زانكۆی سەلاحەدین - هەولێر

Salahaddin University-Erbil

TIME SERIES STUDY ON

ALTUNSA OIL IN TEAM MART MARKET BEFORE AND AFTER ADVERTISEMENT.

By

Solin hikmat hussen

sara salah wali

Supervised By

Dr.Mohammed Abdulmajeed Badal

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بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

وَهُوَ الَّذِي أَنزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجْنَا بِهِ نَبَاتَ كُلِّ شَيْءٍ
فَأَخْرَجْنَا مِنْهُ خَضِرًا نُّخْرِجُ مِنْهُ حَبًّا مُّتَرَاكِبًا وَمِنَ النَّخْلِ مِن
طَلْعِهَا قِنْوَانٌ دَانِيَةٌ وَجَنَّاتٍ مِّنْ أَعْنَابٍ وَالزَّيْتُونَ وَالرُّمَّانَ
مُشْتَبِهًا وَغَيْرَ مُتَشَابِهٍ ۗ انظُرُوا إِلَىٰ ثَمَرِهِ إِذَا أَثْمَرَ وَيَنْعِهِ ۚ إِنَّ
فِي ذَٰلِكُمْ لَآيَاتٍ لِّقَوْمٍ يُؤْمِنُونَ (99)

Dedication

We dedicated this thesis to :

- Our dear parents.

- Our dear brothers and sisters.
- Our dear supervisor (Dr.Mohammed Abdulmajeed Badal), and to those who taught us andeven a letter.

Researchers….

Acknowledgement

First of all thanks to God for giving us health and wisdom to achieve this research. Honestly, we are extremely grateful to Our supervisor(Dr. Mohammed Abdulmajeed Badal) for his invaluable support, encouraging comments, constructive suggestions and critical review of the different chapters of this work. We have learned more than we ever thought imaginable. We will never forget the skills he made us learn on our own. The department of Statistics deserves our appreciation for giving us this opportunity to get the degree of Bachelor of Science in Statistics. We are very grateful to all the lecturers in our department who helped us during our study. Many thanks to our wonderful families, especially our Fathers, Mothers, who helped us through the hardest of times to make it to where we are today. Finally we would like to thank all our trends who helped us to complete this research.

Abstract

The aims of this study were to develop and measure the validity of educational research that can be able to input to the quality of research of the students/researchers of Salahaddin University. Statistical Analysis has been used to provide solutions to complex problems in the market's. We conducted a time series study on altunsa oil in team mart market before and after advertisement. We collected the data in two ways: first, before the advertisements, and second, after the advertisements. The goal of the study was to determine whether or not the advertisements had an impact on sales. We did this using the paired sample T-test, as well as by forecasting the data based on time series and building models for the data. The main features of the project are an input data.

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Chapter one

1. Introduction:

The analysis of time series applied for too many fields. In economics the recorded history of the economy is often in the form of time series. Economic behavior is quantified in same time series as the consumer price index, unemployment, gross natural product, population, and production. The statistical theory of time series has been an area of considerable activity in recent years.

It is generally believed that the degree of financial transactions in and out of a country depends on a number of factors prevailing in that country. Since the advent of money, the world has always experienced the movement of money from one country to another due to economic, cultural, social, political and other reasons. The Central Bank in every country usually keeps a record of such money transactions through various financial intermediaries. Every country has its own money, which can only be accepted for use within its territory. Hence, the establishment of foreign money became necessary. Foreign money is the money of other countries of the world which serves as money in the foreign exchange market.

1.2. Aim of study:

The study's aim is whether to investigate the impacts of the advertisements on sales altunsa oil in team mart market affected sales or not. Also, we take time series to find the model and its effect and then forecast for data.

Chapter Two
Theoretical part

2.1 Time series:

A time series is a set of correlated observations generated (made) sequentially in time. A discrete-time series is one in which the set T_0 of times at which observations are made is a discrete set, as is the case for example when observations are made at fixed time intervals. Continuous-time series are obtained when observations are recorded continuously over some time interval, e.g. when T_0 = [0, 1]. We shall use the notation (t) rather than X, if we wish to indicate specifically that observations are recorded continuously.

2.2 Stationary Time Series:

A stochastic process $X_t$is called stationary if it has time-invariant first and second moments. In other words, X_t is stationary if the first condition means that all members of a stationary stochastic process have the same constant mean. Hence, a time series generated by a stationary stochastic process must fluctuate around a constant mean and does not have a trend, for example. The second condition ensures that the variances are also time invariant because, for k = 0, the variance ${\sigma^2}_x$ = E $[(X_t - \mu_x)^2]$ = γ_0 does not depend on t. Moreover, the covariances E [($X_t - \mu_x$) ($X_{t-k} - \mu_x$)] = γ_k do not depend on t but just on the distance in time k of the two members of the process.

2.3: Time Series Models:

A time series model for the observed data $\{X_t\}$ is a specification of the joint distributions (or possibly only the means and covariances) of a sequence of random Variables $\{X_t\}$ of which $\{X_t\}$ is postulated to be a realization.

2.4: Autoregressive Model (AR):

A process $\{X_t\}$ is said to be an autoregressive model of order p, abbreviated AR (p), is of the form

$$X_t = \emptyset_1 X_{t-1} + \emptyset_2 X_{t-2} + \ldots\ldots + \emptyset_p X_{t-p} + \epsilon_t \qquad \ldots 1$$

Where X_t is stationary, $\emptyset_1, \emptyset_2, \ldots\ldots, \emptyset_p$ are constants $(\emptyset_p \neq 0)$.

2.5: Moving Average Model (MA):

A process $\{X_t\}$ is said to be the moving average model of order q, or MA (q) model, is defined to be

$$X_t = \epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} - \ldots - \theta_q \epsilon_{t-q} \qquad \ldots 2$$

Where there are q lags in the moving average and $\theta_1, \theta_2, \ldots\ldots, \theta_q (\theta_q \neq 0)$ are parameters.

2.6: Autoregressive Moving Average (ARMA) Model:

The process $\{X_t$, t = 0, ± 1, ± 2 , ...}is said to be an ARMA(p, q) process if $\{X_t\}$ is stationary and if for every t,

$$X_t - \emptyset_1 X_{t-1} - \cdots - \emptyset_p X_{t-p} = \epsilon_t + \theta_1 \epsilon_{t-1} + \cdots + \theta_q \epsilon_{t-q} \quad \dots \quad 3$$

Where $\{\epsilon_t\} \sim N(0,\sigma^2)$. We say that $\{X_t\}$ is an ARMA (p, q) process with mean μ. If $\{X_t$- μ} is an ARMA (p, q) process.

2.7: Autoregressive Integrated Moving Average Model (ARIMA):

A time series $\{X_t\}$ is said to follow an integrated autoregressive moving average model if the d^{th} difference $Z_t = \nabla^d X_t$ is a stationary ARMA process. If $\{Z_t\}$ follows an ARMA (p, q) model, we say that $\{X_t\}$ is an ARIMA (p, d, q) process. Fortunately, for practical purposes, we can usually take d = 1 or at most

Consider then an ARIMA (p, 1, q) process. With $Z_t = X_t - X_{t-1}$, we have

$$Z_t = \emptyset_1 Z_{t-1} + \emptyset_2 Z_{t-2} + \dots + \emptyset_p Z_{t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} \dots - \theta_q \epsilon_{t-q} \quad \dots 4$$

2.8: Stages of Time Series Model Building:

A three-step iterative procedure is used to build an ARIMA model. First, a tentative model of the ARIMA class is identified through analysis of historical data. Second, the unknown parameters of the model are estimated. Third, through residual analysis, diagnostic checks are performed to determine the adequacy of the model, or to indicate potential improvements. We shall now discuss each of these steps in more detail.

2.8.1 : Parameter Estimation:

There are several methods such as methods of moments, maximum likelihood, least squares, and Yule-Walker estimation that can be employed to estimate the parameters in the tentatively identified model.

2.8.2 : Verification of Model:

The verification step of box-jenkins methodology is relatively elaborate. Applying various diagnostic instruments, the compatibility of the estimated model with the analyzed data shoud be verified. [10]

2.8.3 : Forecasting:

Once an appropriate time series model has been fit, it may be used to generate forecasts of future observations. If we denote the current time by T, the forecast for $X_{T+\tau}$ is called the τ -period-ahead forecast and denoted by $\hat{X}_{T+\tau}$ (T). The standard criterion to use in obtaining the best forecast is the mean squared error for which the expected value of the squared forecast errors, E[($X_{T+\tau}$ - $\hat{X}_{T+\tau}$ (T))^2] = E[e_T (τ)^2], is minimized. It can be shown that the best forecast in the mean square sense is the conditional expectation of $X_{T+\tau}$given current and previous observations, that is, X_T, X_{T-1} , …:

$$\hat{X}_{t+\tau}(t) = E(X_{t+\tau} | X_t, X_{t-1}, \ldots) \quad \ldots 5$$

Consider, for example, an ARIMA (p, d, q) process at time T+ τ (i.e., τ period in The future):

$$X_{t+\tau} = \delta + \sum_{i=1}^{p+d} \emptyset_i X_{t+\tau-i} + \epsilon_{T+\tau} - \sum_{i=1}^{q} \theta_i \epsilon_{T+\tau} \quad \ldots 6$$

And Box Jenkins described using the flow chart shown in Figure 1

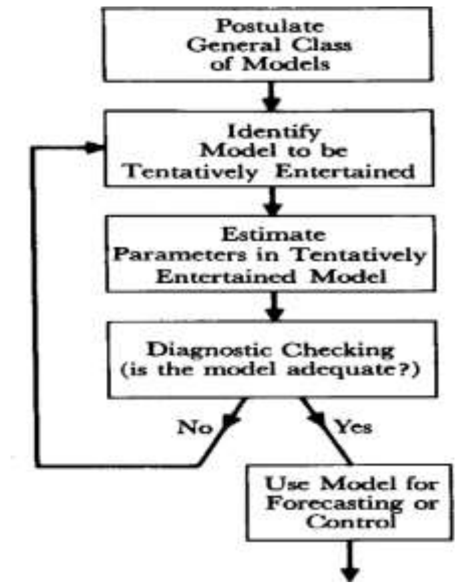

Figure 1: Box-Jenkins methodology of model building.

2.9. Paired sample t-test

The paired sample t.test compares the means of two measurements taken from the same individual object. Or related units

Assumptions for the paired sample t-test:

1. The sample sizes must be equal{n1=n2}
2. The observations must be paired (e.g. Before xi and yi studies, different measuring devices (xi,yi,etc.)which means that the samples are no longer independent.

The test statistic: $Cal.t = \frac{\bar{d} - \mu_d}{S_d / \sqrt{n}}$

di: Difference between each pair of observations.

d: Mean of difference between each pair of observations.

S_d: The standard deviation of these difference.

Chapter Three
Practical Part

3.1. Introduction.

We are going to get data from the market that we are doing scientific research on that we have received the data in two ways 60 days before the advestissement and 60 days after the advertising requests our data. We do the paired sample t-test to know this advertising affected sales and we take time series to find its effect and forecasting for data. we use a stratigraphic and SPSS program for the analysis of our data.

Table 3.1: Data

date 1	Before advertisment	date 2	after advertisement
7/1/2023	6	9/10/2023	10
7/2/2023	12	9/11/2023	20
7/3/2023	10	9/12/2023	14
7/4/2023	5	9/13/2023	9
7/5/2023	15	9/14/2023	25
7/6/2023	4	9/15/2023	9
7/7/2023	7	9/16/2023	13
7/8/2023	6	9/17/2023	10
7/9/2023	4	9/18/2023	8
7/10/2023	9	9/19/2023	14
7/11/2023	25	9/20/2023	30
7/12/2023	8	9/21/2023	9
7/13/2023	4	9/22/2023	7
7/14/2023	17	9/23/2023	22
7/15/2023	11	9/24/2023	15
7/16/2023	9	9/25/2023	16
7/17/2023	8	9/26/2023	10
7/18/2023	30	9/27/2023	41
7/19/2023	10	9/28/2023	16
7/20/2023	14	9/29/2023	18
7/21/2023	6	9/30/2023	8
7/22/2023	10	10/1/2023	13
7/23/2023	15	10/2/2023	21
7/24/2023	5	10/3/2023	8
7/25/2023	14	10/4/2023	13
7/26/2023	24	10/5/2023	30
7/27/2023	4	10/6/2023	10
7/28/2023	29	10/7/2023	41
7/29/2023	9	10/8/2023	12
7/30/2023	12	10/9/2023	16
7/31/2023	35	10/10/2023	54
8/1/2023	10	10/11/2023	12
8/2/2023	12	10/12/2023	10
8/3/2023	7	10/13/2023	12
8/4/2023	3	10/14/2023	9
8/5/2023	11	10/15/2023	16

8/6/2023	15	10/16/2023	32
8/7/2023	8	10/17/2023	14
8/8/2023	10	10/18/2023	9
8/9/2023	5	10/19/2023	15
8/10/2023	16	10/20/2023	25
8/11/2023	16	10/21/2023	21
8/12/2023	9	10/22/2023	7
8/13/2023	6	10/23/2023	13
8/14/2023	14	10/24/2023	17
8/15/2023	7	10/25/2023	6
8/16/2023	17	10/26/2023	18
8/17/2023	9	10/27/2023	15
8/18/2023	6	10/28/2023	5
8/19/2023	18	10/29/2023	16
8/20/2023	10	10/30/2023	12
8/21/2023	9	10/31/2023	10
8/22/2023	21	11/1/2023	25
8/23/2023	19	11/2/2023	36
8/24/2023	32	11/3/2023	54
8/25/2023	5	11/4/2023	8
8/26/2023	11	11/5/2023	11
8/27/2023	22	11/6/2023	40
8/28/2023	6	11/7/2023	12
8/29/2030	20	11/8/2023	21

3.2. Application of the data.

First, take the paired sample t-test compares the means for Before advertisement-After advertisement

H0: $\mu d = 0$

H1: $\mu d \neq 0$

Table 3.2. Paired sample t-test

	Paired Samples Test						
				95% Confidence Interval of the Difference			
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df
Pair 1 before -after	-5.200	5.151	.665	-6.531	-3.869	-7.819	59

Result: According to the results we found that we reject H0 , because P-value less than the alpha =0.05. It means publicity it has a good effect on sales that makes your daily sales more.

3.2.1. Time Series Analysis.

The purpose of time series analysis is to select the best suitable models for the time series, and then to take advantage of these models for the purposes of forecasting and control.

3.2.1.1. Time series plot.

The first step in analyzing time series is drawing it to identify some of its primary characteristics. By looking at the first and second time series as shown in Figures (1-3) to (2-3) respectively, it is noted that there are differences in the shape of the oscillations of the two-time series, which means their instability.

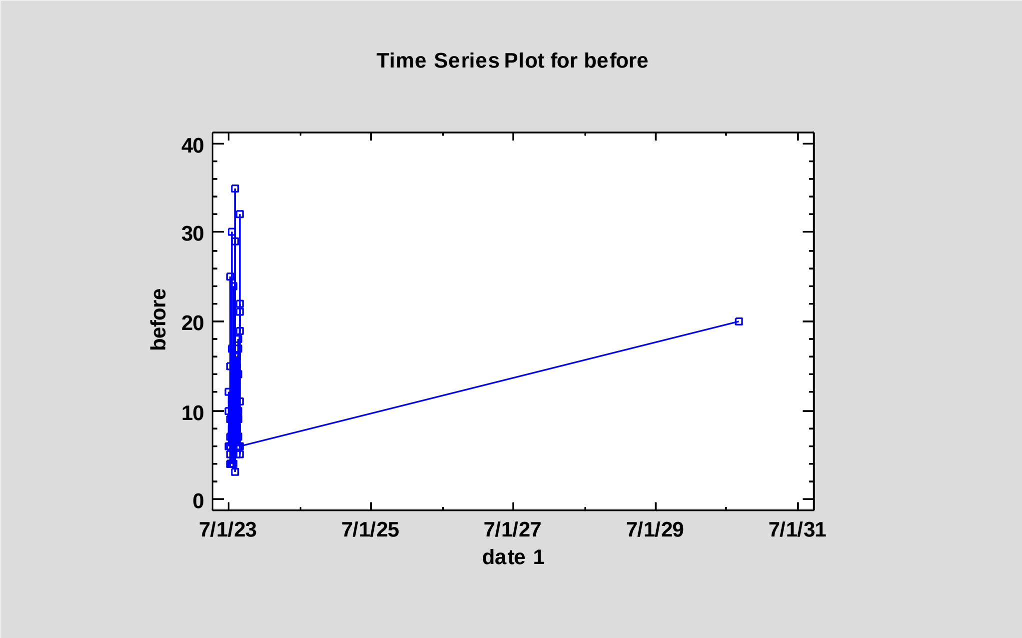

Figure3.1. Time series plot before advetisement

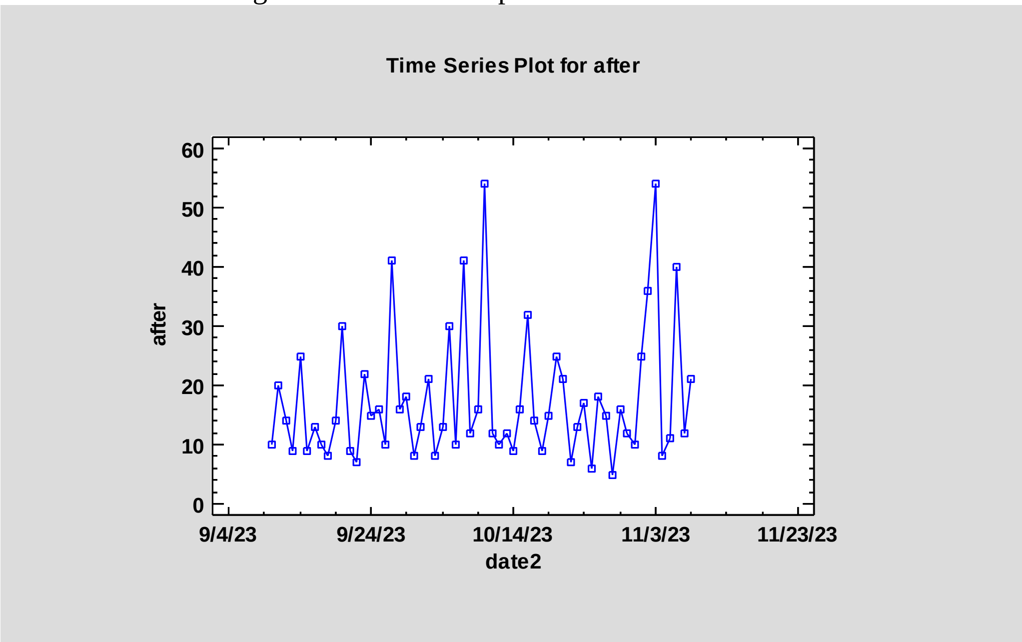

Figure3.2. Time series plot after publicity

1- Stationary.

Just looking at the time series graph is not sufficient to know the stability of the series, so we resort to the values and plotting of the autocorrelation coefficients and partial autocorrelation of the two converted time series as shown in Tables (3.3) to (3.8) and Figures (3.3) to (3.6), respectively. Where it is noted that the autocorrelation values of the two transformed series are all within the following confidence limits:

Table 3.3. Estimated Autocorrelations for residuals (Before).

			Lower 95.0%	*Upper 95.0%*
Lag	*Autocorrelation*	*Stnd. Error*	*Prob. Limit*	*Prob. Limit*
1	-0.166929	0.129099	-0.253031	0.253031
2	0.00466161	0.132648	-0.259986	0.259986
3	0.216033	0.132651	-0.259991	0.259991
4	-0.182035	0.13839	-0.271241	0.271241
5	0.203363	0.142325	-0.278953	0.278953
6	-0.0357647	0.147088	-0.288289	0.288289
7	-0.105359	0.147233	-0.288573	0.288573
8	0.169901	0.148485	-0.291025	0.291025
9	-0.182281	0.15169	-0.297308	0.297308
10	-0.0192313	0.155298	-0.304379	0.304379
11	0.0257335	0.155338	-0.304457	0.304457
12	-0.0991879	0.155409	-0.304596	0.304596
13	0.135677	0.15646	-0.306657	0.306657
14	-0.0166731	0.158409	-0.310476	0.310476
15	-0.100841	0.158438	-0.310534	0.310534
16	-0.038273	0.159504	-0.312623	0.312623
17	0.0105861	0.159657	-0.312923	0.312923
18	-0.172492	0.159669	-0.312946	0.312946
19	0.0228825	0.162745	-0.318975	0.318975
20	-0.0962257	0.162799	-0.31908	0.31908

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This table shows the estimated autocorrelations between values of before at various lags. The lag k autocorrelation coefficient measures the correlation between values of before 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. In this case, none of the 24 autocorrelations coefficients are statistically significant, implying that the time series may well be completely random (white noise). You can plot the autocorrelation coefficients by selecting Autocorrelation Function from the list of Graphical Options.

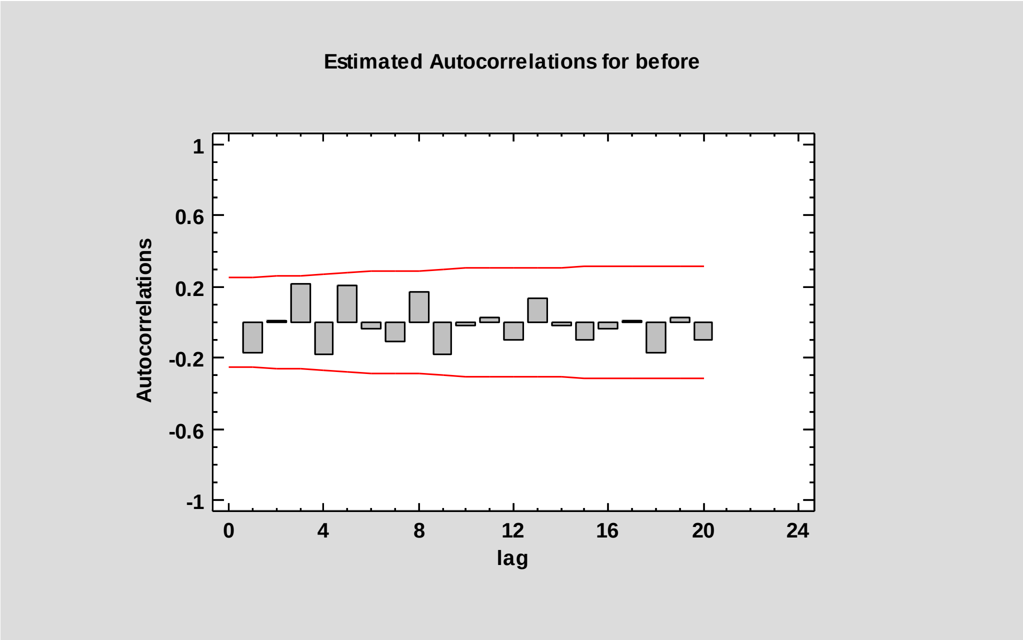

Figure 3.3. Autocorrelations for residuals (Before).

Table 3.4. Estimated Partial Autocorrelations for residuals (Before).

Estimated Partial Autocorrelations for before

Lag	Partial Autocorrelation	Stnd. Error	Lower 95.0% Prob. Limit	Upper 95.0% Prob. Limit
1	-0.166929	0.129099	-0.253031	0.253031
2	-0.0238686	0.129099	-0.253031	0.253031
3	0.219071	0.129099	-0.253031	0.253031
4	-0.118639	0.129099	-0.253031	0.253031
5	0.168784	0.129099	-0.253031	0.253031
6	-0.0323943	0.129099	-0.253031	0.253031
7	-0.0605361	0.129099	-0.253031	0.253031
8	0.0642535	0.129099	-0.253031	0.253031
9	-0.107995	0.129099	-0.253031	0.253031
10	-0.0665853	0.129099	-0.253031	0.253031
11	-0.0402801	0.129099	-0.253031	0.253031
12	0.00118351	0.129099	-0.253031	0.253031
13	0.0813412	0.129099	-0.253031	0.253031
14	0.0542867	0.129099	-0.253031	0.253031
15	-0.0690708	0.129099	-0.253031	0.253031
16	-0.153263	0.129099	-0.253031	0.253031
17	0.0408165	0.129099	-0.253031	0.253031
18	-0.211869	0.129099	-0.253031	0.253031
19	-0.0156021	0.129099	-0.253031	0.253031
20	-0.106842	0.129099	-0.253031	0.253031

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This table shows the estimated partial autocorrelations between values of before at various lags. The lag k partial autocorrelation coefficient measures the correlation between values of before at time t and time t+k having accounted for the correlations at all lower lags. It can be used to judge the order of autoregressive model needed to fit the data. 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. In this case, none of the 24 partial autocorrelations coefficients is statistically significant at the 95.0% confidence level. You can plot the partial autocorrelation coefficients by selecting Partial Autocorrelation Function from the list of Graphical Options.

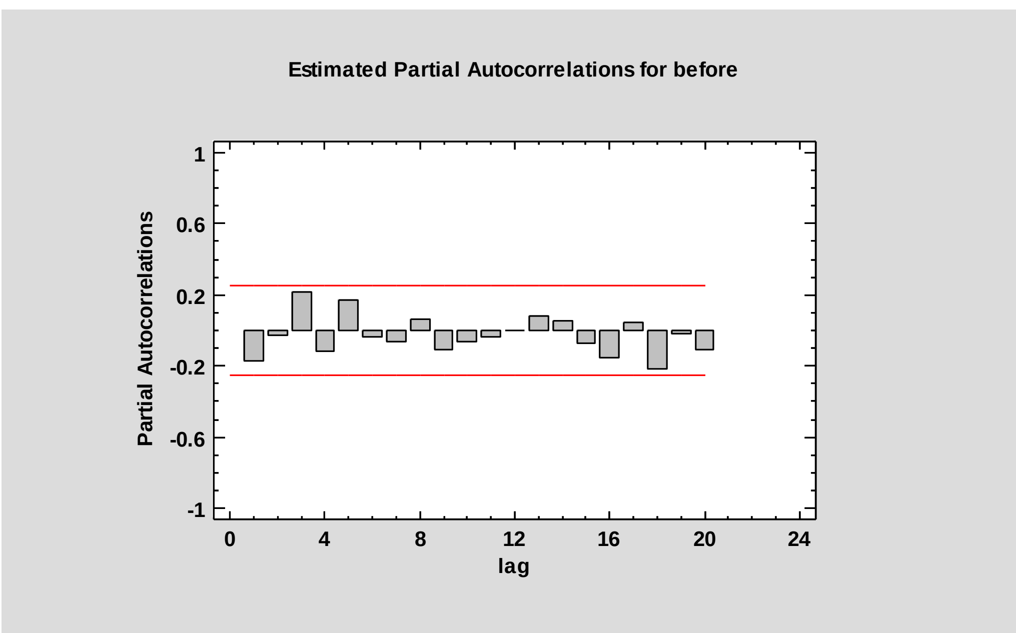

Figure 3.4. Partial Autocorrelations for residuals (Before).

Table 3.5. Estimated Autocorrelations for residuals (After).

			Lower 95.0%	Upper 95.0%

Lag	Autocorrelation	Stnd. Error	Prob. Limit	Prob. Limit
1	-0.0705988	0.129099	-0.253031	0.253031
2	-0.120984	0.129741	-0.254289	0.254289
3	0.181195	0.131608	-0.257948	0.257948
4	-0.091871	0.135702	-0.265972	0.265972
5	0.0806693	0.136735	-0.267996	0.267996
6	-0.0567936	0.137526	-0.269546	0.269546
7	-0.107794	0.137916	-0.270311	0.270311
8	0.0246159	0.139313	-0.27305	0.27305
9	-0.0992865	0.139386	-0.273192	0.273192
10	0.0202912	0.14056	-0.275492	0.275492
11	-0.0131531	0.140608	-0.275588	0.275588
12	-0.114745	0.140629	-0.275628	0.275628
13	0.191928	0.142181	-0.27867	0.27867
14	-0.00208599	0.146435	-0.287008	0.287008
15	-0.172245	0.146436	-0.287009	0.287009
16	-0.0481794	0.149774	-0.293553	0.293553
17	0.0782437	0.150032	-0.294059	0.294059
18	-0.0601461	0.150711	-0.295389	0.295389
19	-0.0609696	0.15111	-0.296172	0.296172
20	-0.0903148	0.15152	-0.296974	0.296974

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This table shows the estimated autocorrelations between values of after at various lags. The lag k autocorrelation coefficient measures the correlation between values of after 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. In this case, none of the 24 autocorrelations coefficients are statistically significant, implying that the time series may well be completely random (white noise). You can plot the autocorrelation coefficients by selecting Autocorrelation Function from the list of Graphical Options.

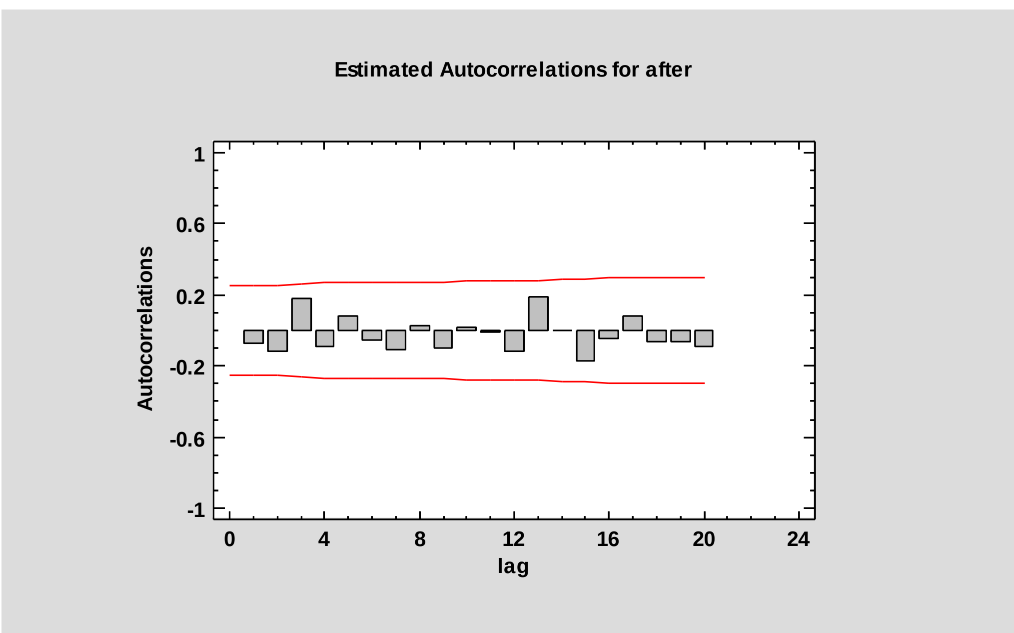

Figure 3.5. Autocorrelations for residuals (After).

Table 3.6. Estimated Partial Autocorrelations for residuals (After)

	Partial		Lower 95.0%	Upper 95.0%
Lag	Autocorrelation	Stnd. Error	Prob. Limit	Prob. Limit
1	-0.0705988	0.129099	-0.253031	0.253031
2	-0.126599	0.129099	-0.253031	0.253031
3	0.166111	0.129099	-0.253031	0.253031
4	-0.0874537	0.129099	-0.253031	0.253031

5	0.118838	0.129099	-0.253031	0.253031
6	-0.107957	0.129099	-0.253031	0.253031
7	-0.0596211	0.129099	-0.253031	0.253031
8	-0.0504858	0.129099	-0.253031	0.253031
9	-0.0826243	0.129099	-0.253031	0.253031
10	0.0210068	0.129099	-0.253031	0.253031
11	-0.0367257	0.129099	-0.253031	0.253031
12	-0.0747914	0.129099	-0.253031	0.253031
13	0.157553	0.129099	-0.253031	0.253031
14	0.000269819	0.129099	-0.253031	0.253031
15	-0.127931	0.129099	-0.253031	0.253031
16	-0.161126	0.129099	-0.253031	0.253031
17	0.0823127	0.129099	-0.253031	0.253031
18	-0.0964942	0.129099	-0.253031	0.253031
19	-0.0240596	0.129099	-0.253031	0.253031
20	-0.131867	0.129099	-0.253031	0.253031

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This table shows the estimated partial autocorrelations between values of after at various lags. The lag k partial autocorrelation coefficient measures the correlation between values of after at time t and time t+k having accounted for the correlations at all lower lags. It can be used to judge the order of autoregressive model needed to fit the data. 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. In this case, none of the 24 partial autocorrelations coefficients is statistically significant at the 95.0% confidence level. You can plot the partial autocorrelation coefficients by selecting Partial Autocorrelation Function from the list of Graphical Options.

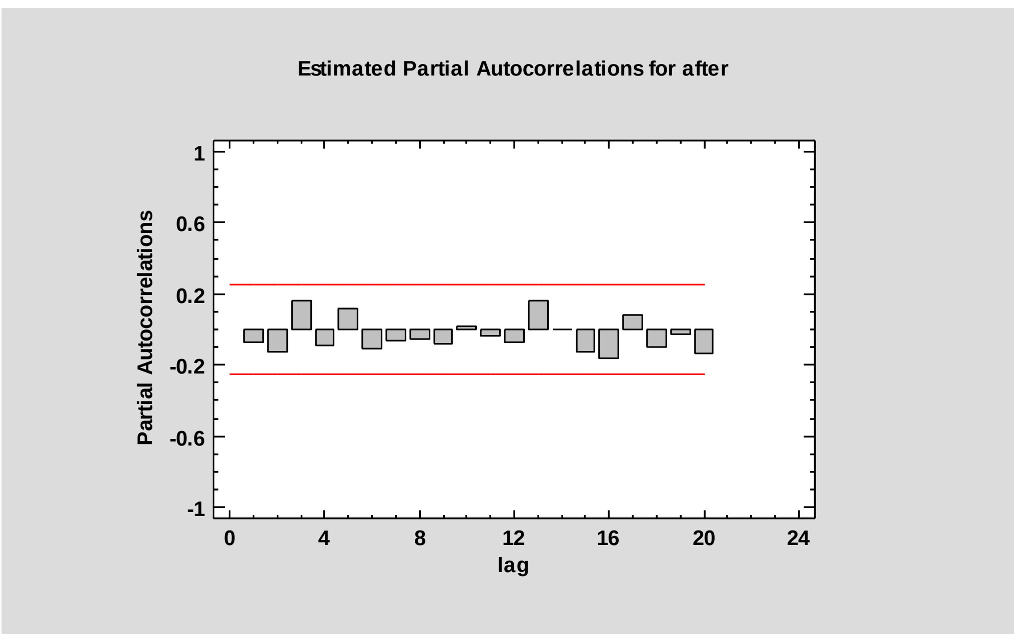

Figure 3.6. Partial Autocorrelations for residuals (After).

3.2.1.2. Choosing Appropriate Model.

After verifying the stability of the converted time series around the mean and variance, we determine the appropriate model by studying the behavior of the autocorrelation and partial autocorrelation functions. However, sometimes these transactions do not show a specific pattern, so eight models are proposed for each time series, as shown in Table (3-7) and (3.8). To choose the best model, the least mean square error (MSE) was used.

Models for Before advertisement Table 3.7. Proposed models and (MSE& AIC) value for time series

Models for befor advertisement
(A) Random walk
(B) Random walk with drift = 0.237288
(C) Constant mean = 12.1833
(D) Simple moving average of 2 terms
(E) Simple exponential smoothing with alpha = 0.0368

(F) Brown's linear exp. smoothing with alpha = 0.0447
(G) Holt's linear exp. smoothing with alpha = 0.1209 and beta = 0.1044
(H) ARIMA(0,1,1)
(I) ARIMA(1,1,1)
(J) ARIMA(0,1,2)
(K) ARIMA(1,1,2)
(L) ARIMA(2,1,1)

3.7. Proposed models and (MSE& AIC) value for time

Series for Before advertisement

Model	RMSE	AIC
(A)	11.2762	4.84539
(B)	11.3705	4.89537
(C)	7.42988	4.04435
(D)	9.44002	4.52325
(E)	7.52144	4.06885
(F)	7.71445	4.11952
(G)	7.87843	4.19492
(H)	7.54309	4.0746
(I)	7.48376	4.09214
(J)	7.48537	4.09257
(K)	7.56032	4.14583
(L)	7.56952	4.14826

Models for after advertisement
(A) Random walk
(B) Random walk with drift = 0.186441
(C) Constant mean = 17.3833
(D) Linear trend = 14.3859 + 0.0982773 t
(E) Simple moving average of 2 terms
(F) Simple exponential smoothing with alpha = 0.0189
(G) Brown's linear exp. smoothing with alpha = 0.0083
(H) Holt's linear exp. smoothing with alpha = 0.1062 and beta = 0.0922
(I) ARIMA(0,1,1)
(J) ARIMA(0,1,2)
(K) ARIMA(1,1,1)
(L) ARIMA(2,1,1)
(M) ARIMA(2,1,2)

Table 3.8. Proposed models and (MSE& AIC) value for time series

Series for after advertisement

Model	RMSE	AIC
(A)	16.2215	5.57267
(B)	16.3596	5.62297
(C)	11.1098	4.84898
(D)	11.0706	4.87525
(E)	14.4871	5.37986
(F)	11.2183	4.86842
(G)	11.2341	4.87125
(H)	11.8284	5.00768
(I)	11.2644	4.87663
(J)	11.3266	4.92098

(K)	11.3322	4.92197
(L)	11.3394	4.95657
(M)	11.1874	4.96291

3.2.1.3. Forecasting.

After verifying the suitability of the diagnosed models, these models are used to predict future values for the two-time series, as shown in Tables (3.14) and (3.15) respectively.

Table 3.9.Predictive Values for Before advertisement

Forecast Table for before

		Lower 95%	*Upper 95%*
Period	*Forecast*	*Limit*	*Limit*
8/30/37	20.2373	-2.52322	42.9978
8/31/44	20.4746	-11.7136	52.6628
9/2/51	20.7119	-18.7105	60.1342
9/3/58	20.9492	-24.5719	66.4702
9/4/65	21.1864	-29.7076	72.0805
9/5/72	21.4237	-34.3279	77.1754
9/7/79	21.661	-38.5576	81.8797
9/8/86	21.8983	-42.4781	86.2748
9/9/93	22.1356	-46.1459	90.4171
9/10/00	22.3729	-49.6022	94.3479
9/12/07	22.6102	-52.8779	98.0982
9/13/14	22.8475	-55.9973	101.692

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This table shows the forecasted values for before. During the period where actual data is available, it also displays the predicted values from the fitted model and the residuals (data-forecast). For time periods beyond the end of the series, it shows 95.0% prediction limits for the forecasts. These limits show where the true data value at a selected future time is likely to be with 95.0% confidence, assuming the fitted model is appropriate for the data. You can plot the forecasts by selecting Forecast Plot from the list of graphical options. You can change the confidence level while viewing the plot if you press the alternate mouse button and select Pane Options. To test whether the model fits the data adequately, select Model Comparisons from the list of Tabular Options

Table 3.10.Predictive Values for Before advertisement

		Lower 95%	*Upper 95%*
Period	*Forecast*	*Limit*	*Limit*
11/9/23	21.1864	-11.561	53.9338
11/10/23	21.3729	-24.9389	67.6847
11/11/23	21.5593	-35.1608	78.2795
11/12/23	21.7458	-43.749	87.2406
11/13/23	21.9322	-51.2932	95.1576
11/14/23	22.1186	-58.0958	102.333
11/15/23	22.3051	-64.3364	108.947
11/16/23	22.4915	-70.1321	115.115
11/17/23	22.678	-75.5642	120.92
11/18/23	22.8644	-80.6919	126.421
11/19/23	23.0508	-85.56	131.662
11/20/23	23.2373	-90.203	136.678

The StatAdvisor

This table shows the forecasted values for after. During the period where actual data is available, it also displays the predicted values from the fitted model and the residuals (data-forecast). For time periods beyond the end of the series, it shows 95.0% prediction limits for the forecasts. These limits show where the true data value at a selected future time is likely to be with 95.0% confidence, assuming the fitted model is appropriate for the data. You can plot the forecasts by selecting Forecast Plot from the list of graphical options. You can change the confidence level while viewing the plot if you press the alternate mouse button and select Pane Options. To test whether the model fits the data adequately, select Model Comparisons from the list of Tabular Options.

Conclusions

Based on the results and their interpretation, the following to number of conclusions can be drawn:

1- The results explained that advertisement has a good effect on sales that makes your daily sales more, According to the paired sample t-test

2- Show the results mode (C) is the best model for advertisement Before series.

3- Show the results model (D) is the best model for advertisement After series.

4- The results explained that publicity After forecasting is better than publicity Before forecasting.

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