

Project Management for Managers
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Lecture – 14
Market and Demand Analysis-II

Hello friends, let us start our next session. In previous session we discussed about qualitative methods and couple of quantitative methods in quantitative methods we have seen trend projection method and moving average method let us look at what is exponentially smoothing method.

As I said in exponentially smoothing method we give weightage to the older data points in exponentially decreasing manner. So, this is the equation for exponentially smoothing method this is the forecast for next period for the period let us say $T + 1$ this is forecast of previous period right then there is something called smoothing constant α whose value would always be between 0 to 1 and there is something error right. So, E_T is error right; this is error. So, error is $S_t - f_T$ whatever its sales in a particular period minus forecast in that particular period right.

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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

So, we will solve this same example which we solved using moving average method right. So, determine the forecast for 2017 by exponentially smoothing method given α is equal to 0.6 assume forecast for 2010 as 32; right. So, we have been given. So,

we collected past data. So, the sale of a particular product in 2010 was 32 and the forecast was also 32, right. So, if you not been given forecast for the initial period then you take the forecast its same as demand right had it not been given at this point not been there in the question we would have considered demand we would have considered forecast in 2010 as 32 right, but since we have been given we will use that number also in calculating forecast for 2007, right. So, this is the question let us solve this one.

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

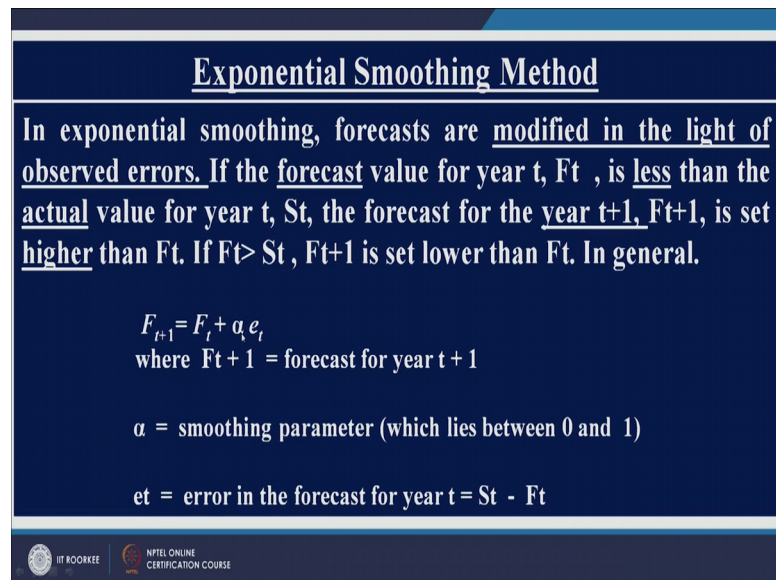
Year	Demand	Forecast	Error (e)	$e \cdot \alpha$
2010	32	32	0	0
2011	36	32	4	2.4
2012	40	34.4	5.6	3.36
2013	35	37.76	-2.76	-1.66
2014	32	36.10	-4.10	-2.46
2015	35	33.64	1.36	.82
2016	45	34.46	10.54	6.33
For 2017		$34.46 + 6.33 = 40.79$		

$32 + 2.4 = 34.4$

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So, you have got different time periods here demand is there we also know the forecast for 2010 it is 32. So, is there any error no there is no error right whatever was the forecast this was the demand. So, error is 0. So, error in 12 5 0 right alpha is 0.6.

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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 , F_t , is less than the actual value for year t , S_t , the forecast for the year $t+1$, F_{t+1} , is set higher than F_t . If $F_t > S_t$, F_{t+1} is set lower than F_t . In general,

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

where F_{t+1} = forecast for year $t+1$

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

e_t = error in the forecast for year $t = S_t - F_t$

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So, this error in to alpha it is there in this equation right this error into alpha right. So, error into alpha for this particular period is 0 right next time demand is 36; forecast is 32. So, what is the error is of 4 units. So, this 36 minus 32 error.

So, sales minus demand right sales minus forecast right. So, this term is here this S_t minus F_t , right. So, this 36 minus 32 this is 4; 4 into alpha it is 2.4 right. So, error into alpha is 2.4, now what would be the forecast for this period 2012 it is the previous periods forecast plus this term right which is there in this equation right previous periods forecast plus I will find 2 error would give you forecast for next period right.

So, this is 32 plus 2.4; it is 34.4 how would you get this value 37.76 this the previous periods forecast plus this value 3.36. So, you will get this forecast similarly this, this, this and finally, for 2017, what would be the forecast it would be 34.46 plus this term right. So, this is 40.79. So, forecast for 2007 would be 40.79 while the forecast for moving forecast for 2017 by moving average method was 36.75. So, 36.75 by moving average method and 40.79 by exponential moving average method now which is better.

Now, we have to take decision whether this method is better or previous one was better you will have to find out there is something called mean absolute percentage error right. So, whenever you calculate mean absolute percentage error in these 2 methods where ever you get that error less than that method would be better right. So, a smaller the mean absolute percentage error better is the method right. So, let us move on to some other

forecasting methods there are some causal methods as I said in causal method you have got cause and effect relationship right.

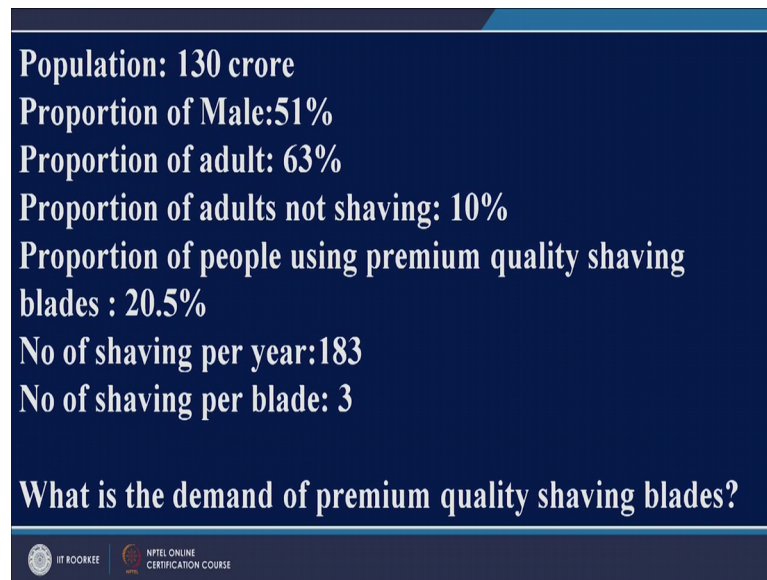
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Causal Methods	
Chain Ratio Method	
The potential sales of a product may be estimated by applying a series of factors to a measure of aggregate demand. For example, a company estimated the potential sales for a new product, a freeze-fried instant coffee (Maxim), in the following manner :	
· Total amount of coffee sales	: 174.5 million 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

So, we will take up an example. So, a company estimated the potential sales for a new product a freeze fried instant coffee its name is maxim right. So, there is a company who wants to know what would be the forecast of this particular brand of coffee right and following information is given to you right. So, the total amount of coffee sales is known 174.5 millions proportion of coffee used at home. So, out of this total amount of coffee sales proportion amount of coffee used is 0.835 million 0.835 coffee used at home you just multiply these 2 values you will get coffee used at home; it is 145.7 million units.

Proportion of non decaffeinated coffee used at home is 0.937. So, non decaffeinated coffee used at home would be its very simple just multiply these 2 values right you have get this value proportion of instant coffee 0.40 right. So, instant non decaffeinated coffee used at home would be multiplication of these 2 right; you will get this number right estimated long run market share for maxim 0.08 and from this; this value you can find out potential sales of maxim as 4.37 million units which is multiplication on these 2. So, this is nothing, but a series of cause and effect relationship right.

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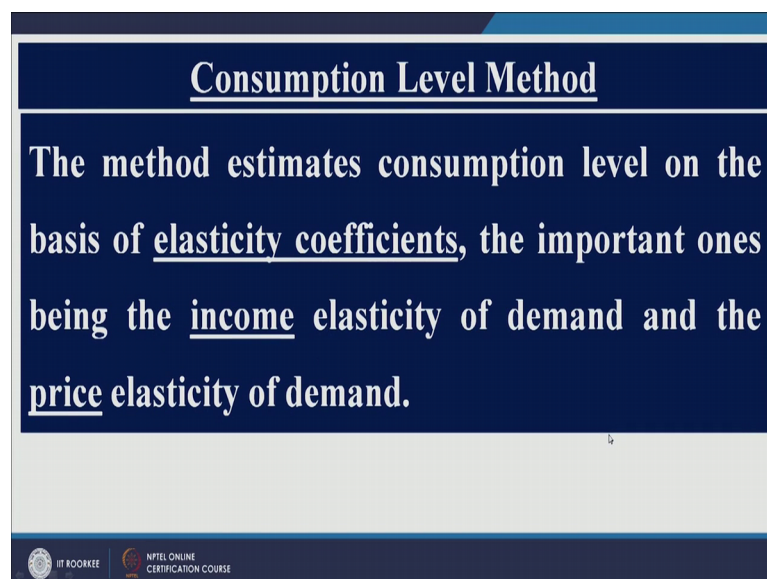
Population: 130 crore
Proportion of Male: 51%
Proportion of adult: 63%
Proportion of adults not shaving: 10%
Proportion of people using premium quality shaving blades : 20.5%
No of shaving per year: 183
No of shaving per blade: 3

What is the demand of premium quality shaving blades?

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Quite a simple method you just try this example very simple example you know that the population is 130 crore let us say a male population is 51 percent proportion of adult 63 percent proportion of adults not shaving ten percent proportion of people using premium quality shaving blade 20.5 percent number of shaving per year 183 number of shaving per blade 3 and what you want to find out what is the demand of premium quality shaving blades right. So, very simple question can solve very easily right.

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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.

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So, let us move on to next method which is consumption level method and consumption level method is basically helps you in finding out how the demand should change with the change in income and with the change in price right. So, the method estimates consumption level basis of elasticity coefficients the important ones being income elasticity and price elasticity right. So, would the demand of a product will change when there is change in price and when there is change in income of a person right. So, we will take first has income elasticity of demand. So, how the demand will change with respect to income right? So, this is income elasticity of demand.



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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.



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So, this is income elasticity of demand yes you need to have this is Q_2 minus Q_1 divided by I_2 minus I_1 multiplied by I_1 plus I_2 divided by Q_2 plus Q_1 right. So, Q_1 and Q_2 are very simple Q_1 means the quantity demanded by you before change in income and Q_2 is quantity demanded by you after change in income. Similarly I_1 and I_2 are what I_1 is your initial income and I_2 is your new income or change changed income. So, these are the definitions of these notations very simple and this week question.

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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 :



So, the following information is available on quantity demanded and income level. So, Q_1 is fifty Q_2 is 55 I_1 is 1000 and I_2 is 1020; what is the income elasticity of demand what is the income elasticity of demand how would you calculate its very simple Q_2 minus Q_1 .



So, this is 5 right 55 minus 50 divided by what I_2 minus I_1 . So, this is 20, right. So, 5 by 20 multiply by you just multiply that value by summation of these 2 divided by summation of these 2. So, what would be the answer did you calculate yeah here is the answer it is 4.8. So, how would you interpret this result the demand will change by this much unit if there is a there is a change in one unit in income.

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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 :

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

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So, this is very simple income elasticity of demand responsiveness of demand to variation in income right.

So, what we are saying is if there is one unit change in income and there would be 4 point eight one unit change in demand right. So, that is the meaning of income elasticity of demand. So, let us look at second consumption level method its price elasticity of demand how responsive the demand is with respect to price right.



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Price Elasticity of Demand

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

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

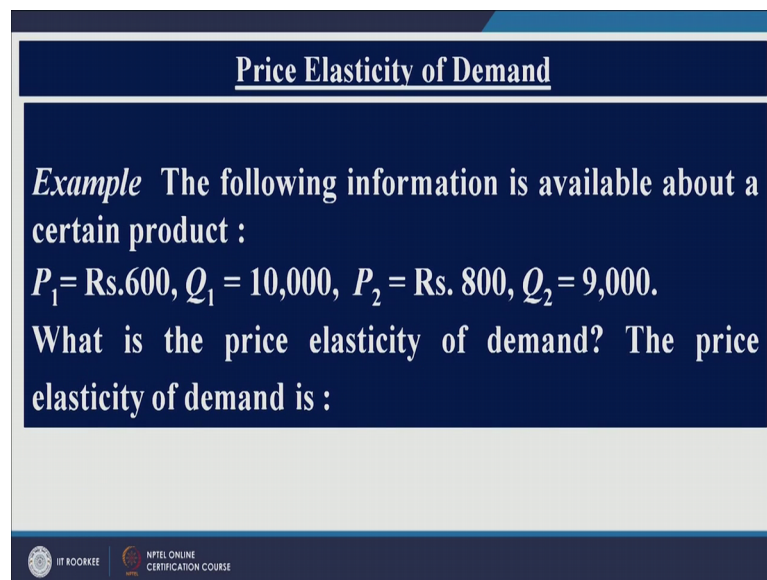
where E_p = price elasticity of demand
 Q_1 = quantity demanded in the base year
 Q_2 = quantity demanded in the following year
 P_1 = price per unit in the base year
 P_2 = price per unit in the following year

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So, the formula is this E_p is equal to $Q_2 - Q_1$ it will remain same it was there it was there in previous method also $p_2 - p_1$ multiplied by $p_1 + p_2$ divided by $Q_2 + Q_1$ right. So, E_p is price elasticity of demand Q_1 is quantity demanded in the base year quantity demanded in the following year right.

So, this is quantity demanded before price change quantity demanded after price change right p_1 is the price of a product initially right p_2 is your changed price right.

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Price Elasticity of Demand

Example The following information is available about a certain product :

$P_1 = \text{Rs. } 600, Q_1 = 10,000, P_2 = \text{Rs. } 800, Q_2 = 9,000.$

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

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So, this is the question the following information is available about certain product. So, p_1, p_2, Q_1, Q_2 all these values are there what is the price elasticity of demand can you calculate it is very simple $Q_2 - Q_1$ right. So, this is minus 1000 divided by summation of divided by $p_2 - p_1$ which is 200 right and remaining calculations can be done very easily right.

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Price Elasticity of Demand

Example The following information is available about a certain product :
 $P_1 = \text{Rs. } 600$, $Q_1 = 10,000$, $P_2 = \text{Rs. } 800$, $Q_2 = 9,000$. What is the price elasticity of demand? The price elasticity of demand is :

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

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So, what is the answer yeah here it is right. So, E_p is minus 0.37, it means what how would you interpret this result whenever there is one unit change in price the demand will come down by 0.37 unit right. So, this is price elasticity of demand right. So, this is this is one of the causal methods right.

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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.

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Let us look at another causal method it; it is known as end use method actually this particular forecasting method is applicable for finding the demand of intermediate products and this is also known as consumption coefficient method. So, one and the same

thing either you call it end use method or consumption coefficient method and there are following steps right. So, first of all you need to identify what is the possible end product right then define consumption coefficient then project the output level for the consuming industry and derive the demand for the product. So, these are 4 steps we will take up an example. So, things should be clearer right. So, let us look at this. So, example is we are actually we want to know what is the demand of a particular chemical right.

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	<i>Consumption Coefficient *</i>	<i>Projected Output in year X</i>	<i>Projected Demand for Indchem in year X</i>
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
		<i>Total</i>	<i>69,000</i>

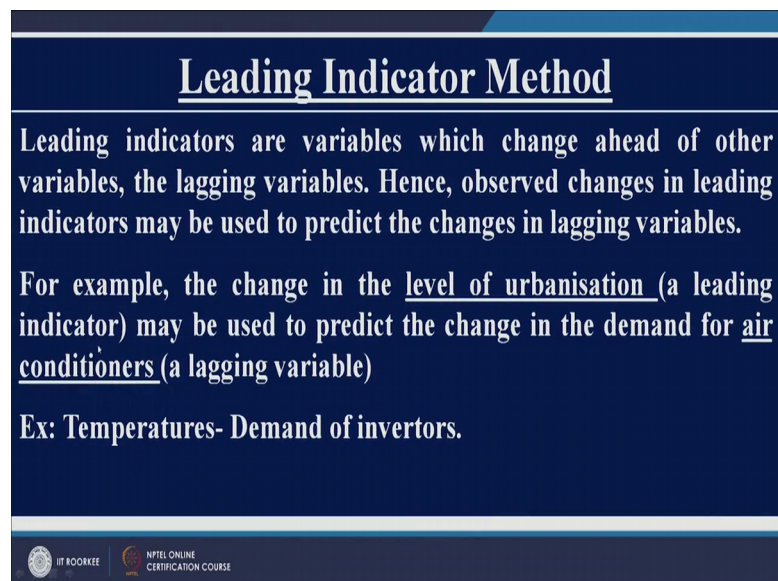
* This is expressed in tonnes of Indchem required per unit of output of the consuming industry

And the name of the chemical is Indchem. So, this chemical is being used by 4 different industry right say right say alpha beta gamma and kappa right. So, there is one chemical Indchem be used by 4 different industries the consumption coefficients for these industries the projected output level of these industries and the projected demand for this particular chemical is shown in this table. So, this is your consumption coefficient for alpha it is 2 for beta 1.2 kappa 1.8 for gamma 0.5 right projected output in x in the year x right. So, this is your projected output.

So, this is your end unit right end product right and this is an end inca is your intermediate product. So, what would be the demand of that particular chemical Indchem chemical you just multiply the output the projected output of end product by their consumption coefficients right. So, this end to this you will get this value 20000, 18000, 16000, 15000, 569000, right. So, this is how you can calculate the demand of a particular intermediate product if you know 2 things what are those 2 things first is consumption

coefficient and the second one is the demand the demand of end product right let us look at leading indicator method. Now this is very simple method. So, in this method what we have generally we have got a dependent variable and an independent variable right. So, we need to find out 2-2 variables. So, you can call them either leading indicator and lagging indicator right or legging variable. So, you have what you have got dependent variable and independent variable right.

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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.

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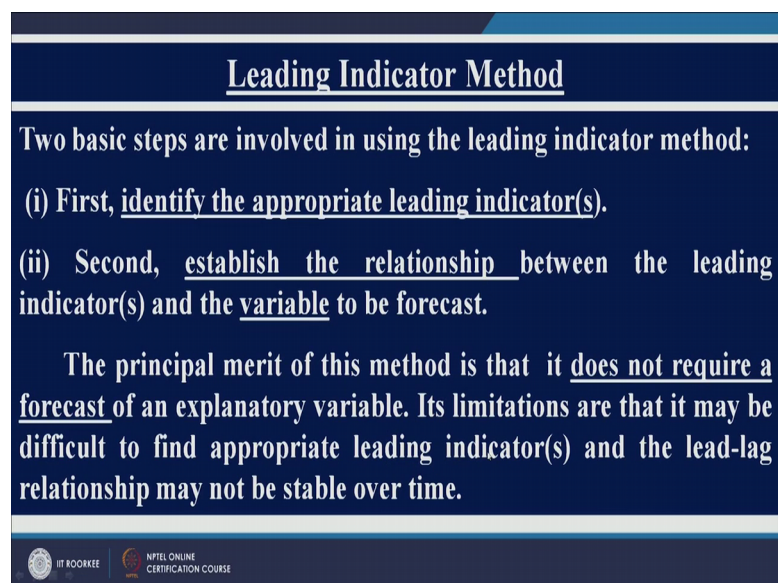
So, let us take an example the change in level of urbanization which is leading indicator maybe used to predict the change in demand of air conditioner right which is lagging variable right. So, this is your independent variable and this is dependent variable right. So, whenever there is urbanization taking place there would be demand of some other products which would be increasing right. So, when you have more urbanization what you will have you will have you let us say you need more transportation facility you need more jobs you need more schools you need more hospitals right. So, just your level of urbanization is just one independent variable and through this you can find out what would be the values of dependent variables namely a number of hospitals educate schools and so on right. So, this is very simple method.

Another example can be temperature if you have got more and more temperature you would have more and more demand of air conditioners fans there would be more power failures and during summers then you would be requiring more and more inverters right.

So, important point in this method is you need to find out leading indicator and lagging indicators right. So, this what I have already talked about identify your leading indicator establish relationship right between leading and lagging indicators right the advantage of this method is that it does not require a forecast for an explanatory variable what is explanatory variable explanatory variable is similar to independent variable right. So, you need not forecast independent variable right.

So, its limitations are that it may be difficult to find appropriate leading indicator.

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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.

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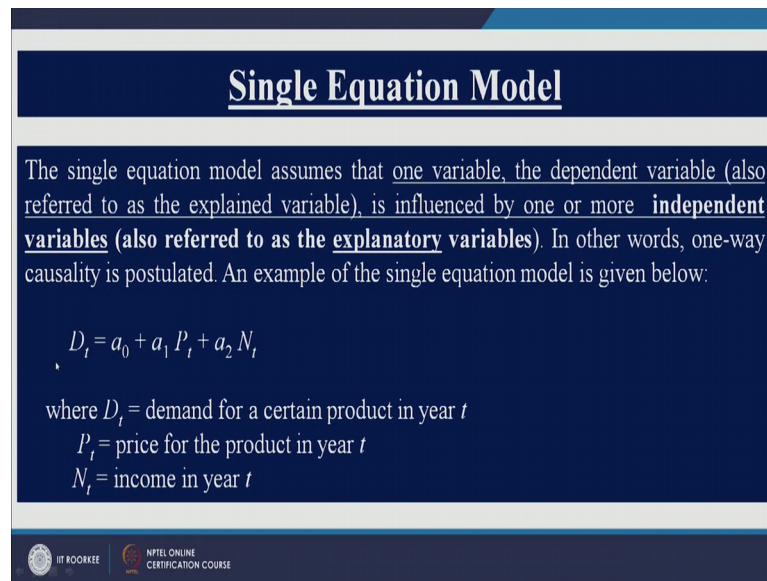
And lead lag relationship many times what happened lead lag relationship its again an important point let us say if there is price hike of fuel due to price hike in fuel you will have inflation right. So, one is leading and one is lagging right, but you need to find out after how much period price hike of fuel has affected inflation right. So, that point is also to be taken care it is called time lagging right.

So, this is leading indicator method let us look at econometric models or econometric methods. So, this is somewhat similar to what we have seen in previous slide. So, what we do here, it is mathematical representation of economic relationship derived from economic theory right. So, we forecast the future behavior of economic variables which we incorporate in our mathematical model. So, you can have either a single equation model or simultaneous equation model. So, if you look at single equation model. So, this is a very simple model. So, you will have one variable. So, the dependent variable also

known as explained variable and independent variable also known as explanatory variable right.

So, explained variable and explanatory variable right explained means dependent and explanatory means independent variable right. So, an example here is.

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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

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Let us say a demand for a certain product in year T is a function of 2 independent variables namely price of the product in that year and income of an incoming that particular year. So, a 0 is nothing, but a constant right this is this is nothing, but your multiple regression equation right. So, there is one dependent variable and these are 2 independent variables right. So, and a 1 and a 2 coefficients right a 0 is constant right.



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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.

$$\begin{aligned} GNP_t &= G_t + I_t + C_t \\ I_t &= a_0 + a_1 GNP_t \\ C_t &= b_0 + b_1 GNP_t \end{aligned}$$

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

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So, this is a single equation econometric model right then simultaneous equation model. So, instead of one equation you have got 2 equations 3 equations. So, on right you can have different series of equations, right.

So, let us say consider a highly simplified 3 equation econometric model right. So, let us say GNP gross national product it is being determined by let us say gross investment right consumption this value and government purchases right this value right. So, you have got C_t here consumption G_t government purchases and I_t is investment right again you can find out gross investment is function of this then C_t consumption is a function of this right. So, you can have 3 different equations right. So, this is simultaneous equation model.

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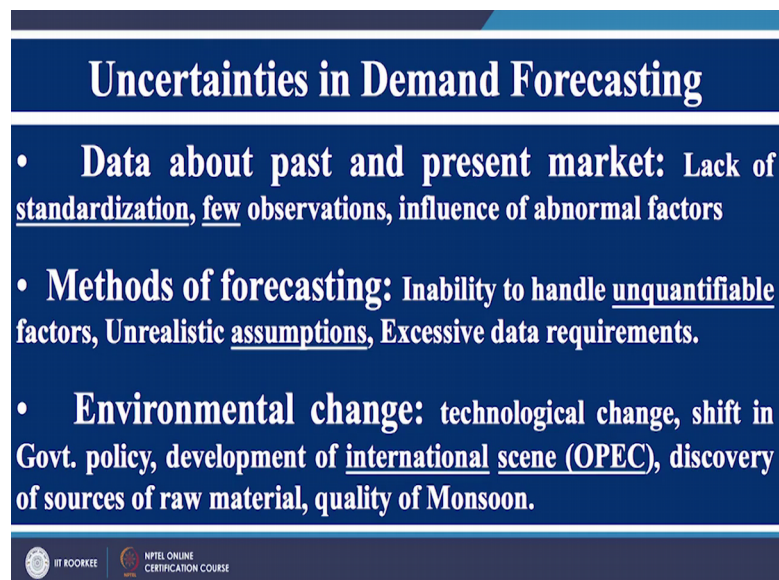


Now, let us look at next method is called strategic advantage method in this method what we do; we forecast the demand of a product and depending upon what is the price of a product in Indian market and what is the price in international market. So, for example, let us say if the price in domestic market is less than price in international market. So, you will have more and more export opportunities. So, this is basically an indicator that when there is a price when there is higher price in international market sell your products there right. So, you can forecast in this way right. So, if you are able to forecast the prices in international marketing and in domestic market you can plan your forecasting accordingly right in exactly opposite case, if you have got domestic prices are higher than international prices then it is good to import products from abroad right. So, this is nothing, but a simple strategic advantage approach right.

Now, whenever we go for forecasting you will always have some errors right. So, this is important point there are lots of uncertainties in forecasting most. So, why there are so many errors in forecasting most of the times forecast errors will be there whether its small or large right, but errors will be there why there are a couple of reasons for that and the reasons are many times you do not have exact data forget about exact data you do not have data sometimes right. So, some even when you have data they are not standardized data right there would be some missing data sometimes twenty percent missing data sometime thirty percent missing data and so on, right. So, data about past and present market, so, there is a lack of standardization and so on right.

Many times we do not use appropriate method to forecast right and the other problem is there are several qualitative factors which we cannot convert them into quantitative variables, but sometimes it is difficult right and this is the most important problem in forecasting and realistic assumptions.

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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.

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We make lots of unrealistic assumptions and we are we are fascinated by optimistic assumptions we think that everything will be alright there will not be any problem in future right. So, we take some unrealistic assumptions and because of that our forecasting models most of the times go wrong right and environmental change of course, affects our forecast. So, there is a change in technology if there is a change in government policy right. Now we will have a GST into picture very soon from most probably from first of July, things will change right. So, whatever people have forecasted demand of their products they will have to revise right. So, this is nothing, but environmental change.

I will give you an example let us say development of international scene let us say if organization of petroleum export companies opaque decide to cut down oil production then what will happen prices will shoot up right. So, this nothing, but environmental change right and of course, discovery of sources of raw material if there, if you are coming up with new material or let us say government policy has affected the supply of raw material then things will change and so on right quality of monsoon in India right

very important point if it is going to be a high quality rain then everything would be all right otherwise you will have to revise your estimates write.

So, the last point in market and demand analysis is market planning. So, in market planning generally what we do we go for current marketing situation? So, after doing all those things right situational analysis secondary data primary data market characterization demand forecasting we go for market planning right. So, you have got opportunity and issue analysis objectives marketing strategy and action programming. So, with this we complete this particular session and these particular topics also right which is on market and demand analysis.

Thank you for watching the session.