

Chapter 6

FORECASTING



Objectives:

- At the end of the lesson students should be able to:
 1. Define forecasting
 2. Know the features of forecasting
 3. Differentiate qualitative from quantitative forecast
 4. Know and understand the formulas involved
 5. Solve some problems

INTRODUCTION

Every day managers make decisions without knowing what will happen in the future. Managers are always trying to make better estimates of what will happen in the future in the face of uncertainty. Making good estimates is the main purpose of forecasting.

There are two uses of forecast. One is to help managers plan the system and the other is to help them plan the use of the system. Planning the system generally involves making long-range plans concerning the types of products and services to offer, what facilities and equipment to have, where to locate and so on.



WHAT IS FORECASTING?



Forecasting

- **Is the art and science of predicting future events.**
- **Forecasts can help managers by reducing some of the uncertainties that cloud the planning horizon, making it difficult for a manager to plan effectively.**

BUSINESS Forecasting

- **Pertains to more than predicting demand.**
- **Forecasts are also used to predict profits, revenues, costs, productivity changes, prices and availability of energy and raw materials, interest rate, movements of economic indications (e.g. GNP, inflation, gov't borrowing), and prices of stocks and bonds, as well as other variables**

Features Common to All Forecasts

- 1. Forecasting techniques generally assume that the same underlying causal system that existed in the past will continue to exist in the future.**
- 2. Forecasts are rarely perfect; predicted values usually differ from actual results**
- 3. Forecasts for group of items tend to be more accurate than forecasts for individual items**
- 4. Forecast accuracy decreases as the time period covered by the forecast increases.**

Steps in forecasting Process

1. **Determine the purpose of the forecast and when it will be needed.**
2. **Establish a time horizon that the forecast must cover.**
3. **Select a forecasting technique.**
4. **Gather and analyze the appropriate data and then prepare the forecast.**
5. **Monitor and forecast.**



APPROACHES TO FORECASTING?



Qualitative Forecast

- **Forecast based on judgment and opinion.**

Qualitative Forecast

A. Judgmental forecast

- rely on analysis of subjective inputs obtained from various sources, such as consumer surveys, the sales staff managers and executives, panel of experts.

A. Judgmental forecast

1. Executive Opinion

- often used as a part of long-range planning and new product development**

2. Sales Force composite-

- is a good source of information because of its direct contrast with consumers**

A. Judgmental forecast

3. **Consumer surveys**

- **it can tap information that might not be available elsewhere**

4. **Outside opinion**

- **This may concern advice on political or economic conditions in a foreign country or some other aspects of interest with which an organization lacks familiarity.**

A. Judgmental forecast

5. **Opinions of managers and staff**

- At times, a manager may solicit from a number of other managers and/or staff. The Delphi Method is useful in the regard.

Quantitative Forecast

- **Forecast based on historical data.**

- A. Naive forecast**
- B. Moving Average**
- C. Weighted moving average**
- D. Exponential Smoothing**
- E. Trend Line Forecast**
- F. Simple linear Regression**

A. Naive Forecast

- the simplest forecasting technique. The advantage of a naive forecast is that it has virtually no cost, it is quick and easy to prepare because data analysis is non-existent, and it is easy to understand.
- the main disadvantage is its inability to provide highly accurate forecast.
- can also be applied to a series that exhibits seasonality or trend.

B. Moving Average

- it is useful if we can assume that market demands will stay fairly steady over time. A three mark moving average is found by simply summing the demand during the past three months and dividing by three.
- with each passing month, the most recent month data are added to the sum of the previous' three months' data and the earliest month is dropped.

B. Moving Average

- **Mathematically serves as an estimate of the next period demand and is expressed as:**

$$\text{Moving Average} = \frac{\sum \text{Demand in previous } n \text{ periods}}{n}$$

***Where n is the number of periods in the moving average.**

C. Weighted Moving Average

- weight can be used to place more emphasis on recent values, when there is a trend or pattern. This makes the technique more responsive to changes.

- A weighted moving average may be expressed mathematically as:

$$WMA = \frac{\sum[(\textit{weight for period } n)(\textit{demand in period } n)]}{\sum \textit{Weights}}$$

Example:

Compute a three period moving average forecast given the ff. demands for cars for the last five periods, with an assigned weight of 1, 2 & 3.

DEMAND	SUPPLY
1	70
2	80
3	65
4	40
5	85

Example:

SOLUTION:

The forecast for period six should be:

$$\text{Weighted Moving Average Forecast} = \frac{65(1) + 90(2) + 85(3)}{6} = 81.67 \text{ or } 82 \text{ cars}$$

- **If actual demand in period six turns out to be 95, the moving average forecast for period 7 would be:**

$$\text{Weighted Moving Average Forecast} = \frac{90(1) + 85(2) + 95(3)}{6} = 90.83 \text{ or } 91 \text{ cars}$$

D. Exponential Smoothing

- when there is no trend in demand for goods/services, sales are forecasted for the next period by means of exponential smoothing method.
- one of the most widely used techniques in forecasting.
- relatively easy to use and understand. Each new forecast is based on the previous forecast plus a percentage of the difference between that forecast and the actual value of the series at that point.

D. Exponential Smoothing

New forecast = Last Period's Forecast + α (Last period's actual demand – Last Period's forecast)

can be written mathematically as:

$$F_t = F_{t-1} + \alpha [A_{t-1} - F_{t-1}]$$

Example 1:

A car dealer predicted a January demand for 550 Honda V-tech cars. Actual January demand was 680 Honda V-tech cars and $\alpha = 0.10$. forecast the demand for Jan. using the exponential smoothing model.

SOLUTION:

$$\text{New Forecast (for February)} = 550 + 0.10 [680 - 550]$$

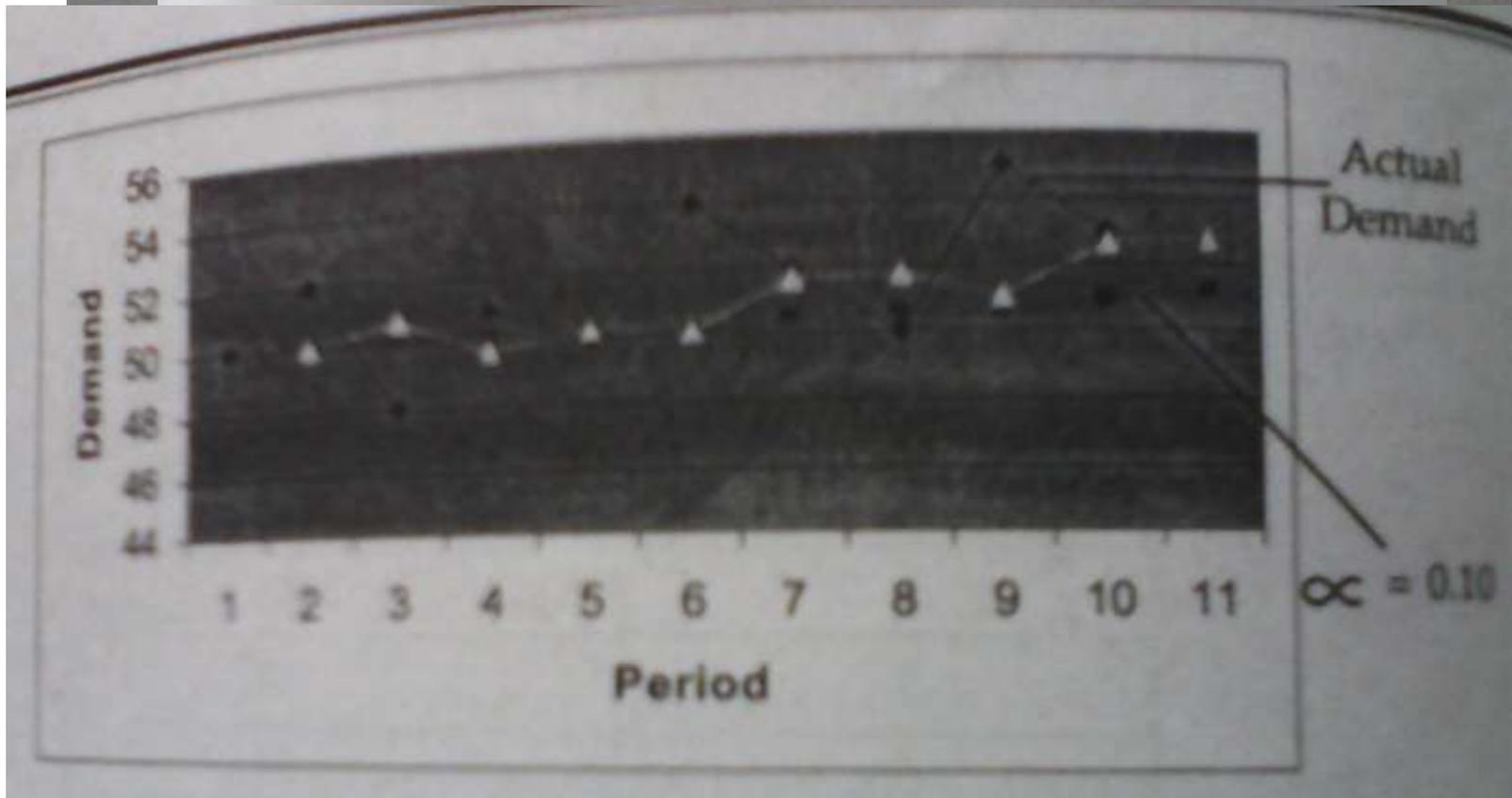
$$F_t = 550 + 0.10 [130]$$

$$F_t = 550 + 13$$

$$F_t = 563$$

Example 11:

Solution:



E. Trend Line Forecast

- a linear trend equation has the form

$$Y_t = a + bt$$

Where:

t = specified no. of time periods from t=0

Y_t = forecast for period t

a = value of Y_t at t=0

b = slope of the line

E. Trend Line Forecast

Example

The
is shown
line would
the sale fo

a. Th

$$b = \frac{10(45,340) - (55)(8,200)}{10(385)^2}$$

$$b = \frac{453,500 - 452,100}{3,850 - 3,025}$$

$$b = \frac{1,400}{825} = 1.70$$

$$a = \frac{8,220 - 93.5}{10}$$

$$a = \frac{8,126.50}{10} = 812.65$$

c.

$$Y_t = 812.65 + 1.070t$$

When $t = 11$

$$Y_t = 812.65 + 1.70(11)$$

$$Y_t = 812.65 + 18.7$$

$$Y_t = 831.35$$

t
1
4
9
16
25
36
49
64
81
100
$t^2 = 385$

t 10 weeks
near trend
and predict

1 2 3 4 5 6 7 8 9 10

F. Simple Linear Regression

- the simplest and most widely used form of regression involves a linear relationship between 2 variables.
- its objective is to obtain an equation of a straight line that minimizes the sum of equation vertical deviations of points around the line

F. Simple Linear Regression

$$Y_1 = a + bX$$

where:

Y_1 = Predicted (dependent variable)

X = Predictor (independent variable)

b = slope of the line

a = value of Y_1 when $X=0$

F. Simple Linear Regression

The coefficient **a** & **b** of the line are computed using these two equations.

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$a = \frac{\sum y - b \sum x}{n} \quad \text{OR} \quad a = \bar{y} - \bar{bx}$$

Where "n" = the number of observations

F. Simple Linear Regression

Example:

JR Hamburgers has a chain of 10 stores in Metro Manila. Sales figures and profits for the stores are given in the following table. Obtain a regression line for the data, and predict profit for a store assuming sales of 30 million.

Sales, x (Millions)	Profits, y (Millions)
15	8
17	9
21	13
18	10
19	11
22	14
16	8.5
17	10
25	15
20	13

Solutions:

Sales, x (Millions)	Profits, y (Millions)	xy	x
15	8	120	225
17	9	153	289
21	13	273	441
18	10	180	324
19	11	209	361
22	14	308	484
16	8.5	136	256
17	10	170	289
25	15	375	625
20	13	260	400
$\Sigma x = 190$	$\Sigma y = 111.5$	$\Sigma xy = 2,184$	$\Sigma x^2 = 3,694$

$$b = \frac{10(2,184) - (190)(111.5)}{10(3,694) - (190)^2}$$

$$b = \frac{2,184 - 21,185}{36,940 - 36,100} = \frac{655}{840}$$

$$b = 0.78$$

$$a = \bar{y} - b\bar{x}$$

where:

$$\bar{y} = \frac{\Sigma y}{n} = \frac{111.5}{10} = 11.15$$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{190}{10} = 19$$

$$a = 11.15 - 0.78(19)$$

$$a = 11.15 - 14.82$$

$$a = -3.67$$

when $x = P30$ million

$$Y_t = a + bX$$

$$Y_{30} = -3.67 + 0.78(30)$$

$$Y_{30} = -3.67 + 23.4$$

$$Y_{30} = 19.73 \text{ million}$$

COMPUTER ANALYSIS for FORECASTING MODELS

There are different quantitative approaches to forecasting given in this chapter. All of these approaches are included in the computer analysis except for the moving and weighted moving averages.



-E N D-

