

Time Series: An Application to Predict the Demand and Supply

*¹ LEO ANTO TA, ²Kona Vijaya Suseela and ³Sharmila K

*^{1,2,3} School of Science, Department of Mathematics, St. Francis De Sales College, Bangalore, Karnataka, India.

Article Info.

E-ISSN: 2583-6528
Impact Factor (SJIF): 5.231
Peer Reviewed Journal
Available online:
www.alladvancejournal.com

Received: 20/Feb/2024
Accepted: 23/Mar/2024

Abstract

Economics is a main stepping stone of a country. How THE Growth in the economic field is gradually increasing according to the fact that only the country will become developed country. As a citizen of our country it's our duty to understand the economic state and also contribute something into the economy of our country. The multinational companies of a country are a main part of that country to develop the economic strength of the country. How the production and sale of one company is increasing because only they can help their country to be more economically stable. This is a review paper about how the time series method we can use in the field of Economics to predict the demand and supply. And also this paper is a novel study about the demand supply and the price of commodities of respected companies and how the time series method we can apply for finding or predicting the demand after some years. And also this paper aims to predict the supply and also to check the state of equilibrium by the people who all are doing business or in the field of marketing to understand that we can use this method to predict the demand and supply changes in the upcoming years. By that they can take initiatives and effective changes for making their business or the field of marketing into success and through they can help the country.

*Corresponding Author

LEO ANTO TA
 School of Science, Department of Mathematics, St. Francis De Sales College, Bangalore, Karnataka, India.

Keywords: Demand, price, timeseries, relation between demand and price, Market equilibrium, prediction of demand and supply

Introduction

Strong Decision making is one of the important values in one's life. Not only in one's life but also it will make big differences in the corporate world also. How can they make a good decision? is the important thing that we have to discuss. This paper is a Study about the method of good prediction of the demand of a commodity by the method of time series. It will help the companies as well as the sellers to understand the demand of the upcoming years and they can arrange their production and sale according to that.

The paper starts with the basic preliminaries like the definitions of demand, supply and the relation between supply and demand etc. And gradually the paper will move to the data interpretation of the specific commodity after that by using the method of time series to find out the demand and supply for the upcoming years. This paper is mainly using the time series method especially in the time series method, the

method of moving averages and also ARIMA (Auto regressive integrated moving average).

By the conclusion of the paper the readers will get a basic knowledge about the demand, supply and the relation of price between demand and supply and also the equilibrium state and also the way of predicting the demand and supply by the usage of time series method especially the method of moving averages.

Demand and Supply

In the field of Economics demand and supply has a significant role. Because both of these are the main two factors which help the economy to grow up, both are interrelated also. There is a significant relation between supply and demand. This relation will lead the economy into market equilibrium.

Demand is the ability or interest of a consumer to purchase a commodity by the influence of his/her income, life

atmosphere and also the price of the commodity. The main factor which decides the demand is price and also the income of the consumer. How the price is related to the demand? If the price of a commodity increases automatically the demand also will be decreasing. If the price is decreasing gradually the demand will increase. So the price and the demand have an inverse relationship.

Supply is mainly about the production of commodities. How much the company is producing and supplying the commodity to the retail shops is mainly about the supply. Supply also has the main role in the economy. Like demand, supply is also related to price. If the price increases the supply also will increase. If the price decreases the supply also will decrease. Because the companies are mainly aiming for their profit, not for loss. So according to the increase in price of the commodity then the companies will make an increase in the supply also. Therefore supply and price have a positive relationship.

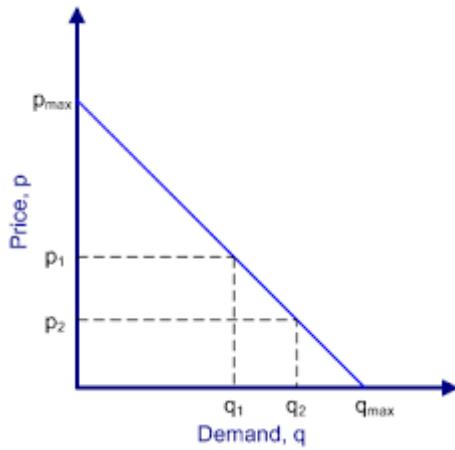


Fig 1: Demand curve

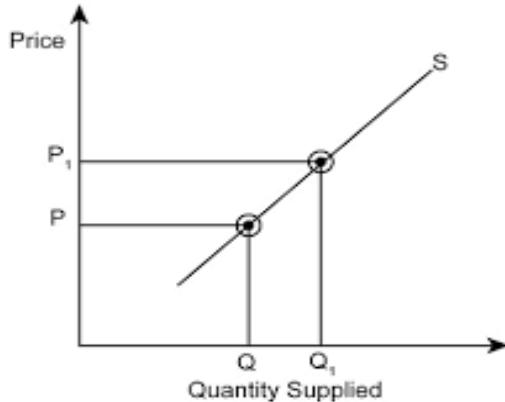


Fig 2: Supply curve

Market Equilibrium

Equilibrium is a state which we need everywhere, not only in economics. The market equilibrium is the state when the demand and the supply become the same. IN graphical representation, the point at which the demand curve and the supply curve intersect each other is the equilibrium point.

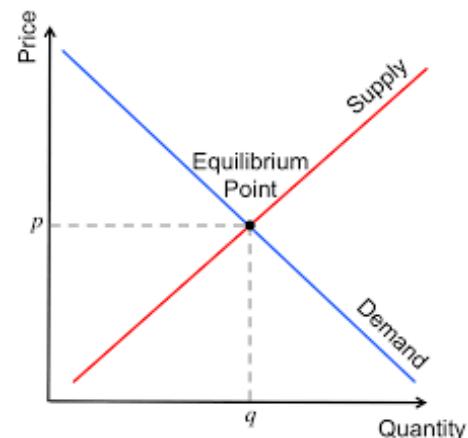


Fig 3: Combined graph of Demand and Supply

Time Series Method and the Prediction

Time series is an effective method to find out or to predict the given variable in the coming years or days. Here we mainly aim to find out the demand of the upcoming years of the particular product by the time series method known as method of least squares. Straight line least square method is one of the easiest time series methods and also it is a flexible method with a few more years of data also available.

The Equations which we use for this Method are

$y = a + bx$ is the trend equation it will get by solving the following equations

$$na + b \sum x = \sum y \quad \text{and} \quad a \sum x + b \sum x^2 = \sum xy$$

Where

$$a = \frac{\sum y}{n}$$

$$b = \frac{\sum xy - a \sum x}{\sum x^2}$$

Here n is the number of the years and y is the demand or supply.

Now we go for example data of demand and supply and will see how the least squares method we can use for finding the demand and supply of the next year.

The first table shows the demand details of a commodity from the year 2017 to 2023. We are considering 7 years so the middle year 2020 will be considering for finding the value of x

Table 1: Demand details from 2017 to 2023

Year (X)	Demand(Y)	x item (X-2020)	x^2	xy
2017	78	-3	9	-234
2018	84	-2	4	-168
2019	89	-1	1	-89
2020	95	0	0	0
2021	95	1	1	95
2022	97	2	4	194
2023	99	3	9	297
Totals	$\Sigma Y = 637$		$\Sigma x^2 = 28$	$\Sigma xy = 95$

$$a = \frac{\Sigma y}{n} = \frac{637}{7} \\ a = 91 \\ b = \frac{\Sigma xy}{\Sigma x^2} = \frac{95}{28} = 3.39$$

Therefore the equation of the straight line is $y = 91 + 3.39x$
 By using this equation of the line we can find out the demand value the commodity for the year 2024
 When we find out the demand value we have to substitute the value of x as 4 (it's understood from table 1).

The demand for 2024
 $y = 91 + 3.39 \times 4 = 104.56$

In the same way we can find out the predicted demand value of the demand of the upcoming years 2025, 2026, 2027 etc. By giving the x values as 5,6,7, etc, in the equation $y = 91 + 3.39x$

By this same way we can find out the supply for 2024 from the following table.

Table 2: Supply details from 2017 to 2023

Year	Supply (Y)	X item (x-2020)	x^2	xy
2017	80	-3	9	-240
2018	79	-2	4	-158
2019	85	-1	1	-85
2020	93	0	0	0
2021	94	1	1	94
2022	92	2	4	368
2023	95	3	9	285
Total	$\Sigma y = 618$		$\Sigma x^2 = 28$	$\Sigma xy = 264$

$$a = \frac{\Sigma y}{n} = \frac{618}{7} \\ a = 88.3 \\ b = \frac{\Sigma xy}{\Sigma x^2} = \frac{264}{28} \\ b = 9.428$$

Therefore the equation of the straight line is $y = 88.3 + 9.428x$
 By using this equation of the line we can find out the supply value the commodity for the year 2024
 When we find out the supply value we have to substitute the value of x as 4 (it's understood from table 2).

The supply for 2024 will be predicted by the equation

$$y = 88.3 + 9.428x \\ y = 88.3 + 9.428 \times 4 \\ y = 126$$

As like demand we can find the supply of the years 2025, 2026, 2027 etc., by giving the x values 5,6,7,8, etc,

Graphs of the Demand and Supply

By the data given by table 1 and table 2 we can draw the graphs of demand and supply by plotting year on x axis and demand and supply on y axis.

The Demand Graph is

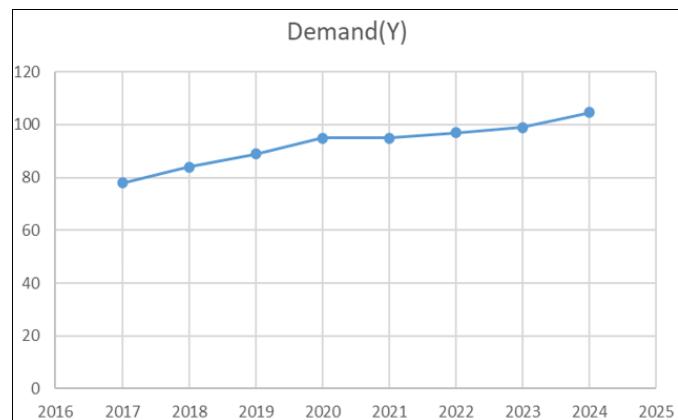


Fig 4: Demand curve from 2017 to 2024

And the Supply Graph is

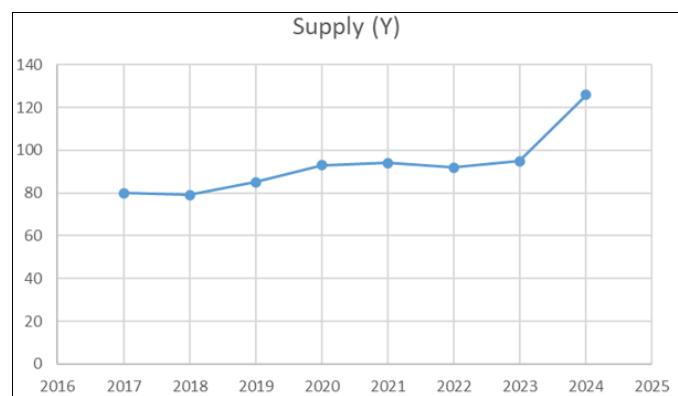


Fig 5: Supply curve from 2017 to 2024

By joining the two graphs we can create another graph from which we can find out the equilibrium state of the demand and supply.

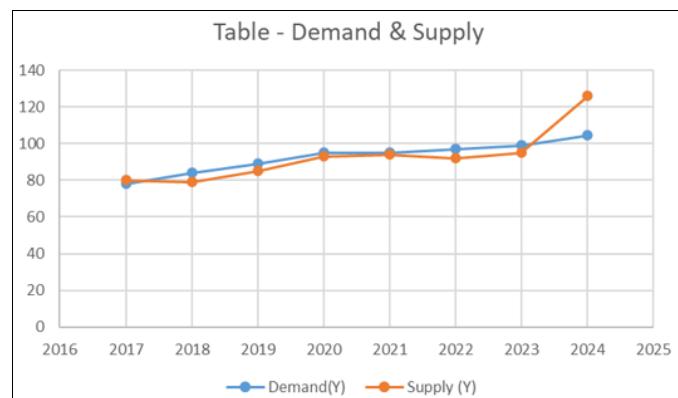


Fig 6: Combined graph of Demand and Supply from 2017 to 2024

Conclusion

In conclusion it is clear that we can use the time series method, especially the method of least squares we can use for predicting the demand and supply values of the upcoming years if the data of some years is given. As a conclusion from the fig 6 the combined graph of demand and supply we can find out that the product attains its equilibrium in the years 2017 and 2021.

References

1. Time Series; Martin Charlton, Alberto Caimo; Espon; June, 2012.
2. Time series analysis, Forecasting and control box; G E P and GM Jenkins; Holden day, Oakland; C A; 1970.
3. Demand and supply cross explanation and their magnitude in changing open market economy; Rajib kumar Sanyal, Amrisha Mitra, International journal of scientific research, March, 2021.
4. Statistics, introductory to statistics, Prof (Dr.) KX. Joseph, Calicut university, Central cooperative stores, July, 2019.
5. The demand and supply concepts:An introduction to the study of market price; Robert H. Hoxie; Journal of political economy. 1906; 14(6).