IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Project Management for Managers

Lec – 14

Market and Demand Analysis - II

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Exponential Smoothing Method

In exponential smoothing, forecasts are modified in the light of observed errors. If the forecast value for year t, Ft , is less than the actual value for year t, St, the forecast for the year t+1, Ft+1, is set higher than Ft. If Ft> St , Ft+1 is set lower than Ft. In general.

$$F_{t+1} = F_t + \alpha e_t$$

where Ft + 1 = forecast for year t + 1

α = smoothing parameter (which lies between 0 and 1)

et = error in the forecast for year t = St - Ft

Determine the forecast for 2017 by exponential smoothing method. Given $\alpha = 0.6$. Assume forecast for 2010 as 32.

Year	Demand
2010	32
2011	36
2012	40
2013	35
2014	32
2015	35
2016	45

Determine the forecast for 2017 by exponential smoothing method. Given α = 0.6

Year	Demand	Forecast	Error (e)	e*α
2010	32	32	0	0
2011	36	32	4	2.4
2012	40	34.4	5.6	3.36
2013	35	37.76	-2.76	-1.66
2014	32	36.10	-4.10	-2.46
2015	35	33.64	1.36	.82
2016	45	34.46	10.54	6.33
For 2017		34.46+6.33=40.79		

32+2.4=34.4

Measures of Forecast Error

- Forecast error = $E_t = F_t - D_t$
- Mean squared error (MSE)

  $MSE_n = (Sum_{(t=1 \text{ to } n)}[E_t^2])/n$

  MSE - estimates the variance of the error
- Absolute deviation = $A_t = |E_t|$
- Mean absolute deviation (MAD)

  $MAD_n = (Sum_{(t=1 \text{ to } n)}[A_t])/n$
- Mean absolute percentage error (MAPE)- is the **average absolute error as a % of demand** and is as follows

MAPE by SA

Year	Demand	4MA	Error (e)	Absolute error	MAD	% Error (Abs Error/Demand) *100	MAPE
2008	32						
2009	36						
2010	40						
2011	35						
2012	32	35.75	-3.75	3.75	3.75	11.71	11.71
2013	35	35.75	-0.75	0.75	2.25	2.14	6.92
2014	45	35.5	9.5	9.5	4.66	21.11	**11.65**
For 2015		36.75					

MAPE by SES

Year	Demand	Fore cast	Error (e)	Absolute error	MAD	% Error (Abs Error/Demand) *100	MAPE
2008	32	32	0	0	0	0	0
2009	36	32	4	4	2	11.11	5.55
2010	40	34.4	5.6	5.6	3.2	14	8.37
2011	35	37.76	-2.76	2.76	3.1	7.8	8.22
2012	32	36.10	-4.10	4.10	3.3	12.8	9.14
2013	35	33.64	1.36	1.36	3	3.8	8.25
2014	45	34.46	10.54	10.54	4.1	23.42	**10.41**
For 2015		34.46+6.33 =40.79					

Example: Sales of wrist watches 25,32,24,28,26,27

Answers:

26,26,26 (Avg last 3,trend, outlier)

27,27 (avg of all, weights (1,2,3) to last 3)

28, (last 2 data show increase)

30 (population is increasing)

Depending on trends, use appropriate method and select the one which gives minimum error.

Causal Methods

Chain Ratio Method

The potential sales of a product may be estimated by applying a series of factors to a measure of aggregate demand. For example, a company estimated the potential sales for a new product, a freeze-fried instant coffee (Maxim), in the following manner :

- **Total amount of coffee sales : 174.5million units**
- **Proportion of coffee used at home : 0.835**
- **Coffee used at home : 145.7 million units**
- **Proportion of non-decaffeinated coffee used at home : 0.937**
- **Non-decaffeinated coffee used at home : 136.5 million units**
- **Proportion of instant coffee : 0.400**
- **Instant non-decaffeinated coffee used at home : 54.6 million units**
- **Estimated long-run market share for Maxim : 0.08**
- **Potential sales of Maxim : 4.37 million units**

Population: 130 crore
Proportion of Male:51%
Proportion of adult: 63%
Proportion of adults not shaving: 10%
Proportion of people using premium quality shaving blades : 20.5%
No of shaving per year:183
No of shaving per blade: 3

What is the demand of premium quality shaving blades?

Consumption Level Method

The method estimates consumption level on the basis of elasticity coefficients, the important ones being the income elasticity of demand and the price elasticity of demand.

Income Elasticity of Demand

The income elasticity of demand reflects the responsiveness of demand to variations in income. It is measured as follows :

$$E_I = \frac{Q_2 - Q_1}{I_2 - I_1} \times \frac{I_1 + I_2}{Q_2 + Q_1}$$

where E_I = income elasticity of demand

Q_1 = quantity demanded in the base year

Q_2 = quantity demanded in the following year

I_1 = income level in the base year

I_2 = income level in the following year.

Income Elasticity of Demand

Example: The following information is available on quantity demanded and income level: $Q_1 = 50$, $Q_2 = 55$, $I_1 = 1{,}000$ and $I_2 = 1{,}020$. What is the income elasticity of demand? The income elasticity of demand is :

Income Elasticity of Demand

Example The following information is available on quantity demanded and income level: $Q_1 = 50$, $Q_2 = 55$, $I_1 = 1{,}000$ and $I_2 = 1{,}020$. What is the income elasticity of demand? The income elasticity of demand is :

$$E_I = \frac{55 - 50}{1{,}020 - 1{,}000} \times \frac{1{,}000 + 1{,}020}{55 + 50} = 4.81$$

Price Elasticity of Demand

The price elasticity of demand measures the responsiveness of demand to variations in price. It is defined as :

$$E_p = \frac{Q_2 - Q_1}{P_2 - P_1} \times \frac{P_1 + P_2}{Q_2 + Q_1}$$

where E_p = price elasticity of demand

Q_1 = quantity demanded in the base year

Q_2 = quantity demanded in the following year

P_1 = price per unit in the base year

P_2 = price per unit in the following year

Price Elasticity of Demand

Example The following information is available about a certain product :

P_1 = Rs.600, Q_1 = 10,000, P_2 = Rs. 800, Q_2 = 9,000.

What is the price elasticity of demand? The price elasticity of demand is :

Price Elasticity of Demand

Example **The following information is available about a certain product :**

P_1= Rs.600, Q_1 = 10,000, P_2 = Rs. 800, Q_2 = 9,000. What is the price elasticity of demand? The price elasticity of demand is :

$$E_p = \frac{9{,}000 - 10{,}000}{600 - 800} \times \frac{600 + 800}{9{,}000 + 10{,}000} = 0.37$$

End Use Method

Suitable for estimating the demand for intermediate products, the end use method, also referred to as the consumption coefficient method, involves the following steps:

1. Identify the possible uses of the product.
2. Define the consumption coefficient of the product for various ses.
3. Project the output levels for the consuming industries.
4. Derive the demand for the product.

End Use Method

Projected Demand for Indchem

This method may be illustrated with an example. A certain industrial chemical, Indchem is used by four industries Alpha, Beta,Gamma, and Kappa.

The consumption coefficients for these industries, the projected output levels for these industries for the year *X*, and the projected demand for Indchem as shown in the following slide

	*Consumption Coefficient **	*Projected Output in year X*	*Projected Demand for Indchem in year X*
Alpha	**2.0**	**10,000**	**20,000**
Beta	**1.2**	**15,000**	**18,000**
Kappa	**0.8**	**20,000**	**16,000**
Gamma	**0.5**	**30,000**	**15,000**
		Total	***69,000***

- This is expressed in tonnes of Indchem required per unit of output of the consuming industry

Leading Indicator Method

Leading indicators are variables which change ahead of other variables, the lagging variables. Hence, observed changes in leading indicators may be used to predict the changes in lagging variables.

For example, the change in the level of urbanisation (a leading indicator) may be used to predict the change in the demand for air conditioners (a lagging variable)

Ex: Temperatures- Demand of invertors.

Leading Indicator Method

Two basic steps are involved in using the leading indicator method:

(i) First, identify the appropriate leading indicator(s).

(ii) Second, establish the relationship between the leading indicator(s) and the variable to be forecast.

The principal merit of this method is that it does not require a forecast of an explanatory variable. Its limitations are that it may be difficult to find appropriate leading indicator(s) and the lead-lag relationship may not be stable over time.

Econometric Method

- **An econometric model is a mathematical representation of economic relationship(s) derived from economic theory.**

The primary objective of econometric analysis is to forecast the future behavior of the economic variables incorporated in the model.

- **Two types of econometric models are employed: the single equation model and the simultaneous equation model.**

Single Equation Model

The single equation model assumes that one variable, the dependent variable (also referred to as the explained variable), is influenced by one or more **independent variables (also referred to as the explanatory variables)**. In other words, one-way causality is postulated. An example of the single equation model is given below:

$$D_t = a_0 + a_1 P_t + a_2 N_t$$

where D_t = demand for a certain product in year t
P_t = price for the product in year t
N_t = income in year t

Simultaneous Equation Model

The simultaneous equation model portrays economic relationships in terms of two or more equations. Consider a highly simplified three-equation econometric model of Indian economy.

$$GNP_t = G_t + I_t + C_t$$
$$I_t = a_0 + a_1 GNP_t$$
$$C_t = b_0 + b_1 GNP_t$$

where GNP_t = gross national product for year t
I_t = gross investment for year t
C_t = consumption for year t
Gt = governmental purchases for year t

Strategic advantage approach:

International price / Domestic Price = Export potential

Domestic Price / International price = Import threat

Price
Quality
Value addition
Brand image

Uncertainties in Demand Forecasting

Demand forecasts are subject to error and uncertainty which arise from ????????

Uncertainties in Demand Forecasting

- **Data about past and present market:** Lack of standardization, few observations, influence of abnormal factors
- **Methods of forecasting:** Inability to handle unquantifiable factors, Unrealistic assumptions, Excessive data requirements.
- **Environmental change:** technological change, shift in Govt. policy, development of international scene (OPEC), discovery of sources of raw material, quality of Monsoon.