right)\theta(B)\omega_t\,, \tag{4}$$

TABLE 1. Behavior of the ACF and the PACF for Pure Seasonal ARMA Models [4].

	$AR(P)_S$	$MA(Q)_S$	$ARMA\ (P,Q)_S$
ACF	Tails off at lags ks, k=1,2,…..	Cuts off after lag Qs	Tails off at lag ks
PACF	Cuts off after lag Ps	Tails off at lags ks k=1,2…	Tails off at lag ks

Where ω_t is the usual Gaussian white noise process. The general model is noted as ARIMA(p,d,q)× (P,D,Q)S. the non-seasonal difference components are $\nabla^d = (1-B)^d$ and the seasonal are $\nabla_S^D = (1-B^S)^D$.

4. BUILDING ARIMA MODEL

In this study, we used the seasonal tourist arrivals data to south Algeria Bechar between 2000 and 2010. The plot of the number of tourism is given in Figure 1 as below.

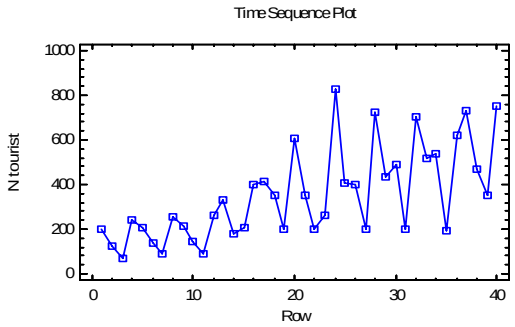

FIGURE 1. The number of tourism series arrivals data to south Algeria Bechar between 2000 and 2010 we can see that the patterns of the whole series became the same.

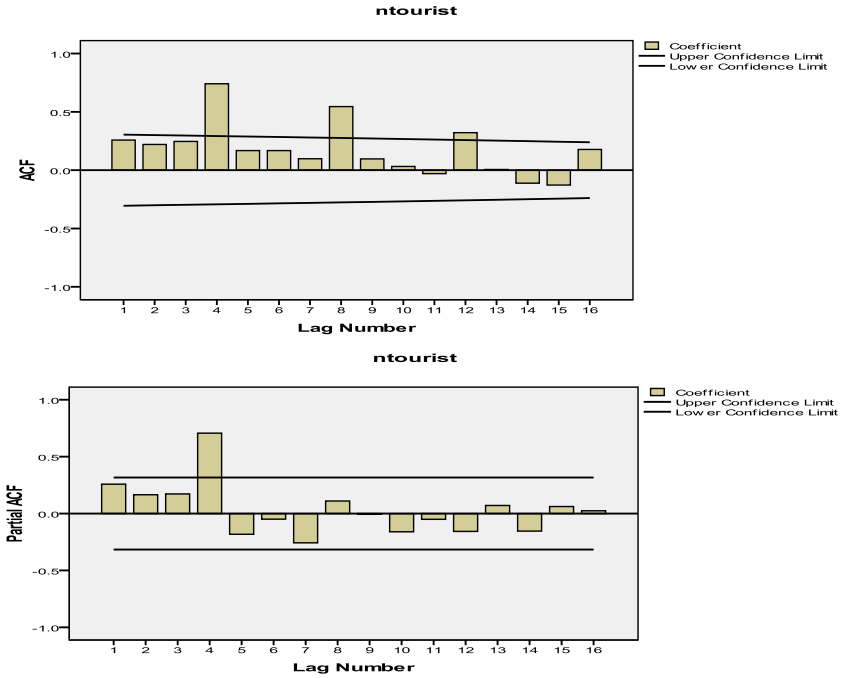

FIGURE 2. The ACF and PACF for the number of tourism series arrivals data to south Algeria Bechar between 2000 and 2010.

4.1. Estimated Autocorrelations

The estimated Autocorrelations for the data are given in the **table 2**

TABLE 2. Represent the Estimated Autocorrelations between Values of Data at Various Lags.

Lag	*Autocorrelation*	*Stnd. Error*	*Lower 95.0% Prob. Limit*	*Upper 95.0% Prob. Limit*
1	0.257919	0.158114	-0.309898	0.309898
2	0.220745	0.168304	-0.32987	0.32987
3	0.246381	0.175393	-0.343764	0.343764
4	0.741158	0.183842	-0.360324	0.360324
5	0.16816	0.247515	-0.485121	0.485121
6	0.167848	0.250355	-0.490687	0.490687
7	0.0983245	0.253152	-0.49617	0.49617
8	0.545307	0.254105	-0.498038	0.498038

TABLE 2. (Continued)

Lag	*Autocorrelation*	*Stnd. Error*	*Lower 95.0% Prob. Limit*	*Upper 95.0% Prob. Limit*
9	0.0966014	0.281846	-0.55241	0.55241
10	0.0319284	0.282673	-0.55403	0.55403
11	-0.0295086	0.282763	-0.554207	0.554207
12	0.321788	0.28284	-0.554357	0.554357
13	0.00626412	0.291849	-0.572015	0.572015

This table shows the estimated autocorrelations between values of number of tourism at various lags. The lag k autocorrelation coefficient measures the correlation between values of number tourism at time t and time t-k. Also shown are 95.0% probability limits around 0. If the probability limits at a particular lag do not contain the estimated coefficient, there is a statistically significant correlation at that lag at the 95.0% confidence level.

4.2. Fitting ARIMA Models

Choosing the best model will involve obtaining some important values in fitting like the root mean squared error (RMSE), the mean absolute error (MAE), the mean absolute percentage error (MAPE), the mean error (ME), the mean percentage error (MPE) and Akaike Information Criterion (AIC), which will be compared to their corresponding values when applying the seasonal ARIMA models ((A) ARIMA(1,0,1)x(2,1,2)4 with constant, (B) ARIMA(1,0,1)x(2,1,1)4 with constant, (C) ARIMA(0,0,2)x(2,1,2)4 with constant, (D) ARIMA(0,0,0)x(1,1,1)4 with constant, (E) ARIMA(1,0,1)x(0,1,2)4 with constant).

TABLE 3. Represent a Comparison Fitting Models

Model	RMSE	MAE	MAPE	ME	MPE	AIC
(A)	74.113	49.0746	15.6431	-1.13528	-3.6556	8.96118
(B)	77.7957	52.8833	17.8201	-9.50527	-6.81926	9.00817
(C)	76.1091	57.019	20.5042	-1.33075	-6.52605	9.01434
(D)	85.5968	66.7088	21.2211	-4.77298	-7.45812	9.0493
(E)	81.6699	56.303	18.3494	0.238029	-4.96267	9.05537

This table compares the results of fitting different models to the data. The model with the lowest value of the Akaike Information Criterion (AIC) is model A, which has been used to generate the fitting. The table also summarizes the performance of the currently selected model in fitting the historical data. The best model selected is ARIMA(1,0,1)x(2,1,2)4 with constant with parameters estimators represent as below:

Where the ARIMA(1,0,1)x(2,1,2)4 with constant equation given as below:

$$(1-\phi_1\beta)(1-\Phi_1\beta^4-\Phi_2\beta^8)(1-\beta^4)T_t=(1+\theta_1\beta)(1+\Theta_1\beta^4+\Theta_2\beta^8)e_t+const, \tag{5}$$

Then

$$\begin{aligned}T_t &= const+\phi_1T_{t-1}-(\Phi_1+1)T_{t-4}-\phi_1(\Phi_1+1)T_{t-5}+(\Phi_2-\phi_1)T_{t-8}-\phi_1(\Phi_2-\Phi_1)T_{t-9}-\Phi_2T_{t-12},\\ &\quad+\phi_1\Phi_2T_{t-13}+\theta_1e_{t-1}+\Theta_1e_{t-4}+\theta_1\Theta_1e_{t-5}+\Theta_2e_{t-8}+\theta_1\Theta_2e_{t-9}+e_t\end{aligned} \tag{6}$$

$$\begin{aligned}\hat{T}_t &= 11{,}7064+0{,}6156T_{t-1}-2{,}0089T_{t-4}-1{,}2367T_{t-5}-1{,}2421T_{t-8}+1{,}0074T_{t-9}+0{,}6265T_{t-12},\\ &\quad-0{,}3857T_{t-13}+1{,}0420e_{t-1}+1{,}3015e_{t-4}+1{,}3562e_{t-5}-0{,}3474e_{t-8}-0{,}3620e_{t-9}\end{aligned} \tag{7}$$

TABLE 4. Represent Parameters Estimators of ARIMA(1,0,1)x(2,1,2)4 with Constant.

Parameter	Estimate	Stnd. Error	T	P-value
ϕ_1	0.615616	0.179238	3.43463	0.001810
θ_1	1.04207	0.035612	29.2618	0.000000
Φ_1	1.00889	0.12846	7.85372	0.000000
Φ_2	-0.626539	0.1128	-5.55442	0.000005
Θ_1	1.30152	0.25145	5.17605	0.000016
Θ_2	-0.34738	0.255548	-1.35935	0.184513
Mean	49.3077	1.99524	24.7126	0.000000
Constant	11.7064			

5. FORECASTING ARRIVAL TOURISTS

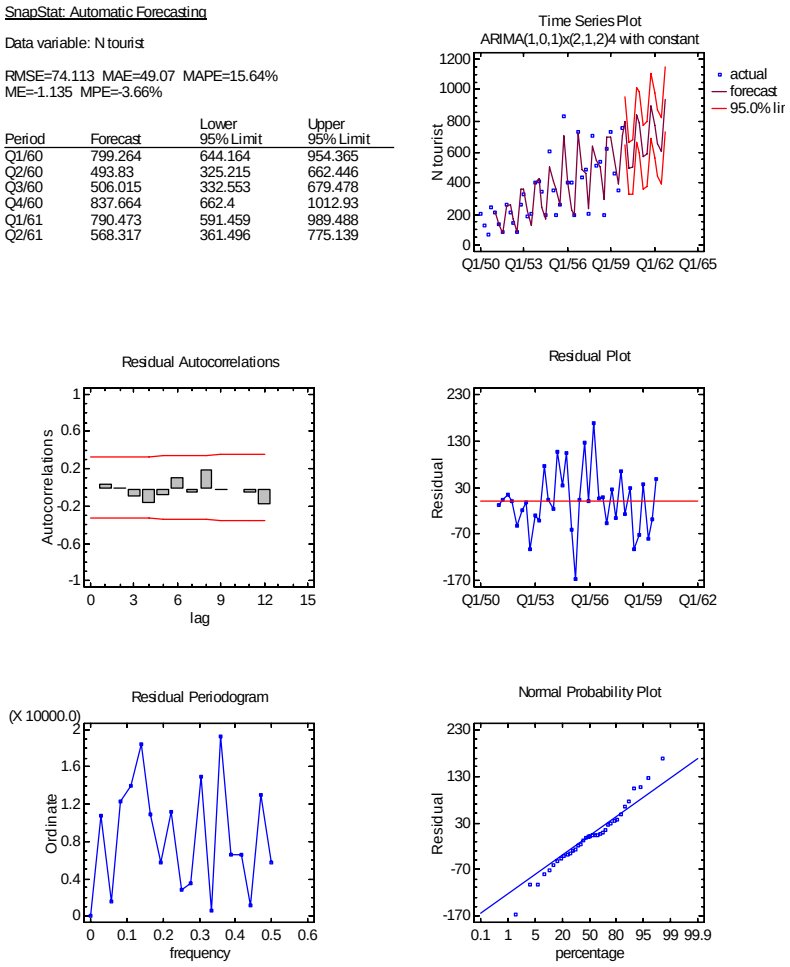

FIGURE 3. Forecasting the arrival tourists.

6. CONCLUSIONS

From the previous results we conclude that

- The best Seasonal ARIMA model is ARIMA (1,0,1)x(2,1,2)4 with constant.

- Although the south west of Algeria possesses diverse and different tourism product the number of tourists is very low compared to Morocco and Tunisia
- It seems that Algeria has not yet established a real marketing tourism strategy able to respond to the real needs and wants of tourists.
- Algeria has to support and enhance the tourism products mainly in the south where it has comparative advantages.

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APPENDIX. SOME PHOTO OF TOURISTICS PLACES

FIGURE. Taghit.

FIGURE. Taghit.

FIGURE. Beni Abbes.