# Prediction For the sale of Diyala Electric Industries using time series after excluding the impact of the season of the series

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**Abstract**
The topic of time series is one of the important statistical methods used to predict a number of phenomena that change over time in many economic, administrative, agricultural, commercial fields, etc.
The main focus of this study is to study the effect of many factors that influence the time series, the most important of which is the seasonal change in the time series in terms of the focus the research to eliminate the effect of the season and then predict the future of the phenomenon to predict the time series in order to exclude the effect of the season.
Two statistical methods were used in this study (the method of ratio to the general average) where both methods showed the same results in case of excluding the effect of the season and gave the results of the prediction itself, this indicates the preference of the two methods to predict the case of the time series data affected by the season as data under studying. This study proved that the sales of the company's products lead to an increase in its profits which are all of MI3 (20-40) and MI1 (10-40) because they gave good previous profits to the company and a significant future forecasts for the company's sales. There are some sales from company's products have given fluctuating profits during seasons that are not constant but vary from one season to another (30-90), electric heater, Arcon gas, 33400, 1600 and 11/100). These products should be given some importance for the purpose of eliminating the fluctuation in sales. Other products of the company's products are new sales, During the last year or two up to date, causing not to give them future predictive values due to the final cessation of both (Mkni 1 (10-40) .The results of the study gave the following predictive values after deducting the effect of the season on the company's products sales in order to know the most important profits for future use.

**Key words:** seasonal, season impact, Arcon gas, the general average, regular changes

## 1. Introduction :

The topic of time series is considered as one of the important statistical methods because it includes the interest of many researchers to make decisions in various disciplines to use it for the purposes of predicting phenomena that change over time in many fields, such as the economic and the administrative fields in addition to the industrial, agricultural and trade sectors.
The main focus was on the concept of time series and the goal of studying it, in addition to analyzing the time series and studying the factors affecting it for the purpose of estimating each component of the time series by appropriate statistical methods and adopting them for the purposes of predicting the studied phenomena.

## 2. Research problem :

In order to determine the impact of each component of the time series on the values of the studied phenomenon, and thus the process of separating the components of the series from one another is a difficult process, that‘s why it was necessary to study all the factors affecting the time series.
The aim of measuring the general trend of the time series is to diagnose the factors affecting the general direction of the series and compare it with the direction of the original series, while seasonal changes are considered among the most important factors affecting the time series of the phenomenon, especially “phenomena whose observations are recorded on a quarterly or monthly way. Phenomena whose observations are recorded annually are not affected by this kind of change.

## 3. Research goal :

This research aims to identify the nature of the changes that occur to the values of the phenomenon during a specific period of time and to diagnose the causes that led to the occurrence of the change in the phenomenon and explain them. This research also aims to predict what will happen in terms of changes in the values of the phenomenon in the future.

## 4. The concept of time series: ( 6. 7. 9 )

Time series analysis is considered as one of the mathematical and statistical methods for explaining the nature of phenomena and their behavior through time periods (daily, weekly, and seasonal). Time series are a phenomenon's values arranged according to the time of its occurrence. Time series analysis includes determining the general trend of change in the value of the phenomenon such as seasonal changes and cyclical changes in addition to the irregular or random changes related to the occurrence of unexpected developments such as the occurrence of natural and health disasters or wars and political unrest.

The outcome of these changes determines the direction of the change of the phenomenon with time. The study of time series in terms of building and analyzing models, and then predicting the future has given priority to their application in various fields, accordingly, they have been used in economic planning and in geographical, engineering and physical applications..etc which was characterized by accuracy, comprehensiveness and effectiveness.

Today, the ability to predict many events seems natural, and the prevailing trend these days is the presence of the ability to correctly predict many events that were difficult to predict correctly previously, as the methods of the traditional trend depend on the assumption that the compounds of seasonal cycles are specific and independent of other compounds that constitute the time series.

## 5. Factors affecting the time series:

### *5.1. The general trend:* (1. 4 )

The general trend of the series is defined as "the amount of the impulse in the increase or the decrease, or the stability in the values of a certain phenomenon during a certain period of time."

The aim of measuring the general trend of the time series is to diagnose the factors affecting the general trend of the series and compare that with the direction of the original series, and to determine the growth factor at the level of the series, which is the basis in the process of predicting the behavior of the phenomenon that is under the study in the future.

In addition, the trend measurement general helps us to remove or exclude a trace of the studied values of the phenomenon in order to be able to study the other components of the series. A general form is where the general direction of the series is a straight line or curved or semi-logarithmic or any other shape in light of the time series data. In addition to that, the measurement of the general trend helps us to remove or exclude its trace from the studied phenomenon values so that we can study the other components of the series. Generally, the general direction of the series is a straight line or curved or semi-logarithmic or any other shape in light of the time series data.

### *5.2. Seasonal changes:*

Seasonal changes are among the most important factors affecting the time series of the phenomenon, specifically phenomena whose observations are recorded seasonally or monthly, as phenomena whose observations are recorded annually are not affected by this kind of changes.

In view of the impact of seasonal changes on the course of the time series (whether seasonally or monthly), seasonal changes should be measured in order to exclude or (eliminate) the effect of this type of changes from the values of the studied phenomenon and obtain modified observations of phenomena that are eliminated from the impact of seasonal changes and it is called the modified or (abstracted) observations from the impact of seasonal change.

### *5.3. Cyclical changes :*

Cyclical changes are defined as "long-term movements that repeat up and down" on the general trend line of the time series of a phenomenon.

One of the most important causes that lead to the occurrence of periodic changes in the time series of phenomena of an economic or commercial nature are the economic causes, so this type of changes is called the economic cycles.

The successive periods of economic phenomena reflect the recession or economic prosperity that characterize the economies of some countries. Periodic changes occur regularly, as a result of the affection of the time series by cyclical factors and with the smallest number of seasonal changes, for example the periods of rainfall and their quantities which vary from one year to another as well as the price fluctuations for some durable commodities.

It is possible to obtain one cycle of a time series between every two tops or two bottoms on the series curve, which requires that the time series be with long periods of time in order to repeat the occurrence of periodic changes, and we need more than six complete cycles of observation to estimate this type of changes.

***5.4. Irregular changes* (1. 3. 6. 7)**

It is the changes that cannot be controlled or predicted in future periods of time. This type of change is considered as one of the simplest factors affecting the time series, because its errors may occur as a result of slight accidental changes that the causes of their occurrence cannot be controlled.

Irregular changes occur because of causes that cannot be accurately predicted, for example: earthquakes, volcanoes, floods, hurricanes, fires, or wars. These changes are sometimes called random or accidental changes.

**6. Estimation methods: (1. 3. 8)**

***6.1. Estimation method for irregular changes :***

To estimate the irregular changes (I), it should be possible to estimate the remaining components of the time series represented by the directional changes (T), seasonal (S) and cyclical (C). To estimate the irregular (random) changes, we follow the coming steps:

1. Using the mathematical form (Y = T * S * C * I) to describe the time series of the studied phenomenon
2. Estimating the equation of the general trend line of the time series, and calculating the estimated directional values ($T = \grave{Y}$)
3. Calculation of adjusted seasonal indicators (S%) of the time series.
4. Estimating the periodic ratios (C%) for the time series.
5. Calculating the irregular percentages (I%) according to the following relationship:

$$I * 100\% = \frac{Y}{T * S\% * C\%} * 100\% \qquad (2\text{-}2)$$

***6.2. Method of estimating the cyclical changes: (10. 12)***

For the purpose of estimating cyclical changes and separating them from the rest of the other components of the time series, we follow these steps-:

1. Using the mathematical form (Y = T * S * C * I) to describe the time series of the phenomenon.
2. Find the estimated general trend line equation $[\grave{Y} = T = \acute{a}_0 + \acute{a}_1 t]$ using the small squares method
3. Finding the percentage of values of the phenomenon (Y) stripped of the effect of the general trend (T) according to the following:

$$\%\frac{Y}{T} * 100\% = \frac{T * S * C * I}{T} * 100 = (S * C * I) * 100\%$$

4. Calculating the adjusted seasonal indicators (% S), using the ratio to trend method.
5. Finding the periodic ratio of the time series, according to the following relationship-:

$$\frac{Y}{T * S} * 100\% = \frac{(S * C * I) * 100\%}{S\%} = (C * I) * 100\%$$

The fifth step involves the estimation of the cyclic changes (C) and the irregular changes (I)) simultaneously, due to the occurrence of irregular changes one time and sporadically during the period, or the nonoccurrence of it during the time period of the phenomenon under study.

## The practical chapter

**7. Introduction**

This chapter was based on the real data taken from the industrial complex in Baqubah city, represented by studying some factors affecting the seasonal time series, and the data change according to the time series change, so it is clear that it is a time series, so: t = 0,1,2 ……. That is, p (t) represents the factors affecting the seasonal time series by (14) products.

This data, which was represented by the value of the seasonal sales in millions of dinars, was drawn to the General Company _ for Electrical Industries in Diyala during the period (2013-2017). And the ratio to the general average method was used to calculate the seasonal indicators for the purpose of finding the forecast values of sales after excluding the season effect 100%. The method below was applied as follows:

### 7.1. *The ratio to the general average method*:

#### 7.1.1. M Electronic 1 i (10 – 40)

The general average of the seasons was calculated as follows:

**The general average of seasons**

$$: \frac{=609239000}{5*4} \frac{\text{Total observations of the phenomenon}}{the\ number\ of\ seasons*the\ number\ of\ years} =$$

evidence of the seasons is calculated according to the following relationship:

$$\text{seasonal evidence}(S\%) = \frac{Q_i \text{seasonal average}}{\text{the overall average of the seasons}} * 100$$

The values of the seasonal evidence calculation for the first semester (Q_1) are as follows:

$=6.746 * 100\% \frac{2055000}{30461950} =$ Seasonal evidence of the first semester$Q_1$

In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table

| *seasons* | Q1 | Q2 | Q3 | Q4 | *Total* |
|---|---|---|---|---|---|
| (S%) | 6.746 | 120.89 | 174.544 | 97.82 | *400* |

The impact of the season is removed from the phenomenon observations according(Y) according to the following relationship- :

$$The\ views\ are\ stripped\ of\ the\ trail\ of\ the\ season = \frac{(Y)\text{phenomenon observation}}{(s\%)Seasonal\ average\ indicator}$$

$$=* 100\%$$

And as shown in Table (1) in the appendix, which represent the predictive values of the time series

#### *7.1.2. the electronic transformer F3 (10-60)*

* The general average of the seasons is calculated as follows:

**The overall average of the seasons**

$$86234500 = \frac{(Y)\text{the total of the phenomenon observations}}{\text{seasons number} * \text{years number}} = \frac{1724690000}{5*4} =$$

* Seasonal evidence is calculated for the seasons according to the following relationship- :

$$Seasonal\ evidence\ (S\%) = \frac{Q_i \text{ the average of the season}}{\text{the general average of seasons}} * 100\%$$

The values of the seasonal evidence calculation for the first semester (Q_1) are as follows:

***The seasonal evidence of the 1st season***$Q_1 = \frac{35200000}{86234500} * 100\% =$ 40.81

In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| seasons | Q1 | Q2 | Q3 | Q4 | Total |
|---|---|---|---|---|---|
| (S%) | 40.82 | 80.15 | *256.06* | 22.96 | *400* |

The impact of the season is removed from the (Y) phenomenon observations according to the following relationship:

**The observation abstracted from the season s affect**

$$= \frac{(Y)\textbf{phenomenon observation}}{\textbf{he adjusted seasonal indicator}} * \mathbf{100}\%$$

appendix, which represents the predictive values of the time series

#### 7.1.3. The transformer F3 (20-60)

*The general average of the seasons is calculated as follows:

seasons general average= $\frac{(Y)\text{ the total of phenomenon observations}}{\text{seasons number}|*\text{years number}} = \frac{8548875000}{5*4} = 427443750$

The seasonal evidence of the seasons is calculated according to the following relationship:

**Seasonal evidence (S%)** $= \frac{\text{the average of the season} Q_i}{\text{the general average of the seasons}} * 100\%$

The values of the seasonal evidence calculation for the first season (Q_1) are as follows:
**The seasonal evidence of the 1st season =**
$\frac{835650000}{427443750} * 100\% = 195.50$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seasons* | Q1 | Q2 | Q3 | Q4 | *Total* |
|---|---|---|---|---|---|
| *(S%)* | 195.50 | *120.38* | 67.85 | 16.27 | *400* |

The impact of the season is removed from the (Y) observations according to the following relationship:

**The season affect abstracted from observations** $\frac{\boldsymbol{phenomenon\ observations(Y)}}{\boldsymbol{the\ adjusted\ seasonal\ indicator}(s\%)} * \mathbf{100}\%$

And as shown in Table (1) in the appendix, which represent the predictive values of the time series

**7.1.4. The transformer F3 (30-90)**
* The general average of the seasons is calculated as follows:
The general average of seasons $= \frac{(Y)\text{the total of phenomenon observations}}{\text{seasons number} * \text{years number}} = \frac{1443680000}{5*4} = 72184000$
The seasonal evidence of seasons is calculated according to the following relationship:
*The seasonal evidence(S%)* $= \frac{the\ season\ s\ average Q_i}{\text{the general average of seasons}} * 100\%$
The values of the calculation of the seasonal evidence for the first season (Q_1) are as follows:
$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1} = \frac{37184000}{72184000} * 100\% = 51.51$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seasons* | Q1 | Q2 | Q3 | Q4 | *Total* |
|---|---|---|---|---|---|
| *(S%)* | 51.51 | 54.62 | *290.76* | 3.103 | *400* |

The impact of the season is removed from the (Y) observations according to the following relationship:
**seasons affect abstracted from the observations**
$$= \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$
And as shown in Table (1) in the appendix, which represents the predictive values of the time series
***7.1.5. The transformer F1 (10-40)***
The general average of the seasons is calculated as follows:
The general average of seasons $= \frac{phenomenon\ s\ obeservations\ total(Y)}{\text{number of years} * \text{number of season}} = \frac{449262000}{5*4} = 224631000$
*Seasonal evidence is calculated for the seasons according to the following relationship- :

*Seasonal evidence (S%)*$= \frac{Q_i \text{ the average of the season}}{\text{the general average of seasons}} * 100\%$

The values of the calculation of the seasonal evidence of the first seasonr (Q_1) are as follows:
***The seasonal evidence of the 1st season***$Q_1 = \frac{165158400}{224631000} * 100\% = 73.52$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 73.52 | *33.71* | 47.42 | 245.34 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (1) in the appendix, which represents the predictive values of the time series

**7.1.6. The Electric Heater:**

* The general average of seasons is calculated as follows:

The general average of seasons $=\frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number}*\text{years number}} = \frac{53100000}{5*4} == 2655000$

The seasonal evidence of seasons is calculated according to the following relationship:

*The seasonal evidence(S%)* $=\frac{the\ season\ s\ averageQ_i}{\text{the general average of seasons}} * 100\%$

The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:

$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1} = \frac{5040000}{26145000} * 100\% =$ 189.830

In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 189.83 | 20.34 | 176.27 | *13.56* | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (1) in the appendix, which represents the predictive values of the time series

**7.1.7 Connect 48 filament wires**

* The general average of seasons is calculated as follows:

The general average of seasons $=\frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number}*\text{years number}} = \frac{703966500}{5*4} =$ *35198325*

The seasonal evidence of seasons is calculated according to the following relationship:

*The seasonal evidence(S%)* $=\frac{the\ season\ s\ averageQ_i}{\text{the general average of seasons}} * 100\%$

The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:

$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1} = \frac{33236250}{35198325} * 100\% =$ 94.425

In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 94.425 | 305.574 | 0 | 0 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (1) in the appendix, which represents the predictive values of the time series

***7.1.8. Gaz O2***

* The general average of seasons is calculated as follows:

The general average of seasons $=\frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number}*\text{years number}} == \frac{28500000}{5*4} =$ *1425000*

The seasonal evidence of seasons is calculated according to the following relationship:

*The seasonal evidence(S%)* $=\frac{the\ season\ s\ averageQ_i}{\text{the general average of seasons}} * 100\%$

The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:
$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season Q_1} = \frac{2910000}{1425000} * 100\% = 204.21$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 204.21 | 191.58 | 4.211 | 0 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (2) in the appendix, which represents the predictive values of the time series

***7.1.9. Arcon gaz Ar***

* The general average of seasons is calculated as follows:
The general average of seasons $= \frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number} * \text{years number}} == \frac{218437500}{5*4} = 10921875$
The seasonal evidence of seasons is calculated according to the following relationship:
*The seasonal evidence(S%)* $= \frac{the\ season\ s\ average Q_i}{\text{the general average of seasons}} * 100\%$
The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:
$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1} = \frac{27250000}{10921875} * 100\% = 249.5$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 249.5 | 123.03 | 27.47 | 0 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (2) in the appendix, which represents the predictive values of the time series

***7.1.10.* the *1600 transfomer***

* The general average of seasons is calculated as follows:
The general average of seasons $= \frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number} * \text{years number}} == \frac{535000000}{5*4} = 26750000$
The seasonal evidence of seasons is calculated according to the following relationship:
*The seasonal evidence(S%)* $= \frac{the\ season\ s\ average Q_i}{\text{the general average of seasons}} * 100\%$
The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:
$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1} = \frac{7000000}{26750000} * 100\% = 26.17$
In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 26.17 | 37.38 | 336.45 | 0 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (12) in the appendix, which represents the predictive values of the time series

***7.1.11.The 11/00 transformer***

* The general average of seasons is calculated as follows:

The general average of seasons $=\frac{\text{the total of phenomenon observations}(Y)}{\text{seasons number}*\text{years number}}==\frac{682500000}{5*4}=$ *34125000*

The seasonal evidence of seasons is calculated according to the following relationship:

*The seasonal evidence(S%)* $=\frac{the\ season\ s\ averageQ_i}{\text{the general average of seasons}}*100\%$

The values of the calculation of the seasonal evidence of the first season (Q_1) are as follows:

$\boldsymbol{Seasonal\ evidence\ for\ the\ first\ season\ Q_1}=\frac{65000000}{34125000}*100\% =$ 190.48

In the same way, seasonal evidence is calculated for the other seasons, as shown in the following table:

| *seansons* | Q1 | Q2 | Q3 | Q4 | *total* |
|---|---|---|---|---|---|
| *(S%)* | 190.48 | 30.47 | 72.38 | 106.7 | *400* |

The impact of the season is removed from the phenomenon observations(Y) according to the following relationship:

$$\textbf{seasons affect abstracted from the observations} = \frac{phenomenon\ observations(Y)}{the\ adjusted\ seasonal\ indicator(s\%)} * 100\%$$

And as shown in Table (1) in the appendix, which represents the predictive values of the time series

**8. Conclusions and recommendations**

***8.1. Conclusions*:**

Through the theoretical and practical chapters devoted for studying the effect of changes in time series analysis, a number of conclusions were reached, as follows:

1- Calculating the seasonal indicators from the seasons by reorganizing the observations of the phenomenon Y that represent sales values. The results of the ratio to the general average method were good and sufficient due to its close proximity to reality, which were recorded in the numbered tables (1,2,3,4,5,6,7,8,9,10,11) in the attached appendix of the research.

2- - The calculation of seasonal indicators for the other seasons gave close results.

3- - The sales values abstracted from the impact of the season (seasonal changes) varied between the increase, the decrease and the stability.

4- Some of the sales of the company's products lead to an increase in its profits, which are both (M3 (20-40) and MF1 (10-40), which were recorded in Tables (5,3) because they gave good past profits to the company and important future predictions for the company's sales

5- Some of the commodities from the sales of the company's products gave fluctuating profits during seasons that are not fixed, but change from one season to another. They are (MF3 (30-90), an electric heater, Alarcon gas, 1600 and 11/100), which are recorded in the numbered tables (4,6,9,10,11). These products must be given a certain importance in order to eliminate the fluctuation in sales.

6- There are other commodities from the sales of the company's products that achieve new sales and gave bad predictions because of their stoppage during the last two years until the study period, which caused to not give them future predictive values due to their final halt. They are (electronic m 1 (10-40), transformer 3F (10-60), Gabel 48 filaments, and O2 gas), which are recorded in the numbered tables (1,2,7,8).

***8.2. recommendations :***

1. The researcher recommends using the ratio to the general trend method to estimate seasonal changes and to estimate the general line equation using the small squares method because it gives the lowest value of the average of squares of error.
2. We also recommend using annual or monthly sales data for the length of time.
3. Some products that were left behind or not produced were giving good profits to the company, inciting the company to re-produce them.
4. Some products give good profits to the company according to fluctuating seasons, it is recommended to stabilize its production and sell it regularly to see their profits in a good way.

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**<u>Appendix</u>**

**Table No. (1**) represents the sales forecasts abstracted from the impact of the season using the method of ratio to the general average of commodities

| **years** | **seasons** | **electronic transformer F1 (40 -10 )** | **electronic transformer F3 (10-60)** | **Transformer F3 (20-60)** | **Transformer F3 (90-30)** | ***Transformer F1 (10-40)*** |
|---|---|---|---|---|---|---|
| | **Q1** | **0** | **61381.074** | **26948281.26** | **43484337.35** | **157090892.7** |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2016 | Q2 | 4249714006 | 685329.789 | 0 | 0 | 23496966.53 |
| | Q3 | 33358229.2 | 607958.7325 | 8591660.857 | 0 | 236600185.9 |
| | Q4 | 6324724.14 | 299653189.7 | 0 | 360920000 | 40350441.27 |
| 2017 | Q1 | 5769916.67 | 121614348 | 108637968.8 | 317435662.7 | 18258066.7 |
| | Q2 | 565475064 | 810016062 | 146285768.6 | 0 | 2310535.042 |
| | Q3 | 0 | 628145126 | 185279166.4 | 347141748730.1 | 171883076.2 |
| | Q4 | 0 | 19395626.7 | 0 | 0 | 67251568.78 |
| 2018 | Q1 | 10153983393 | 11.2560888 | 215586250 | 0 | 162117801.3 |
| | Q2 | 59156018.96 | 996990771.7 | 284886731.4 | 319906363.5 | 3289575.314 |
| | Q3 | 118950341 | 761887093.7 | 233005842.4 | 180652593.5 | 192759563.2 |
| | Q4 | 0 | 287266657.2 | 0 | 0 | 107602510 |
| 2019 | Q1 | 0 | 695391.761 | 0 | 0 | 291746229.4 |
| | Q2 | 0 | 74764962.26 | 0 | 41013636.35 | 24476006.8 |
| | Q3 | 0 | 72950164.21 | 0 | 0 | 243559014.8 |
| | Q4 | 0 | 34575368014 | 0 | 0 | 874270394.1 |
| 2020 | Q1 | 0 | 0 | 0 | 0 | 403948009.9 |
| | Q2 | 0 | 186912405.7 | 0 | 0 | 58742416.33 |
| | Q3 | 0 | 61344456.26 | 0 | 38518676.66 | 278353159.8 |
| | Q4 | 89285025.86 | 101426796 | 0 | 0 | 33679585.64 |

**Table No. (2**) represents the sales forecasts abstracted from the impact of the season using the method of ratio to the general average of commodities

| years | season | Electric heater | Connect 48 filament wires | Gaz O2 | Arcon Gaz Ar | Transformer 1600 | Transformer (11/100) |
|---|---|---|---|---|---|---|---|
| 2016 | Q1 | 0 | 1898305085 | 175992851.5 | 9552933194 | 11272577.29 | 477749999.99 |
| | Q2 | 2348912.714 | 2033898305 | 0 | 0 | 3301962.211 | 0 |
| | Q3 | 7124198.528 | 1762711864 | 0 | 594444445 | 0 | 170625000 |
| | Q4 | 0 | 1355932203 | 0 | 0 | 0 | 0 |
| 2017 | Q1 | 3158497.828 | 1898305085 | 0 | 38214285.71 | 13276591.03 | 58012499.99 |
| | Q2 | 1644234.91 | 0 | 93450440.81 | 0 | 22859738.38 | 63984374.99 |
| | Q3 | 0 | 1762711864 | 0 | 4458333134 | 0 | 0 |
| | Q4 | 0 | 0 | 0 | 0 | 0 | 54843749.98 |
| 2018 | Q1 | 396648.5 | 0 | 0 | 0 | 16032109.92 | 64837499.99 |
| | Q2 | 0 | 0 | 8254138114 | 0 | 28447674.43 | 106640625 |
| | Q3 | 0 | 0 | 0 | 14861111.11 | 0 | 0 |
| | Q4 | 0 | 13559322.3 | 0 | 0 | 0 | 670312499.98 |
| 2019 | Q1 | 0 | 1898305085 | 0 | 0 | 14028096.18 | 0 |
| | Q2 | 3131883.619 | 2033898305 | 0 | 0 | 0 | 0 |
| | Q3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Q4 | 0 | 0 | 0 | 0 | 0 | 304687491 |
| 2020 | Q1 | 0 | 1898305685 | 0 | 0 | 0 | 0 |
| | Q2 | 0 | 0 | 0 | 191071428.6 | 0 | 0 |
| | Q3 | 0 | 0 | 0 | 14861111.11 | 54609375 | 0 |
| | Q4 | 0 | 0 | 0 | 0 | 0 | 18281249.94 |