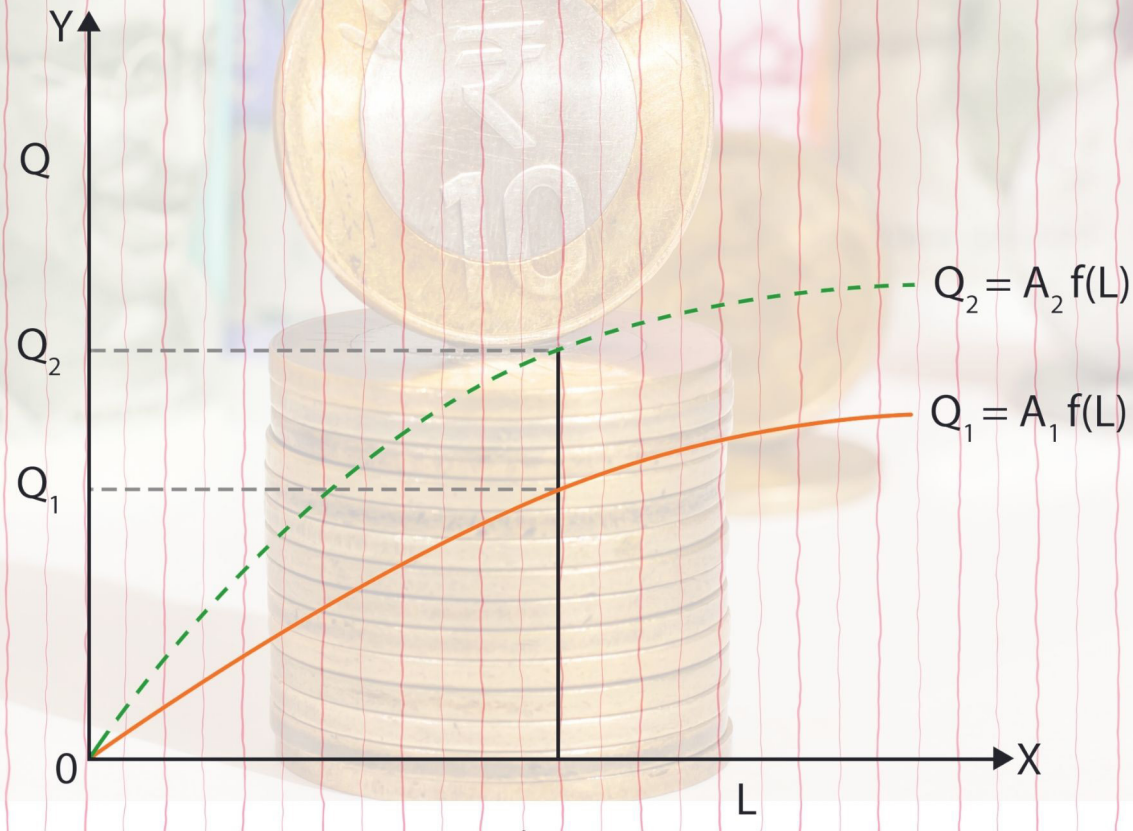
Microeconomics I

POST GRADUATE PROGRAMME IN ECONOMICS

Self Learning Material

M23EC01DC



SREENARAYANAGURU
OPEN UNIVERSITY

SREENARAYANAGURU OPEN UNIVERSITY

The State University for Education, Training and Research in Blended Format, Kerala

Vision

To increase access of potential learners of all categories to higher education, research and training, and ensure equity through delivery of high quality processes and outcomes fostering inclusive educational empowerment for social advancement.

Mission

To be benchmarked as a model for conservation and dissemination of knowledge and skill on blended and virtual mode in education, training and research for normal, continuing, and adult learners.

Pathway

Access and Quality define Equity.

Microeconomics I

Course Code: M23EC01DC

Semester-I

Master of Arts Economics
Self Learning Material

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Message from Vice Chancellor

Dear

I greet all of you with deep delight and great excitement. I welcome you to the Sreenarayanaguru Open University.

Sreenarayanaguru Open University was established in September 2020 as a state initiative for fostering higher education in open and distance mode. We shaped our dreams through a pathway defined by a dictum 'access and quality define equity'. It provides all reasons to us for the celebration of quality in the process of education. I am overwhelmed to let you know that we have resolved not to become ourselves a reason or cause a reason for the dissemination of inferior education. It sets the pace as well as the destination. The name of the University centers around the aura of Sreenarayanaguru, the great renaissance thinker of modern India. His name is a reminder for us to ensure quality in the delivery of all academic endeavors.

Sreenarayanaguru Open University rests on the practical framework of the popularly known "blended format". Learner on distance mode obviously has limitations in getting exposed to the full potential of classroom learning experience. Our pedagogical basket has three entities viz Self Learning Material, Classroom Counselling and Virtual modes. This combination is expected to provide high voltage in learning as well as teaching experiences. Care has been taken to ensure quality endeavours across all the entities.

The university is committed to provide you stimulating learning experience. The PG programme in Economics is conceived to be a continuum of the UG programme in Economics as it has organic linkage with the content and the form of treatment. In fact is a progression of the finer aspects of theories and practices. The discussions are meant to arouse interest among the learners in understanding the discipline in the real context and therefore, the examples are drawn heavily from the real life experiences. The provision for empirical evidences integrated endeavour of the academic content makes this programme special and relevant. We assure you that the university student support services will closely stay with you for the redressal of your grievances during your studentship.

Feel free to write to us about anything that you feel relevant regarding the academic programme.

Wish you the best.

Regards,

Dr. P.M. Mubarak Pasha

01.11.2023

Contents

MASTER OF ARTS ECONOMICS

Theory of Consumer Behaviour

Block 1

UNIT 1
Pragmatic Approach to Demand Theory

Learning Outcomes

After completing this unit, the learner will be able to

- familiarise with the pragmatic approach to demand theory
- examine the commonly used demand functions under pragmatic approach
- distinguish between different versions of dynamic demand functions

Background

Demand theory is a fundamental concept in economics that explains the relationship between the quantity demanded of a commodity and various factors affecting the demand of the commodity. Demand analysis and the theory of consumer behaviour examine how consumers make decisions about what to buy and how much to buy. You might have learnt different theories of consumer behaviour and utility approaches during your graduation. Cardinal Utility Theory, Ordinal Utility Theory or Indifference Approach, Revealed Preference Hypothesis are some of the basic theories of consumer behaviour. Though these traditional theories are impressive theoretically, applied economists have criticised traditional consumer theories for not being practically usable.

A pragmatic approach to demand theory involves using real-world data to gain insights into consumer behaviour. This can involve analysing historical sales data, conducting market research, and considering broader economic and social factors that influence consumer behaviour. For example, imagine you are a business owner trying to determine the price of your product. A pragmatic approach to demand theory would involve analysing data on consumer preferences, competitive prices, and economic trends to make an informed pricing decision. You might conduct surveys or experiments to understand how changes in price affect consumer behaviour, or you might use statistical techniques like regression analysis to model the relationship between price and quantity demanded. However, a pragmatic approach to demand

theory is not just about analysing data. The approach considers the broader economic and social context in which consumer behaviour occurs.

Let us examine the pragmatic approach to demand analysis in detail.

Keywords

Demand, Elasticities of demand, Lagged values, Dynamic models, Durable goods, Non-durable goods

Discussion

1.1.1 Pragmatic Approach to Demand Theory

- Real market data instead of traditional theories

The traditional demand analysis consists of various theories of consumer behaviour and approaches to utility. These theories and approaches are considered theoretically sound. However, the practical applicability of the theories and approaches of consumer theories in the complex real world is meagre. Take the case of Cardinal Utility Approach. You have already learnt that under Cardinal Utility Approach, the marginal utility is assumed to be measurable in terms of numbers. Think about the practical applicability of using the cardinal measure of marginal utility to form a demand function for future predictions. Utility is difficult to measure, as satisfaction from consumption is a qualitative parameter and not a quantifiable parameter. Hence, we cannot consider utility as a factor in the formulation of demand function for future predictions as we cannot quantify the utility. So, applied economists have developed a pragmatic approach to Demand Theory by using real market data for the formulation of demand functions. Under Pragmatic Approach, the 'law of demand' is considered as the fundamental concept for formulating demand function but, the individual consumer behaviours or utility theories are not referred. Instead, the market behaviour of all consumers is considered for formulating the demand function.

Pragmatic approach is considered as a recent development in demand analysis. The approach considers the broader economic and social context in which consumer behaviour

occurs. Factors like income, demographics, and cultural norms can all influence consumer preferences and behaviour; so it's important to take these factors into account while developing pricing and marketing strategies. By taking a pragmatic approach to demand theory, economists and business analysts can develop more effective strategies for pricing, marketing, and product development. This can help businesses to better understand their customers and improve their competitiveness in the market.

- Effective market strategies and competitiveness

1.1.1.1 Constant Elastic Demand Function

Constant Elastic Demand Function is the most commonly used demand function under the recent developments in applied economics. Let us consider the demand for a commodity,

$$Q_x = \beta_0 \times P_x^{\beta 1} \times P_0^{\beta 2} \times Y^{\beta 3} \times e^{\beta 4 t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Here, Q_x is the quantity demanded of the commodity, x; P_x is the price of the commodity, x. β_1 is the price elasticity of demand; P_0 is the price of related commodities; β_2 is the cross elasticity; Y is the money income of the consumer; β_3 is the income elasticity of demand; $e^{\beta 4 t}$ is trend factor for tastes and preferences. β_1, β_2 *and* β_3 which are the co-efficient of elasticities of demand with respect to price, price of related commodities, and income respectively, are constant. Hence, the demand function given under equation (1) is termed as Constant Elastic Demand Function.

- Co-efficients of elasticities of demand are constant

Let us discuss the proof of β_1 as the constant coefficient of price elasticity of demand:

- Log of $X^n Y^{n-1}$ = n log X + n-1 log Y

Given below is the logarithmic form of the equation (1)

$$\log Q_x = \log \beta_0 + \beta_1 \log P_x + \beta_2 \log P_0 + \beta_3 \log Y \ldots\ldots\ldots (2)$$

Here, trend factor for taste and preferences is not taken in order to avoid complexity.

Now, consider the partial derivative of the above logarithmic function with respect to P_x since β_1 is the coefficient of the price elasticity of demand, P_x and we are considering the proof of β_1 as the constant coefficient.

The partial derivative of P_x is calculated to know the effect

of price of commodity, x in the demand for the commodity, with other factors being constant. The partial derivative of the demand function with respect to P_x is,

$$\frac{\partial log Q_x}{\partial log P_x} = \beta_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(3)}$$

One of the basic properties of the logarithms with respect to operation of derivative is that the change of the logarithm of a variable is equal to the proportionate change of the variable. This property can be used in both numerator and denominator of the equation.

$$\partial log Q_x = \frac{\partial Q_x}{Q_x} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(4a)}$$

$$\partial log P_x = \frac{\partial P_x}{P_x} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(4b)}$$

Inserting equation (4a) and (4b) in the equation (3),

$$\frac{\partial log\, Q_x}{\partial log\, P_x} = \frac{\partial Q_x / Q_x}{\partial P_x / P_x} = \beta_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(5)}$$

- Logarithm and partial derivatives to prove Constant elasticities of demand

Rearranging the second part of the equation $\frac{\partial Q_x / Q_x}{\partial P_x / P_x}$:

$$\frac{\partial Q_x}{\partial P_x} \times \frac{P_x}{Q_x} = \beta_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(6)}$$

We know that the price elasticity of demand, $e_p = \frac{\partial Q}{\partial P} \times \frac{P}{Q}$

So, in the equation (6), left hand side is the price elasticity of demand.

Hence, $e_p = \beta_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(7)}$

The above equation shows that β_1 is the coefficient of price elasticity of demand which is constant. Following the method β_2 and β_3 can be proved to be equal to cross and income elasticity of demand respectively.

- Absence of Money Illusion

The Constant Elastic Demand Function under Pragmatic approach considers the assumption of absence of money illusion, though it is advocated by traditional utility theory. Without money illusion, the demand is a homogeneous function with a degree equal to zero. The function can be made relative to general price index, making money income in the demand function as real income ($^{Y}/_{P}$), and price of the commodity and related commodity as relative to general price level.

Then, the Constant Elastic Demand Function can be written as

- Homogenous function of degree one leading to no money illusion

$$Q_x = \beta_0 \left(\frac{P_x}{p}\right)^{\beta_1} \cdot \left(\frac{P_0}{p}\right)^{\beta_2} \cdot \left(\frac{Y}{p}\right)^{\beta_3} \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Here, P is general price index. A rise in price and income in the same proportion, say, 'k' causes no change in demand for the commodity, X. Here, there is no money illusion and demand function is a homogenous function of degree one. Hence, pragmatic approach assumes the absence of money illusion as change in price and income do not lead to change in quantity demanded. Moreover, it shows that the function is homogenous with degree one.

1.1.1.2 Dynamic Versions of Demand Function

- Demand as a function of lagged values of factors

Representing demand function in a dynamic form is another recent development in demand analysis. R. Stone, D. A. Rowe, H. S. Houthakker, and L. D. Taylor are the major proponents of the dynamic demand functions. The main idea of dynamic version of demand function is that the consumer behaviour or demand for the commodity is influenced by the lagged variable of the factors affecting demand. This follows the idea that the current consumption is based on the past behaviour, and ensures the reflection of reality in the demand analysis. Since demand in the dynamic demand function depends on lagged factors, the model is called Distributed-lag Models of Demand.

The relation between current consumption decisions and past behaviours can be understood from the common notion of relation between current consumption behaviour and previous income and demand. Let us see the relation between present consumption and past demand. This relation can be seen separately for durable and non-durable goods. In the case of durable goods such as furniture, TV, Fridge etc., since it

stays for a particular period of time, the current and future consumption of the good depends on the stock of the durable commodity with the consumer. For non-durable goods, the present consumption is based on the habit of consumption in the past period. Here, the past consumption leads to present and future consumption. You might be familiar with experiencing how good habits in the past transcend to the present. Similarly, bad habits, especially intake of toxic non-durable commodities cause the similar habit to continue in present and future periods. With respect to the relation between present consumption and income in the past period, income in the recent past has more impact than the income long back in affecting the consumption.

- Present demand based on stock of goods and habit of past

The demand function expressed as distributed lag model is given below:

$$Q_{X(t)} = f(P_{X(t),} P_{X(t-1),} \ldots Q_{X(t-1)}, Q_{X(t-2)}, \ldots\ldots, Y_{(t)}, Y_{(t-1)} \ldots..) \ldots\ldots (9)$$

Here, 't' represents the current period, 't-1' represents previous period, and 't-2' represents the period previous to 't-1'. So, $Q_{X(t)}$ represents quantity of the commodity 'X' demanded in present time; $P_{X(t)}$ represents price of the commodity 'X' in the present period; $P_{X(t-1),}$ represents price of the commodity in the previous period; $Q_{X(t-1)}$ represents quantity demanded of 'X' in the previous period; $Q_{X(t-2)}$ represents quantity demanded in the period previous to 't-1'; $Y_{(t)}$ represents level of income in the present period; and $Y_{(t-1)}$ represents the level of income in the previous period.

- Lagged factors affecting demand

One can add lags based on the relationship being studied. Lagged model is mainly used to represent demand function for durable goods. Extension of dynamic model for a vast number of commodities was done by R Stone. The dynamic model was used for formulating investment function by Nerlove in Stock Adjustment Model. The Stock Adjustment Model was extended to include non-durable goods by Houthakker and Taylor in Habit Creation Principle.

- Lagged concept for durable and non-durable goods

Stock Adjustment Model of Nerlove

Nerlove model was first developed for durable goods. The demand function is given below.

- Nerlove model - durable goods

$$Q_{X(t)} = a_1 Y_{(t)} + a_2 Q_{X(t-1)} \quad \ldots\ldots\ldots\ldots\ldots (10)$$

The quantity demand in the present period is a function of present income and quantity demanded in the previous period.

The demand function given under Nerlove's Stock Adjustment Model under equation (10) can be derived using the concept of lag that can be derived from the concept of desired level of quantity demanded of the durable goods, Q^*_t . This desired level of quantity demanded ($Q^*_{(t)}$) is a function of current income.

- Consumption of desired level in portions

$$Q^*_{(t)} = b\, Y_{(t)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Due to limited income, a consumer may not attain the desired level of durable goods at a single purchase. Instead, they consume portions of desired level at each period leading to consumption having lagged components. Thus consumption of desired level of durable goods is a gradual process, and at each point, the actual level of durable goods comes closer to the desired level as the consumer consumes a certain quantity of $Q^*_{(t)}$. The difference between the actual quantities bought in previous and present period is $Q_{(t)} - Q_{(t-1)}$.

- Actual Purchases - a portion of desired difference needed to reach $Q^*_{(t)}$

This difference in the actual quantity bought is just a portion of the desired difference needed to reach the desired level, $Q^*_{(t)}$. The desired difference in quantities bought in the previous and present periods is $Q^*_{(t)} - Q_{(t-1)}$. The relation between difference in actual quantity bought and desired difference to attain desired level of demand can be given as:

$$Q_{(t)} - Q_{(t-1)} = k\,(Q^*_{(t)} - Q_{(t-1)}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Here, 'k' represents the coefficient of stock adjustment. That is, each time, the actual purchase is only a fraction of the desired level. The value of the coefficient ranges between zero and one.

Now, substitute equation (11) in (12) for $Q^*_{(t)}$,

$$Q_{(t)} - Q_{(t-1)} = k\,(b\, Y_{(t)} - Q_{(t-1)}) \ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Rearranging the equation

$$Q_{(t)} = k\,(b\, Y_{(t)} - Q_{(t-1)}) + Q_{(t-1)}$$

$$= (kb)\, Y_{(t)} + Q_{(t-1)} - k\, Q_{(t-1)}$$

$$Q_{(t)} = (kb) Y_{(t)} + (1-k)\, Q_{(t-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (14)$$

- Past stock determines present demand for durable goods

Substitute 'kb' as 'a_1 ' and (1-k) as 'a_2 ', we get the Nerlove's Stock Adjustment Demand Function,

$$Q_{X(t)} = a_1\, Y_{(t)} + a_2\, Q_{X\,(t-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Therefore, the Stock Adjustment Model shows that the present demand for the durable good depends on the stock of the good accumulated in the previous period, and the desired level would be achieved by building up stock of the goods in each period.

Dynamic Model of Houthakker and Taylor

- Demand for non-durable - function of past habit

Houthakker and Taylor introduced their dynamic model by extending Nerlove's model on durable goods to non-durable goods. We have seen in Nerlove's model that the demand for the durable goods in the present period is dependent on the commodity brought during the past time together with other factors. In the case of non-durable goods, the present consumption is dependent on the habit formed by the consumption of the goods in the previous periods.

The demand function can be written as

$$Q_t = a_0 + a_1 P_t + a_2 \Delta P_t + a_3 Y_t + a_4 \Delta Y_t + a_5 Q_{t-1} \ldots\ldots\ldots\ldots (15)$$

Here, P_t is the price of the non-durable goods at the present period; ΔP_t is the difference in price level between present period, 't' and previous period, 't-1'; Y_t is the income of the consumer in the present period; ΔY_t is the difference in price level between present period, 't' and previous period, 't-1'; Q_{t-1} is the quantity of the same non-durable good demanded at the previous period. a_1, a_2, a_3, a_4, a_5 are the coefficients showing proportional changes in Q_t in response to the proportional changes in the factors viz. current price, change in price, current income, change in income, and quantity demand in previous period respectively.

We can derive the above function. Demand for goods in any period can be a function of price of the goods at the time, stock of the goods that the consumers already have, and income of

- Factors - Price, income, change in factors, past consumption

the consumers. So, the respective demand function can be written as:

$$Q_t = b_0 + b_1 P_t + b_2 S_t + b_3 Y_t \quad \text{.....(16)}$$

Here, b_0, b_1, b_2, b_3 are the coefficients of the respective factors showing proportional change in the demand due to the changes in these factors. S_t refers to the physical stock of the durable goods or stock of habits of non-durable good.

- Measuring stock of goods is difficult due to heterogeneity

It is important to note that the stocks of both durable and non-durable goods are difficult to quantify. With respect to quantifying the stock of the durable goods, the age of the goods that the consumers possess may be different. For example, electrical fans used in a house or in an office might have been bought during different times making them old differently. In this situation, the level of depreciation may be different. If we consider the stock of different kinds of durable goods such as electric lights, electric fans, mobile phones, laptops, and so on together, the chances of differences in the depreciation level are very high. When some goods are purchased new, some other goods might be in the state of scrapping. So, the heterogeneity of items and their relative oldness make it difficult to measure the stock of durable goods. The second best option is to get the sum of stock of depreciated goods. But, it is difficult to measure the rate of depreciation too. In the case of non-durable goods, habits are a psychological factor which is difficult to measure.

Inorder to tackle the issue of quantifiability of stock, the part of the equation demonstrating the stock of the goods can be replaced by quantifiable variable which are reasonably capable of representing the stock.

The following set of equations shows the replacing of the stock S_t of the durable goods:

The difference in the stock of the durable goods between the previous and present periods can be represented as $S_t - S_{t-1}$. This difference in stock can be equal to the quantity of goods purchased in the present period minus the old goods's depreciation.

So,

$$S_t - S_{t-1} = Q_{Dt} - \text{depreciation} \text{.....(17)}$$

Note: In the above equation, 'D' given as subscript to Q is to represent durable. The equation can be used without 'D'

For analytical convenience, let us consider the rate of depreciation is same in each period, the depreciation can be represented as δ S_t. So, the equation (17) will become

- Change in stock of goods be represented in terms of depreciation

$$S_t - S_{t-1} = Q_{Dt} - \delta S_t \text{..... (18)}$$

Since we get the equation for S_t, we can solve the equation (16) for S_t

$$Q_{Dt} = b_0 + b_1 P_t + b_2 S_t + b_3 Y_t \text{..... (16)}$$

$$b_2 S_t = Q_{Dt} - b_0 - b_1 P_t - b_3 Y_t$$

$$S_t = \frac{1}{b_2}(Q_{Dt} - b_0 - b_1 P_t - b_3 Y_t) \text{..... (19)}$$

We can substitute the value of equation (19) in Right Hand Side of equation (18)

$$S_t - S_{t-1} = Q_{Dt} - \frac{\delta 1}{b_2}(Q_{Dt} - b_0 - b_1 P_t - b_3 Y_t) \text{..... (20)}$$

- Both demand function in present and pervious period a function of price, stock of goods, and income in subsequent period

Now, again think of equation (16). Since the quantity demand in the present period 't' is a function of price, stock of goods, and income, the quantity demanded in the previous period, 't-1' also has the same relation, and is related to the price, stock of goods, and income at the previous period.

$$Q_{Dt-1} = b_0 + b_1 P_{t-1} + b_2 S_{t-1} + b_3 Y_{t-1} \text{..... (21)}$$

Therefore, equation (16) shows the demand function in present 't' period and equation (21) shows demand function in previous period 't-1'.

So, subtracting the equation (16) and equation (17), we get

$$Q_{Dt} - Q_{Dt-1} = b_0 + b_1 P_t + b_2 S_t + b_3 Y_t - [b_0 + b_1 P_{t-1} + b_2 S_{t-1} + b_3 Y_{t-1}]$$

$$Q_{Dt} - Q_{Dt-1} = b_1(P_t - p_{t-1}) + b_2(S_t - S_{t-1}) + b_3(Y_t - Y_{t-1}) \text{.....(22)}$$

Note: 'b_0' of both the equation get cancelled out.

See, in equation (22), there is a part representing $S_t - S_{t-1}$. We already have the value for $S_t - S_{t-1}$ in equation (20). Substituting equation (20) in equation (22), we get

$$Q_{Dt} - Q_{Dt-1} = b_1(P_t - p_{t-1}) + b_2[Q_{Dt} - b_0 - b_1P_t - b_3Y_t] + b_3(Y_t - Y_{t-1}) \quad \text{..... (23)}$$

Rearranging the above equation,

$$Q_{Dt} = Q_{Dt-1} + b_1(P_t - p_{t-1}) + b_2Q_{Dt} - \delta\frac{b_2}{b_2}(Q_{Dt} - b_0 - b_1P_t - b_3Y_t) + b_3(Y_t - Y_{t-1}) \quad \text{... (24)}$$

Note: In the above equation, $\frac{b_2}{b_2}$ get cancelled out.

Take all the variables related to $Q_{Dt}$to the Left Hand Side (LHS),

$$Q_{Dt} - b_2Q_{Dt} + \delta Q_{Dt} = Q_{Dt-1} + b_1\Delta P_t + \delta b_0 + \delta b_1P_t + \delta b_3Y_t + \delta b_3\Delta Y_t \quad \text{..... (25)}$$

Factor out Q_{Dt} in LHS and re-arrange the equation,

$$Q_{Dt}(1 - b_2 + \delta) = \delta b_0 + \delta b_1P_t + b_1\Delta P_t + \delta b_3Y_t + \delta b_3\Delta Y_t + Q_{Dt-1} \quad \text{..... (26)}$$

$$Q_{Dt} = \frac{\delta b_0}{1-b_2+\delta} + \frac{\delta b_1}{1-b_2+\delta}P_t + \frac{b_1}{1-b_2+\delta}\Delta P_t + \frac{\delta b_3}{1-b_2+\delta}Y_t + \frac{b_3}{1-b_2+\delta}\Delta Y_t + \frac{1}{1-b_2+\delta}Q_{Dt-1} \quad \text{..... (27)}$$

Consider,

$$\frac{\delta b_0}{1-b_2+\delta} = a_0;\ \frac{\delta b_1}{1-b_2+\delta} = a_1;\ \frac{b_1}{1-b_2+\delta} = a_2;\ \frac{\delta b_3}{1-b_2+\delta} = a_3;\ \frac{b_3}{1-b_2+\delta} = a_4;\ \frac{1}{1-b_2+\delta} = a_5;$$

Substituting the val$Q_{Dt} = a_0 + a_1P_t + a_2\Delta P_t + a_3Y_t + a_4\Delta Y_t + a_5Q_{t-1}$ ..... (15)

- Demand for durable and non-durable a function of price, income, change in these factors, previous demand

Therefore, we have derived the Houthakker and Taylor demand function.

1.1.2 Linear Expenditure Systems

- Total consumption of groups rather than individuals

Linear Expenditure Systems (LES) include the models dealing with the consumption of a group of commodities instead of the consumption of individual ones. R. Stone in his work, 'Economic Journal' in 1954 introduced one of the earliest linear expenditure models. The linear expenditure model, when dealt with total consumption of groups of commodities gives total expenditure of the consumer. Hence, LES is considered

important under econometric models.

- Deals with group of commodities that are not substitutable

Under LES models, demand functions are generated from the traditional utility functions where demand depends on the maximisation of utility, given the budget. Hence, it is possible to say that the LES models are similar to models based on Indifference Curves. The difference between traditional indifference curve models and LES models is that LES models are applicable to groups of commodities that are not substitutable among each other whereas the indifference curve models primarily deal with the substitutability of commodities. Hence, the indifference curve under LES model will be 'L' shaped showing absence of substitution between the commodities. The indifference map under LES model is as follows:

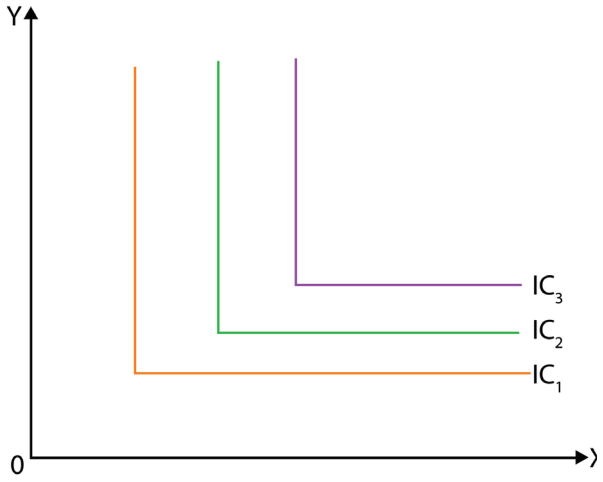

Fig 1.1.1 Indifference Map under LES Model

- Addition of utilities possible as goods are non-substitutable

The indifference map shown above represents the shape of the indifference curves of complementary goods. The groups of commodities considered under LES model are not substitutable goods. Hence, the total utility from the consumption of the group of commodities is the sum of the utilities. If a group of commodities consumed comprises food articles (A), durable goods (B), clothing (C), household expenses (D), and service expenses such as transport, entertainment (E), total utility is the sum of the individual groups.

$$U = U_A + U_B + U_C + U_D + U_E \quad \text{.....(28)}$$

So, $U = \Sigma U_i$ where i measures the group of commodities.

- Subsistence quantity is consumed from each group

Each group of commodities considered under LES model are broad categories within which there are substitute and complimentary goods. So, substitutability is not present among the group of commodities under consideration. A certain minimum amount of commodity is consumed from each group and this amount of commodity is referred to as subsistence quantities. LES assumes that these quantities are consumed regardless of prices. However, any income available above what is needed for the consumption of the subsistence quantities is used among the group of commodities considering the prices.

Summarised Overview

The pragmatic approach to demand theory refers to using real-world data to gain insights into consumer behaviour. The approach gives a practical way of generating a demand function that can be used for understanding the role of real factors in determining the demand of a commodity in the present period. One widely used model of pragmatic approach is the constant elasticity demand function, which assumes that the percentage change in quantity demanded of a good is proportional to the percentage change in its price, income, price of related income. Here, elasticities of demand, cross elasticity, income elasticity are considered constant. There are dynamic versions of the demand function, which take into account the time lag between changes in factors affecting demand and changes in quantity demanded of the commodity. Examples of dynamic demand models include the Nerlove model and Houthakker-Taylor model. Under dynamic model, demand function for durable and non-durable goods are considered. Past consumption, past habit of consumption and past income level determine the present demand for a commodity. Stock of the commodity accrued in the past and stock of habit are two important concepts in the dynamic demand models. Linear Expenditure System assumes that consumers allocate their income across goods and services based on a linear relationship between their expenditure and income and there is no substitutability among the group of commodities considered under the system.

Self Assessment

1. What is pragmatic approach to demand analysis?
2. Give the equation for constant elasticity demand function. Describe each factors in the function.
3. Explain the concept of distributed lagged models.
4. What is Nerlove's Stock Adjustment model?
5. Explain Houthakker-Taylor models.
6. Explain the linear expenditure system.

Assignments

1. Explain how pragmatic approach is different from traditional approaches in determining demand function.
2. Discuss the constant elasticity demand function. Can this model accurately capture consumer behaviour in all markets and for all goods and services?
3. Compare and contrast the dynamic versions of the demand function, including the Nerlove, Houthakker-Taylor models. How does the model for durable goods extend for non-durables?
4. In what types of markets or situations might the pragmatic approach to demand theory be more appropriate than traditional economic models of demand?
5. Analyse the potential effects of a price increase on the demand for a specific good using the constant elasticity demand function. How might the results differ if a dynamic version of the demand function were used instead?

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2. Mankiw, Gregory.N (2012), *Principles of Microeconomics*, 6th Edition, Cengage Learning.

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1. Snyder, Christopher, Nicholson, Walter. (2012). *Microeconomic Theory: basic principles and extensions* (Ed. 11th), Cengage Learning.
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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 2
Consumer Choices Involving Risk and Uncertainty

Learning Outcomes

After completing this unit, the learner will be able to

- evaluate the consumer choices under uncertain situations
- explain the reason for non-participation of individuals in fair games
- distinguish between Bernoulli Hypothesis and Friedman-Savage hypothesis

Background

Risk and uncertainty are parts of life where individuals are supposed to make best possible choices. Similarly, choices of a consumer are taken under various conditions of certainty, uncertainty or risk. We know that certainty is a situation where there is only one outcome available. Most of the consumer theories you have learnt already might have discussed only about certainty. Factors associated such as price, income, savings, investments under consideration are given as certain. In reality, like the certainty situations, the consumers also face risky and uncertain situations. Risk represents a situation where there are more than one possible outcome associated with the event or action involved.

Inorder to make choices under uncertain situations, consumers need to make different strategies to take the proper decision. Strategies are alternative actions taken at the time of decision making. Individuals make decisions regarding purchase of new variant automobiles, choose a job, make large purchases like house, loan for education where quality of the good, or the future income in which the consumption is based are unknown. However, it is important to take decisions in these matters at a point as the uncertainty of income or risk of not having complete information may be a permanent thing.

Keywords

Uncertain situation, Probability, Payoffs, Expected value, Expected utility, Utility index

Discussion

1.2.1 Consumer Choices Involving Risk and Uncertainty

- Risk and uncertainty are common and make consumer choices difficult

Most of the demand theories that consider the factors involving consumer behaviour are certain and people face no risky situation while making choices. Under these theories, factors like price, income and returns from investment are considered certain and known. However, in reality, we all know, there are many uncertain and risky situations about which we have to make a choice. Consider the investment of your hard earned money in Stock Market. You can have a high return on your savings, if you invest your savings in Stock Market via Mutual Funds or directly in Shares or Bonds. But, it is widely known that "Stock Markets are subject to market risks". You might have heard this in Mutual Fund advertisements. The risks involved in Stock Markets are the chances of losing your money due to general market fluctuations like recession, depression, or due to market problems specific to the shares or bonds of the company you invested. So, it is very important to evaluate the market situation and trustworthiness of the company before investing in. Therefore, a rational individual's choices under risky and uncertain situations are difficult to make, and they requires greater care.

- Extent of risk be understood from all possible outcomes

A rational consumer's choice in an uncertain situation depends on the extent of risks the person faces. In order to understand the risk involved in a particular situation, we must list out all the possible outcomes of the particular situation. Consider the above mentioned situation of investing in stock market. If you invest in an infrastructure company dealing with the construction of airport, and expect it to complete the prestigious project within the stipulated time, then, the value of the shares of the company will increase from Rs. 100 per share to Rs. 150 per share. If the company fails to complete the project within the targeted time, the value of the share may fall from Rs. 100 to Rs. 50 . Here, the two possible outcomes

are completing the work leading to rise in share price to Rs. 150 per share and not completing the work causing a fall in share price to Rs. 50 per share.

- Chance of occurrences of an outcome is probability

We have seen that, the possible outcomes of a situation give an idea of the extent of risks. In the above case, the extent of risk is that there is a chance of loss of money at the rate of Rs. 50 per share if the company fails to complete the project in time. But, there is also a chance of gain of the money at the rate of Rs. 50 if the company completes its work in time. So, the extent of the risk involved here also depends on the chance of occurrence of both the outcomes. This chance of occurrences of an outcome is called probability. So, probability measures the 'likelihood that a given outcome will occur'.

- Probability based on past experiences, current situations, subjective experiences

Probability can be assigned to the increase and decrease in share price in the above example. Let us say the probability is 60 percent for completing the work in stipulated time and having a hike in the share price and the probability of not completing the work is 40 percent. The probabilities are assigned on the basis of the past experiences of the company, present market situations, and so on. However, if there are no possibility of referring to a past situation, probability can be assigned subjectively since an outcome has to occur. The issue with subjective probability is that different people assign different probabilities to same outcomes. Experiences in the field may act as the referral for assigning probability.

- Payoffs – values associated with outcomes

The probability is very useful in calculating the expected value of uncertain situations which explains and compares the risky choices. Let us explain the expected value of an investment in a Construction Company. We know that the two outcomes are as follows, successful completion of work and failure in the completion of the work. Both the outcomes are associated with a payoff or 'value associated with the outcomes'. In the case of successful completion, the payoff or value of outcome is Rs. 150 per share, and for unsuccessful in completion, the payoff is Rs. 50 per share. The expected value of an uncertain situation is equal to payoffs times the probability of related outcomes. The expected value is defined as the 'probability weighted average of payoffs associated with all possible outcomes'.

The expected value can be represented as E(x).

E(x) = Probability of outcome 1 × payoff + Probability of outcome 2 × payoff …….. (1)

In the example, E(x) = 0.6 × 150 + 0.4 × 50

= 110

So, the expected value of investment in the construction company, with 60 percent probability of getting a hike in share price to Rs. 150 and 40 percent probability of fall in share price to Rs. 50 is Rs. 110 per share. This is a gain of share price of Rs. 10 per share. This means that, with the above mentioned probability and payoffs of investment, on an average, an individual consumer will gain from the investment in the construction company by Rs. 10 per share (since the original price of each share is taken as Rs. 100 in the example). So, the consumer choice under risky and uncertain situation depends basically on the possible outcomes of an uncertain situation, the probability of the occurrence of outcome, the payoff or value of the outcomes, and the resulted expected value.

- Consumer choice under uncertain situation depends outcomes, probability, payoffs, expected value

Time and Characteristics

Risk of an action and the particular time at which the action takes place are related. Timing of an action is important as it represents the nature of the general and particular situation or scenario of the economy. Take the case of the investment in a Construction Company. The timing of the investment is important. Consider, if the investment is made during the period of recession, then the overall Marginal Efficiency of Capital (MEC) and future expectations of investment will be lower. There are high chances of delay in the completion of the work during the period of recession. Since delay in the construction work is associated with the fall in share price of the company, an investment in the construction will give loss to the investors. Similarly, a boom in the economy gives all the needed facilities to complete the construction within stipulated time. Since the construction can be completed at the right time, the share price will increase and investment in the company earns profit.

- Risk and time are related

Here, the period of time or length of time is very important. Longer the period of recession, the risk in investment will be higher, and respective gain from the investment is lower. Conversely, if the period of boom is longer, risk associated will be lower and gain or return will be higher. So, the nature

- Nature and length of time affects extent of risk and return

of the time and length of such time determine the extent of risk in an action and associated return from an action.

1.2.2 St. Petersburg Paradox

St. Petersburg Paradox explains the consumer behaviour of not participating in fair games and non-fair games. Let us explain fair and non-fair games. Fair games are those games where expected value is equal to zero. A simple example for explaining fair game is tossing the coin. When you toss a coin, the chances of getting a head is 50 percent. That is, you might end up in getting a head or a tail while tossing the coin, and there is a 50-50 chance or probability of getting or not getting a head. Suppose, getting a head while tossing the coin is considered as winning. The prize of getting a head is 100 rupees and not getting head (or getting a tail) is (-100) rupees. That is, you have to give Rs. 100 if you get a tail.

- Under fair games, expected value is zero

The expected value of a game is probability times the prize of the game. i.e., E (x) = Probability times prize. In the case of tossing a coin, the expected value can be written as:

$$E(x) = 0.5 \times 100 + 0.5 \times (-100) \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Here, 0.5×100 is the value from getting a head and $0.5 \times (-100)$ is value lost due to not getting a head.

$$E(x) = 50\text{-}50$$

$$E(x) = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

- E (x) = Probability × prize

Since the expected value of tossing the coin is zero in the situation, the tossing coin can be considered as a fair game. Since there are 50-50 probability of getting and losing the money from the game, most of the time people do not take part in fair games (unless those are fond of gambling or those get a utility from uncertain games).

There are chances that prize of winning are much higher than loss due to failing. Suppose, while tossing a coin, winning price for getting a head is fixed as 200 while not getting a head is fixed as 100 itself. Then, expected value will be

$$E(x) = 0.5 \times 200 + 0.5 \times (-100) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$E(x) = 100 - 50$$

$$E(x) = 50 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

- Entry fee convert non-fair game to fair game

Here, the expected value is equal to 50 and not equal to zero. So, the game is a non-fair game. But, it is possible to change the non-fair game to fair game by imposing a fee for participating in the game, equal to the expected value. In this case, game can be changed to fair one by imposing an entry fee of 50 rupees. You might be aware of the entry fee in casinos to participate in different types of games.

- Non participation in fair game refers St. Petersburg paradox

People may not participate in fair game when the outcomes are uncertain. Even when the winning price is too high, people might be hesitant to participate in games. This is termed as St. Petersburg paradox. Let us explain the St. Petersburg paradox in detail.

Consider tossing a coin. Here, tossing is supposed to continue until one gets a head. If the prize of getting a head is fixed as rupees 10 and a head appears only at 5^{th} time, then the player gets 10^5 which is equal to 1,00,000 rupees. If the player gets a head at the first attempt, then the price is rupees 10, at the second attempt, it is rupees 100. This can be written as

$$X_{1=}10\ ;\ X_{2=}100\ ;\ X_{3=}1000;\ X_{4=}10000;\ X_{5=}100000..,\ X_n = 10^n .. (6)$$

- Prize of winning in nth time is prize of (first time) ^{n}

The above representation shows that if the player gets head at the 'nth' time, the prize is 10^n.

With respect to probability, the probability of getting a head at the first time is ½. We have already seen that there is 50-50 chance for getting head and tail. The probability of getting a head at the first time is ½, for the second time is $(½)^2$, for the third time is $(½)^3$. If there are 'n' number of tossing, the probability of getting head is $(½)^n$. This can be written as

$$P_1 = ½\ ;\ P_2 = ¼;\ P_3 = ⅛.\ ;\ P_n = (½)^n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

- Probability of winning in tossing a coin is $(1/2)^n$

We know that, the expected value of the game is probability times the price. Then, the expected value of tossing the coin for n times is

$$E(x) = P_1X_1 + P_2X_2 + P_3X_3 + \ldots\ldots\ldots + P_nX_n \ldots\ldots\ldots\ldots\ldots (8)$$

$$= ½.10 + ¼\ .\ 100 + ⅛.\ 1000 + \ldots\ldots + (½)^n.\ 10^n \ldots\ldots\ldots (9)$$

If a coin is tossed for infinite times, the expected value will be

$$E(x) = 5+25+125+\ldots\ldots = \infty \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

- For infinite number of tossing, expected value is infinite

If the expected value is infinite, the fee to play tossing coin will be a considerably higher amount, leading no rational individual to play. So, St. Petersburg paradox shows that rational individuals do not take part in fair games.

1.2.3 Expected Utility and Bernoulli Hypothesis

- Participation in game based on utility of money and not on monetary value of money

Daniel Bernoulli, a Mathematician in the 18th Century explored the reasons for non-participation in fair games. Bernoulli explained that people participate in games not based on the monetary value of the prize of winning or losing, but on the utility derived from the prize or loss. You have already learnt that the utility of money falls when the stock of money increases. Therefore, the participation in games is based on comparing the utility derived from the winning prize with the utility loss due to loss of money if failed.

- Participation based on comparison of gain of utility from winning with loss of utility from failure

Consider the earlier case where the winning prize is 100 rupees and losing the game is Rs. -100. Let us consider that the winning prize and loss have increased to Rs. 2000 each. If an individual has Rs. 8000, winning a game gives 2000 additional money leading to a total money holding of Rs. 10,000. But, a loss in the game makes the player pay Rs. 2000 leading to fall in money holding to Rs. 6000. Before participating in a game, an individual compares the marginal utility of money derived from winning the prize with utility of money derived from losing the money due to failure. The marginal utility of money is the increment to the total utility of money when an additional amount of money is added to the stock of money. Since marginal utility of money is inversely related to stock of money holding, an individual's utility derived from increase in money stock to Rs. 10,000 will be lesser than utility lost due to fall in money stock to Rs. 6000 when failed. Thus expected utility from winning and losing the game determines the decision making regarding participation in the game.

The above situation can be explained using a figure.

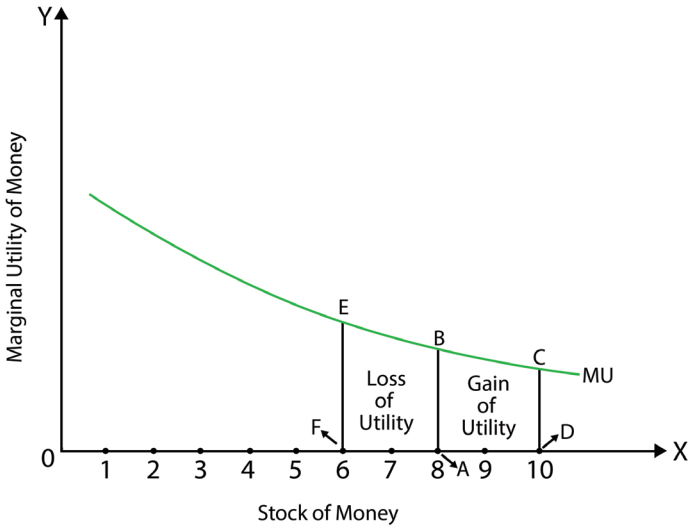

Fig 1.2.1 Utility of Money and Non-participation in Game

- Decision of participation based on utility of money, not on monetary value of money

In the figure, the X axis measures the stock of money and the Y axis measures the marginal utility derived from winning and losing the money. Here, winning the prize of Rs. 2000 increases the stock of money from Rs. 8000 to Rs. 1000. This causes gain in utility shown as 'ABCD'. If the individual lost the game, the person has to pay Rs. 2000 reducing the total stock of money from Rs. 8000 to Rs. 6000. This reduces the utility shown as 'ABEF'. From the figure, it is clear that the gain of utility 'ABCD' is less than the loss of utility 'ABEF', though the money value of winning and losing the game is the same. Since the gain of utility from participation in the game is lesser than the loss of utility, the individual decides not to participate in the game. Therefore, the decision of participation in a game is based on the utility derived from winning or losing the game and not on the basis of the monetary value. This is the Bernoulli's solution to St. Petersburg paradox.

1.2.4 Neumann and Morgenstern Index

- Mathematical foundation for Bernoulli's hypothesis

A mathematical foundation for Bernoulli's hypothesis as a solution for St. Petersburg was given by John Von Neumann and Oscar Morgenstern in their work, 'The Theory of Games and Economic Behaviour'. The basic axioms of N-M theorem also shows that rational individuals make choices under uncertain situations based on the utility function rather than the monetary value. Individuals try to maximise their expected value of utility, and not the monetary value of money. The theorem used cardinal measure of utility of prize.

Inorder to explain N-M utility index, let us consider the case of taking lottery as the uncertain game. Here, there are

- Utility assumed to various prizes of participating in lottery

a number of prizes associated with the winning while taking lottery. Let us suppose the prizes be $x_1, x_2, x_{3,.....} x_n$ if there are 'n' number of prizes. x_1 represents the least favoured prize, x_2 represents the second least favoured, and x_n shows the most favoured prize. It is possible to assume utility to each prize of participation in the lottery as given below:

$$U(x_1) = 0, U(x_1) = 1 \text{ .....(11)}$$

- Assign probability to prize of game

We can explain the utility index using an illustration. Suppose a person wants to purchase a lottery. Rs. 5,000 is the winning prize of the lottery and Rs. 100 is the consolation prize which the individual prefers the least. So, the outcomes are Rs. 5,000 and Rs. 100. Let us assume the probability of occurrence of Rs. 5000 price and the consolation price of Rs. 100. For Rs. 5,000, the probability of occurrence of the outcome is 70 per cent, and for Rs. 100, the probability of getting the consolation is 30 per cent.

Then, expected value is

$$E(x) = P_1 \times W + (1- P_1) \times F \text{ ---------- (12)}$$

- $E(x) = P_1 \times W + (1- P_1) \times F$

P_1 is the probability of occurrence of the winning outcome, i.e., winning the lottery and getting Rs. 5000; W is the winning outcome, Rs. 5000; $(1-P_1)$ is the probability of getting the occurrence of the second outcome, i.e., getting the consolation price. Since the total probability of occurrence of all the possible outcomes adds up to 100 per cent or 1 under the probability theorem, the probability of getting consolation can be written as $(1- P_1)$ as there are only two outcomes here; F is the failing outcome.

- Hypothetical monetary value by assigning amount of prize and its probability

Putting the numerical values in the equation (12)

$$E(x) = 0.7 \times 5000 + 0.3 \times 100$$

$$= 3500+30$$

$$= 3530$$

3530 is the expected monetary value of purchasing a lottery ticket.

Since the N-M theory suggests that the individual's decision to participate in uncertain game depends on the utility of the winning and losing prize and not on the monetary value of the prize, the expected monetary value assigned to winning and losing the lottery must be converted to utility. Then, the equation (12) will be changed to

$$E(u) = P_1 \times U \text{ of } W + (1-P_1) \times U \text{ of } F \text{----------(13)}$$

- $E(u) = P_1 \times U \text{ of } W + (1-P_1) \times U \text{ of } F$

Suppose the utility for 5000 rupees is 500 utils and 100 rupees is 10 utils. Utils are the hypothetical measure of utility. Here, the expected utility will be

$$E(u) = 0.7 \times 500 + 0.3 \times 10$$

$$= 353 \text{ utils}$$

This is the expected utility of purchasing the lottery when the winning price is Rs. 5000 and the consolation prize is Rs. 100. Let us find out the expected utility of the expected sum of money. This will generate the N-M utility index. In order to find out the utility of other sums of money, we need to find a certain sum of money. Certainty sum of money is sure or certain money. We use certain money to find utility. Certain money is an amount of money that the individual will be indifferent to other sums of money if the person have the certain money. Since, certain money involves constant part, it helps in building the index based on it.

- Certain sum of money

Under the case of purchasing the lottery ticket, if the individual is indifferent about having Rs. 3500 as certain money and different prizes associated with the lottery ticket, then the expected utility from purchasing the lottery will be equal to the utility of Rs. 3500.

- Indifference of having certain money and prizes

$$\text{Utility of } 3500 = E(\text{utility of lottery})$$

$$\text{Utility of } 3500 = P_1 \times U \text{ of } W + (1-P_1) \times U \text{ of } F$$

$$= 0.7 \times 500 + 0.3 \times 10$$

$$= 353 \text{ utils}$$

Therefore, an individual's N-M utility index for participating in uncertain game associated with a lottery is

Money/Prize	Expected Utility
5000	500
3500	353
100	10

- Index shows prize and utility

Similarly, the utility index of uncertain games can be calculated.

We have seen that the N-M uses cardinal measure of utility to generate the utility index. Can you name the theory of consumer behaviour that relies on the cardinal measure of utility? Neo-Classical measure of cardinal utility also measures utility in numbers. However, they differ in the base of measurement. In the N-M utility, utility of money corresponding to outcomes of a game is measured to generate the utility index so that consumer behaviour of acting in uncertain situations can be analysed whereas, the Neo-Classical theory measures utility derived from the consumption of goods. So, the Neoclassical measure is used to understand the level of satisfaction of consumers whereas, the N-M utility measure is used to predict the preference of an individual when the individual faces uncertain situations. So, the N-M utility theory does not measure the pleasure an individual receives from choosing different outcomes of an uncertain event.

- In N-M Index, utility of money and in Neo-Classical theory, utility from consumption

N-M utility index helps in ranking of alternative choices in an uncertain situation. The ranking is made by comparing the choices. The index computes the expected utilities so that the consumer behaviour can be dealt with. However, it is not possible to compare the utility of two individuals. That is, interpersonal comparison may not yield appropriate comparing level. It is suggested that the N-M utility theorem can be used for uncertain situations in the field of investment, consumption, production, and insurance.

- Rank choices

1.2.4 Friedman and Savage Hypothesis

Friedman - Savage hypothesis works in the situation where people takes part even in unfavourable games or in situations of great risk. This is in contradiction to the idea of Bernoulli and St. Petersburg paradox that people do not take part even in fair games or fair situations as marginal utility of money is diminishing. In Bernoulli's hypothesis, we have asserted that

- Participation in highly risky situation through careful calculations

the individuals under consideration are rational. Then, it may be possible that you may consider those who gamble in very risky games and situations as irrational individuals. But, it may also believed that the participation in very risky situations, especially gambling is done after very careful calculations.

- Risk takers and risk averse at the same time

Individual behave in complex ways through participation in very risky gambles and situations. Though they resort to risky acts, individuals make calculated and careful steps while participating in risk by taking risk averse methods such as insurances. These individuals act as both risk averse and risk takers at the same time making their behaviour complex. This complex behaviour of individuals is explained by Friedman and Savage by doing away with Bernoulli's condition of marginal utility of money.

We know that under Bernoulli's hypothesis, since the marginal utility is diminishing with respect to increase in the stock of money, it is not possible to explain the use of continuous diminishing of marginal utility of money for risk takers. Friedman and Savage advocated that the diminishing marginal utility of money is not a continues one. During the initial levels of income, the marginal utility of money decreases first till at a certain point. When the levels of income are at the intermediate level, the marginal utility of money increases instead of usual diminishing trend, and when levels of income increases, the marginal utility of money also increases. This is a probable explanation for the complex behaviour of being a risk-taker and risk-averse at the same time.

The figure 1.2.2 explains the change in trend in marginal utility with the stock of money.

- Lower range of income – risk averse

In the figure, the X axis measures stock of money income and Y axis measures the marginal utility of money. MU curve shows the levels of marginal utility at different levels of income. When income is $0M_0$., the marginal utility of money is MU_0. Marginal utility starts declining with increase in the level of income. When income reaches OM_1, the marginal utility falls to MU_1. This range of marginal utility where utility declines, makes individual risk averse and prompt not to take part in risky games or situations. The range income where utility declines is the initial lower level of income that an individual possesses, and the person will be reluctant to enter even in fair game.

- Marginal utility diminishes, then increases, and later diminishing with increasing levels of income

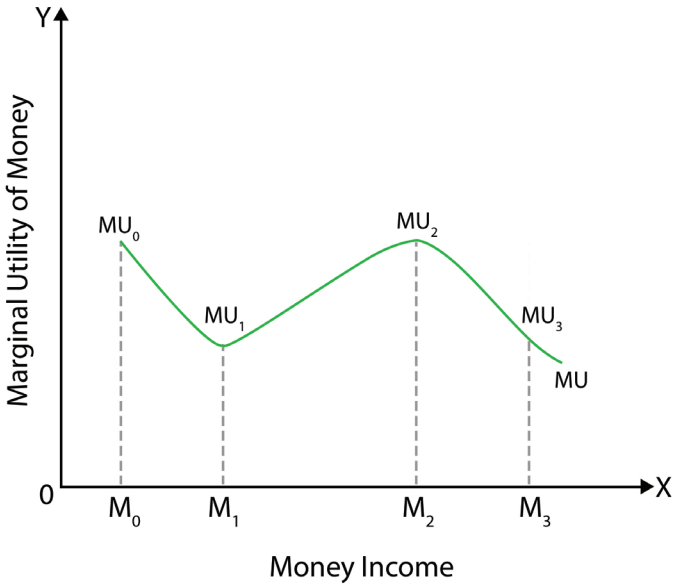

Fig 1.2.2 Friedman-Savage Hypothesis

- Range of increase in MU – gain greater than loss

When income increase from $0M_1$ to $0M_2$, the marginal utility of money increases from MU_1 to MU_2. During the range of MU_1 to MU_2, the marginal utility is increasing. That is, the gain of utility from increase in money stock is higher than the loss of utility from the loss of money stock. So, people in the middle income range might tend to participate in uncertain situation to increase their position in the community. However, being middle income, they are risk averse too. So, they resort to methods to insure them against any risks that shall materialise.

- Sections of people with different status have different response to risks

When income increases above the intermediate level from $0M_2$ to $0M_3$, the marginal utility curve falls from MU_2 to MU_3. A decrease in utility with increase in income makes this range too risk averse. Hence, it is clear from the hypothesis that the different sections of the society, especially with respect to income status, act differently to the uncertain situations. Certain sections may act more prone to participate in risky games and situations where certain others remain mostly risk averse. However, all the rational individuals among all the different sections take calculated steps only while participating in risky games.

Summarised Overview

Consumer choices involving risk and uncertainty discuss how choices are decided under the uncertain situations. The consumer choice under risky and uncertain situation depends basically on the possible outcomes of an uncertain situation, the probability of the occurrence of outcome, the payoff or value of the outcomes, and the resulted expected value. Important approaches under consumer choice under uncertainty are Bernoulli Hypothesis, the Neumann and Morgenstern Index, and the Friedman and Savage Hypothesis. The Bernoulli Hypothesis, formulated by Daniel Bernoulli suggests that individuals make decisions based on expected utility rather than expected monetary value. According to this hypothesis, people evaluate the potential outcomes of a decision by assessing the utility or satisfaction they expect to derive from each outcome. The Neumann and Morgenstern Index, also known as expected utility theory, was developed by John von Neumann and Oskar Morgenstern in the mid-20th century. N-M index made cardinal measure of utility to generate the index. The Friedman and Savage Hypothesis, proposed by Milton Friedman and Leonard J. Savage in the mid-20th century, challenges the assumptions of expected utility theory. They argue that individuals may not have consistent utility functions nor make decisions solely based on expected utility. Instead, they propose, marginal utility is not declining constantly. It decreases at lower levels of income, increases at intermediate levels of income, and later declines at the higher levels of income.

Self Assessment

1. Explain the concepts a)outcome of an uncertain situation b) payoffs c) probability d) expected utility
2. What are fair and non-fair games?
3. Discuss the St. Petersburg Paradox.
4. Explain the Bernoulli's Solution.
5. Explain how the N-M utility index and Neoclassical Cardinal utility are related.
6. What is Friedman – Savage Hypothesis?

Assignments

1. Explain St. Petersburg paradox using a hypothetical example. Also, describe how Bernoulli hypothesis is a solution to this paradox with the help of the same illustration.
2. Construct an N-M utility index based on a hypothetical certainty sum.
3. Compare and contrast the Bernoulli and Friedman-Savage hypotheses for decision-making under risk and uncertainty. Discuss the implications for consumer behaviour and welfare, and explain how these theories can help us understand the factors that influence consumer decision-making.

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2. Koutsyiannis, A (2013), *Modern Microeconomics*, Macmillan Press, London.

Space for Learner Engagement for Objective Questions

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UNIT 3
Case Studies of Elasticities of Demand and Consumer Surplus

Learning Outcomes

After completing this unit, the learner will be able to

- understand the practical applicability of elasticity of demand
- know how consumer surplus is used in real world
- generate a way of connecting theoretical concepts to reality

Background

Elasticity of demand is a ratio of the proportionate change or percentage change in the demand to the changes in the factors affecting demand. In the case of demand for a commodity, we assume that it depends mainly on its own price, income of the consumer, and price of related commodities. Accordingly, we have three types of elasticities with respect to demand. They are price elasticity of demand, income elasticity of demand, and cross elasticity of demand. Among these, price elasticity of demand is more significant due to its theoretical and practical value. The price elasticity of demand is an important concept which is used to determine the change in price of a goods or services. Firms, institutions providing services examine the price elasticity of demand for their goods or services before changing the price of the good or service. This is done to understand the total revenue and the resultant profitability of a price change in advance, and thereby make a change in price which yields greater profitability.

Consumer surplus is the difference between the total amount a consumer is willing to pay for a good or service and the amount they actually pay. Consumer surplus is based on the willingness to pay of the consumer. Based on the ability and willingness to pay, different consumers have different surplus. Knowing this willingness of the consumer, producers fix the price to reap maximum benefit for them.

Keywords

Price Elasticity of Demand, Cross Elasticity, Income Elasticity, Consumer Surplus

Discussion

1.3.1 Price Elasticity

Price elasticity of demand is defined as the degree of responsiveness of a commodity to the change in its price. Price elasticity of demand is measured as the percentage change in quantity demanded divided by the percentage change in price.

$$e_p = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

Case Study 1 - Admission in to a museum

Take the case of the museum you have visited. Let us suppose, you are the curator of that museum. While analysing the revenue of the museum, the finance section has found out that the museum is running short of funds and it is important to increase the revenue of the museum to ensure its smooth functioning. You are asked to raise the admission fee into the museum. What will be your take on this? Will you raise the fee, lower the fee, or not do neither of it?

It is not possible to change the fee of the museum simply to increase the total revenue. The price elasticity of demand is the key concept which needs to be considered to find a solution as to whether to increase or decrease the entry fee inorder to increase the total revenue. If the price elasticity of demand for entry in to the museum is inelastic, then the demand for entry into the museum is less responsive to changes in the entry fee. So, an increase in entry fee does not reduce the demand for entry, and an increase in the entry fee is possible to increase the total revenue. Here, there will not be any reduction in the number of visitors to the museum with increase in fee. This increases the total revenue of the museum.

However, this not the case, if the price elasticity of demand for museum entry is elastic. With an elastic demand for the visitors,

- Calculating price elasticity of demand for making decisions on changing price

any increase in entry fee will result in the fall in demand for the visit. Here, it is better to reduce the entry fee rather than increase it. By reducing the entry fee, since the responsiveness of demand to price is high, lower price leads to higher demand for the visit. Increase in the visit to the museum will increase the total revenue of the museum.

If you can have an understanding of the price elasticity of demand of your visitors, you can decide whether you should increase or decrease the entry fee to the museum. Here, it is important to know the price elasticity of demand first to change the entry fee. You can calculate the price elasticity relying on the past data on the visit to museum during the past years when entry fee changed. An idea about change in demand as related to a change in fee can be understood with a short survey with the visitors. You can also rely on the similar data available from museums across the country to do the calculation. While doing this, an analyst needs to calculate other things that determine the entry such as type of population visiting the museum, weather, collections in the museum etc. This is needed to differentiate between the effect of price on the demand for visit to the museum and that of the effect of other factors mentioned above on the demand for visit. Then only, an appropriate price change can be initiated to successfully increase the total revenue of the museum.

Case Study 2 – Fixing Toll in Highways

When new highways are constructed, especially under Public Private Partnership (PPP) models, for the initial years, it is usual that a toll or a fee is charged to use the way. This is done to collect the cost of construction from users themselves, so that the private company that has associated with the construction under PPP model can recover their investment and further invest in other areas where investment is required.

Let us suppose that you are in charge of the Construction Company 'C Limited' for constructing a new highway. The new highway allows the people to cut short the travel time by 25 minutes in comparison to the busy old route they use earlier. Considering the total cost of construction, your team in the company decides to charge Rs. 100 to pass the highway. The amount of toll is fixed based on the average estimate of number of vehicles likely to pass through the highway and the accepted time period within which the company plans to

- Price Elasticity of Demand is key to fixing new prices

fully recover the cost of investment through the toll. When charged with the toll, the C Limited and your team realise that the number of vehicles passing the toll plaza are very low than what you expected. Considering the current number of vehicle movement with the present toll, you calculate that it is not possible to recover the cost in the stipulated time.

Here, the key point is the understanding of price elasticity of demand for highway users. The number of people willing to use the highway by paying Rs. 100 instead of taking a 25 minutes extra time of travel is found to be low. That is, the price elasticity of demand is high here. High toll amount will reduce the demand for using the new highway. Most of the people are ready to spend 25 minutes extra instead of paying Rs. 100 each time. The way forward is to reduce the amount of toll so that more number of people are willing to pass through the highway. The company can fix a toll price below Rs. 100 considering the related vehicle movement.

1.3.2 Cross Elasticity of Demand

Cross elasticity is the measure of responsiveness of demand for a commodity to the change in the price of its related commodity (substitutes and complementary goods).

$$e_c = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

Here, quantity demanded and price are of related goods.

Case study 1 - Case of Substitutes and Complements

We know that the cross elasticity of demand measures the demand for a commodity in response to the price of other related commodities. Take the example of combination of palm oil and coconut oil, and cement and sand.

Let us look into the hypothetical cross elasticity table given below.

Table 1.3.1 Cross Elasticity

Commodities	Cross Elasticity
Palm oil with respect to coconut oil	1.53
Sand with respect to cement	-0.87

- Cross Elasticity of Demand identifies substitute and complimentary goods

Here, we are measuring the cross elasticity of demand for palm oil with respect to coconut oil and of sand with respect to cement. The cross elasticity of demand for palm is 1.53. This shows that, the demand for palm oil increases by 1.53 percent if there is an increase in the price of the coconut oil by 1 percent. In the case of the cross elasticity of demand for sand in terms of the price of cement is that, there will be a reduction in the demand for sand by 0.87 percent when the price of the cement increases by 1 percent. This makes it clear that palm oil and coconut oil are substitutes and price rise of one commodity increases the demand for the other commodity and vice versa. Similarly, sand and cement are complements and need to be consumed together. So, any increase in the price of cement decreases the demand for sand too. It is important to note that, by understanding the cross elasticity of demand, it is possible to understand the extent of substitutability and complementary nature between two goods. The value of cross elasticity between two goods represents the extent of substitutability or complementary nature.

Case Study 2 - Market Strategy to Sell Complimentary Goods

- Market strategy to sell complementary goods are to sell them in combined offer

Take the case of the supermarket near your home. Assume that the supermarket sell bread in a combo offer where one taking bread gets butter for free. Have you ever witnessed such selling strategy? What is the reason for selling bread with butter free? Such offers last only for some time. Here, the supermarket sell bread with butter because bread and butter are complementary goods. If butter is not demanded with bread as expected, then the market strategy to sell butter is to offer the butter for free with bread. When people form a habit of having bread with butter, then the offer is called off. Then, people will buy butter for money as they have the tendency to have both bread and butter together and if the supermarket does not offer butter for free, people will be willing to pay for the butter.

Here, the price elasticity of demand for bread is related to butter and vice versa. Increase in the price of bread cause reduction in the demand for butter. Conversely, a fall in the price of bread cause an increase in the demand for butter.

1.3.3 Income Elasticity of Demand

Income elasticity of demand is defined as the responsiveness of demand to the change in consumer's income.

$$e_m = \frac{\Delta Q}{\Delta M} \times \frac{M}{Q}$$

Case Study – Foreign Travel, Expenditure on Food

Travel via flight is a costly mode of transportation. When income increases, people tend to move on to the consumption of luxury goods and reduces the consumption of commodities such as food articles like noodles, flour, etc. Let us see the hypothetical income elasticity of the following commodities.

Table 1.3.2 Income Elasticity

Commodities	Income Elasticity
Foreign Flight Travel	1.9
Noodles	-0.44

- Income Elasticity of Demand helps in distinguishing goods into luxuary, necessary, inferior goods

The income elasticity of flight travel to make a foreign trip is 1.9. The consumer's expenditure on travel abroad increases by 1.9 percent when there is a 1 percent increase in income. However, in the case of food articles, the income elasticity of demand is very low. The table shows that the demand for noodles fall by 0.44 percent when there is an increase in the income of the consumer by 1 percent. This shows that noodles are inferior goods whose demand decreases with increase in price. The reason is that the processed foods are not healthy options. When income increases, people move from un-healthy food to healthy options.

The income elasticity of a goods can be given in terms of percentage change in quantity demanded of goods with respect to percentage change in income or percentage change in expenditures on that good with respect to percentage change in income. Here, it is possible to assume the income elasticity given is in terms of change in expenditure on commodities due to the change in income, especially when flight travel is included. The fall in expenditure of food article at increase in income proves the Engel's Law. Engel's law states that percentage share of expenditure on food articles falls with increase in income. Therefore, the income elasticity is higher for luxuary goods and lower for food articles. It is even lower for food articles belonging to inferior goods. Hence, the income elasticity of demand is the key concept which helps in understanding the shift in consumption and expenditure of a consumer from one good to another when the income changes.

1.3.4 Consumer Surplus

Consumer surplus arises when the price consumers pay for a product or service is lower than the maximum price they are willing to pay. It quantifies the extra benefit consumers experience by pay

Case Study 1– Sale of Vintage Car

Suppose you have a vintage car. Now, you are planning to sell it. Inorder to attract buyers, you have arranged an auction. In the auction, 4 potential buyers show interest. The buyers are John, Smitha, Kareem, and Arya. These potential buyers have their own willingness to pay. Willingness to pay refers to maximum amount of money a consumer is willing to pay to get that commodity rather than go without it. The following table shows the willingness to pay.

Marshallian consumer surplus is based on the law of diminishing marginal utility, as the consumer consumes more and more of a product, the utility he derives from the additional units declines. This in turn will reduce his willingness to pay for additional units of the commodity.

Table 1.3.4 Consumer surplus

Buyers	Willingness to pay
John	Rs. 28 lakhs
Smitha	Rs. 20 lakhs
Kareem	Rs. 20 lakhs
Arya	Rs. 18 lakhs

The table shows maximum amount of money that each of the buyers is willing to pay to get the car. In the auction, the initial bidding is Rs. 15 lakhs. All the buyers are willing to pay this amount of money. So, bidding continues by raising the amount. When the amount increases above Rs. 18 lakhs, Arya drops out of the auction since her maximum willingness to pay is Rs. 18 lakhs. When the bidding amount increases to Rs. 21 lakhs, Smitha and Kareem also drop out since both of their willingness or maximum amount ready to pay is Rs. 20 lakhs. Hence, John buys the car since his willingness to pay is Rs. 28 lakhs, and he would purchase the car at Rs. 21 lakhs.

Here, the consumer surplus of John is Rs. 7 lakhs. But, three

other buyers have no consumer surplus as they could not buy the car. If the case was different and the bidding stopped at Rs. 19 lakhs, then John, Smitha, and Kareem would have a consumer surplus equal to Rs. 9 lakhs, Rs. 1 lakh, Rs. 1 lakh respectively. Here, the total consumer surplus would be Rs. 11 lakhs.

Case Study – Sale of Mobile Phone via E-commerce

You are familiar with Amazon and Flipkart sale of mobile phones in offers during festival seasons. Now-a-days, people wait for such offers to buy new and advanced mobile phones through e-commerce sales. Suppose the shop price of new mobile phone is Rs. 30,000 and the e-commerce site offers the same phone in Rs. 26,000 during the festival season, then consumer's reservation price is 30,000 and the consumer surplus is Rs. 4,000. But we see such offers for new and advanced mobiles only. In the case of base model phones, such offers are not usually placed. With no offers, consumers planning to purchase base model mobile phones have zero consumer surplus.

Summarised Overview

The price elasticity of demand is defined as the degree of responsiveness of a commodity to the change in its price. Price elasticity of demand has many practical uses. Firms, companies, service providers calculate price elasticity of demand for their goods and services to decide on matters related to fixing the price or changing the existing price. In addition to price elasticity of demand, cross and income elasticities of demand are useful in real life situations. Cross elasticity of demand is the measure of responsiveness of demand for a commodity to the change in the price of its related commodity (substitutes and complementary goods). The demand for complementary goods has negative cross elasticity because an increase in the price of one of the complementary goods leads to a decrease in the demand for the other whereas the cross elasticity of demand for substitute goods are positive as the demand for a substitute good is positively related to the changes in the price of the related good. The degree of substitutability and complementary nature can be understood from the cross elasticity of demand. We know that there exists a positive relation between demand for a normal good and income of the consumer. The demand for normal goods (independent goods) increases with

increase in the consumer's income. Income elasticity of demand is defined as the responsiveness of demand to the change in the consumer's income. For luxuary goods, income elasticity is very high whereas for inferior goods, it is very low. Understanding income elasticity of demand ensures calculating shift in consumption of different types of goods with changes in income. Consumer Surplus is an important concept where willingness to pay of consumers and informed price fixing of producers are evaluated.

Self Assessment

1. What is price elasticity of demand? Explain it using the mathematical equation.
2. Explain the cross elasticity of demand, and state the reasons for negative and positive cross elasticity.
3. Write a short note on income elasticity of demand. Explain income elasticity for luxuary and normal goods.
4. State Engel's law.
5. What is consumer surplus? How is consumer surplus calculated using the marginal utility concept?

Assignments

1. Conduct a price elasticity analysis of a commodity. Identify the factors that affect the elasticity of demand, and discuss the implications of the results for producers and consumers.
2. Prepare case studies on different situations with respect to elasticity of demand and consumer surplus.
3. Calculate the consumer surplus for a commodity or service. Discuss the factors that contribute to consumer surplus, and explain why it is an important concept in understanding the welfare implications of changes in price or income.

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Suggested Readings

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2. Pindyck, Robert.S, Rubinfield, Daniel, L, Mehta, Premlal, L (6th edition), Micro Economics

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MASTER OF ARTS ECONOMICS

Block 2

Production and Cost Analysis

UNIT 1
Production Function

Learning Outcomes

After completing this unit, the learner will be able to

- distinguish between different types of production function
- analyse the impact of technical progress on the production function
- know different types of technical progress

Background

In the previous block, we dealt with the demand side of the market. Now, let us look into the supply side. Production refers to the transformation of inputs into output. Here, the basic economic problem of 'how to produce' is answered. The theory of production explains how firms produce output efficiently and how the cost of production is determined under various factors, prices, and amounts of output. The production decisions are based on the optimising decisions under the profit motives and cost minimization. The optimising behaviour of the producer has similarities with the optimising behaviours of consumers. Understanding both helps us understand the workings of the economic system.

A firm's production decision mainly relates to the planned output level, the amount of input needed to produce the planned output, the price of inputs, and available technology. Suppose a firm starting a new plant for its automobile industry. It mainly considers the machinery level, the labour required to produce the output that the firm plans to produce from its new plant, availability of resources, location of plant. The relation between input and output is expressed in a production function. This unit discusses production functions.

Keywords

Production Function, Homogeneous and Non-Homogeneous Production Functions, Technical Progress, Capital Deepening, Labour Deepening, Neutral Technical Progress

Discussion

2.1.1 Production Function

- Transformation of inputs to outputs

A production process refers to transforming resources or factors of production such as labour, capital, and raw materials, into products that are useful for the economy. Through a production process, a firm generates something new to the economy. Consider the production process involved in making the mobile you use. It uses machines, labourers to operate the machines, and different electronic inputs to produce a mobile. The production of any product goes through different stages and actions. So, a production process involves chains of actions.

The production function shows the functional relation between inputs and outputs.

A general production function can be expressed as follows:

$$Q = f(L, K) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

- Technical relation between inputs and output

Here, Q is output, K is capital, and L is labour. Output is a function of capital and labour. Capital and labour are the basic inputs used in the production process. When technology is considered in the function, the production function can be represented as the technical relation between inputs used and the output produced. Since technology is given in the short run, the production function can be written as

$$Q = A f(L, K) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Here A is the technology.

Now, let us see some of the common forms of production

function and the role of technical progress in production function.

2.1.2 Homogeneous Production Functions and Non-Homogeneous Production Functions

Homogeneity of a production function can be understood from the proportionate change in output due to changes in inputs. Consider the general production function:

$$Q = f(L, K) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Suppose a firm increases the amount of all inputs by a constant, 'k', then the firm will get a new output, say Q_*. The new output can be expressed as

$$Q_* = f(kL, kK) \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

- An increase in all inputs cause a proportionate increase in output

If the constant 'k' can be factored out, the new output, Q_* can be represented as a function of the constant, 'k' with it to any power.

$$Q_* = k^v f(L, K) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Here, 'v' is the power.

Since f (L, K) is Q, the equation (3) can be written as

$$Q_* = k^v Q \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The equation (4) shows that the new output can be expressed as a function of the constant, 'k' and original output. In a production function, if all the factors of production are increased by a constant, and the new output can be represented as a multiplier of the constant of the original output, then the production function can be termed as a homogenous production function. So, the original production function shown in equation (1) is homogenous. Conversely, if it is impossible to factor out the constant 'k' from a function, then the production function is non-homogenous. "A homogenous function is a function if each of the inputs is multiplied by 'k', then 'k' can be completely factored out of the function".

- Power of 'k' represents degree of homogeneity

The power of the 'k' ie., 'v' represents the degree of homogeneity of the function. It also shows the returns to scale of production. The returns to scale represent the long-run production. If 'v' is equal to one, then the degree of homogeneity is one, and can be called a linear homogenous function. Here, the returns to scale is constant. When 'v' is not equal to one, the function is a non-linear homogenous function. If 'v' is less than one, there is decreasing returns to scale, and if 'v' is greater than one, there is increasing returns to scale.

2.1.2 Technical Progress and Production Function

- Enhance efficiency in the method of production

Technical progress refers to improvement in technology in the economy. In an economic sense, technical progress is reflected in the improvement in the efficiency of the production method. Research and Development lead to new inventions, which can be used for economic purposes in the way of new and efficient production methods. The efficient production method refers to producing output with fewer resources and lesser time. This will reduce the cost of production and increase the output. Depending on the type of technical progress, the output produced will be more advanced than the previous versions.

- Technical progress be graphically represented in Production Function and isoquant

Since the technical progress affects the input and output size, it also changes the production function, as the production function represents the technical relation between input and output. An improvement in the technology can be shown in the production function with a higher level of output. This can be graphically represented by the shift of production function upward. The graphical representation of technical progress can also be depicted in an isoquant. We know that isoquants represent the different combinations of factors or inputs of production that produce the same output level. Under technical progress, isoquant can be represented as a shift downwards in a dashed line showing fewer inputs being used in the production for the same output level.

Let us look at the graphical representation of technical progress in production function and isoquant.

- More output with same level of input

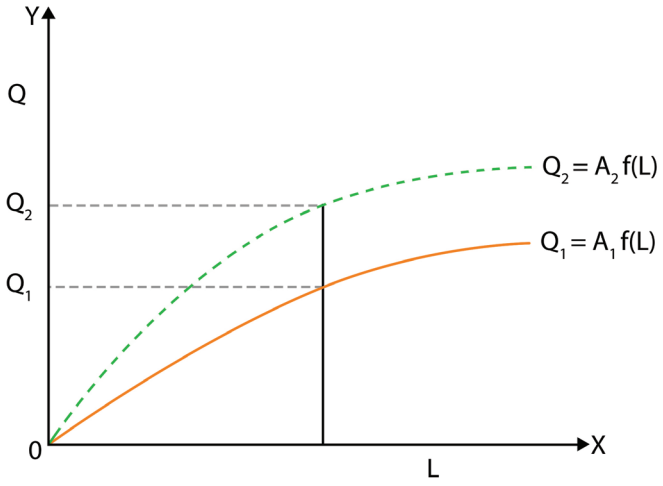


Fig 2.1.1 Technological Progress and Shift in Production Function

The initial production function is $Q_1 = A_1 f(L)$. A_1 is the initial level of technology. With the A_1 technology, the output Q_1 is a function of the variable input, L. An improvement in technology can be represented as A_2. Under technological progress, the production function becomes $Q_2 = A_2 f(L)$, and Q_2 is greater than Q_1. The increase in output due to technical progress is shown by an upward shift in the production function from $Q_1 = A_1 f(L)$ to $Q_2 = A_2 f(L)$.

Now, let us see the change in Isoquant due to technical progress.

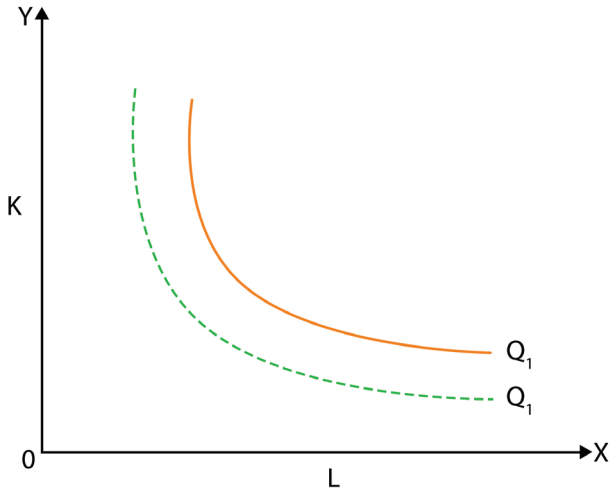


Fig 2.1.2 Technological Progress and Isoquant

The initial isoquant is Q_1. The isoquant shows the various quantities of inputs, labour, and capital that give the same output level equal to Q_1. Due to technical progress, the same output level can be produced with less labour and capital. This can be graphically represented as a downward-shifted dashed line Q_1. The downward shift represents the use of lesser amount of inputs. The dashed line shows that the output produced is the same as the initial output, as the normal downward shifts in isoquants represent a lesser output level with lesser amounts of inputs.

- Rate of substitution of factors explains different types of technical progress

Hicks, in his work, "Value and Capital", explained different types of technical progress based on the rate of substitution of inputs or factors of production. Since the substitution rate of factors is represented by isoquants, the different types of technical progress explained by Hicks can be shown using isoquants. There are three types of technical progress: Capital-deepening technical progress, Labour-deepening technical progress, and Neutral technical progress. Let us explain these in detail.

Capital Deepening Technical Progress

- MP_K is more than MP_L

The capital deepening technical progress refers to the improvement in technology that enhances the Marginal Product of Capital (MP_K) more than the Marginal Product of Labour (MP_L) . So, when MP_K is more than MP_L, production is done using more capital. $MRTS_{LK,}$ equal to $MP_L / MP_{K,}$ falls in absolute terms as MP_K increases. However, since the slope of the isoquant is negative, considering the negative sign, the $MRTS_{LK}$ is said to be increasing when K/L is constant.

- Downward shifted dashed lined isoquants

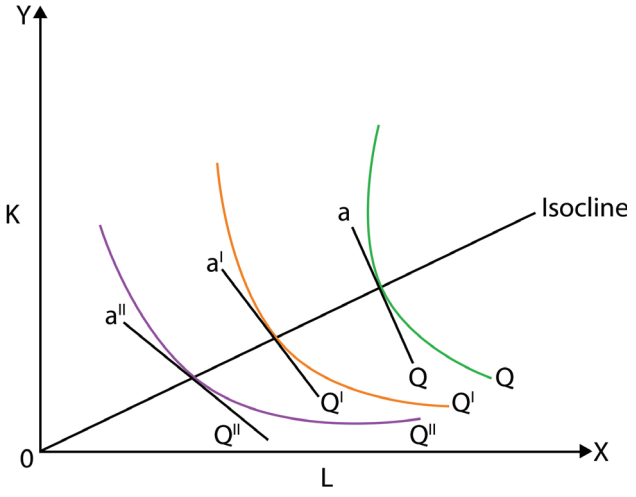


Fig 2.1.3 Capital Deepening Technical Progress

- Isoquants are flatter downwards, showing lesser substitution of capital for labour

Under technological progress, the isoquant shifts backward from Q to Q^{I}, and then to Q^{II}. The backward shift of the isoquant under Capital deepening technical progress shows that the downward isoquants are flatter than the previous ones along the isocost line originating from origin (An isocline is the locus of points of different isoquants at which the MRS of factors is constant). See the slope of isoquants represented by 'aa', 'a^{I} a^{I}', 'a^{II} a^{II}'; these are flatter downwards. This shows that moving downwards, the slope of isoquants is falling. So, the rate of substitution of capital for labour falls when the marginal product of capital is greater than the marginal product of labour, and the producer is less willing to substitute productive capital for less productive labour.

Labour Deepening Technical Progress

- MP_L is more than MP_K

The labour deepening technical progress refers to the improvement in technology that enhances the Marginal Product of labour more than the Marginal Product of capital. So, when MP_L is more than MP_K, the production uses more labour. Here, $MRTS_{LK,}$ equal to MPL / $MP_{K,}$ increases in absolute terms as MP_L increases. However, since the slope of the isoquant is negative, the $MRTS_{LK}$ is said to be decreasing along the isocost line with K/L being constant.

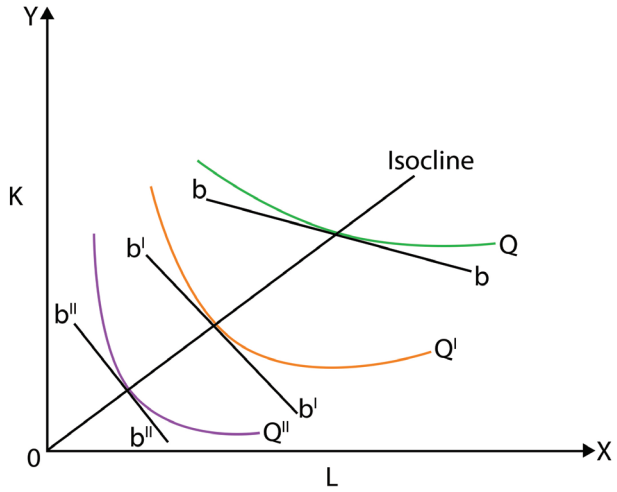


Fig 2.1.4 Labour Deepening Technical Progress

Under labour deepening technical progress, the backward shifting isoquants are named Q to Q^{I}, and then to Q^{II}. Here,

the downward isoquants are steeper than the previous ones along the isocost line. The steepness of isoquants is evident from the shape of tangents 'bb', 'b^1 b^1', and 'b^{11} b^{11}', which are steeper downwards. So, the slope of isoquants is increasing downwards. Hence, the rate of substitution of capital for labour increases when the marginal product of labour is greater than marginal product of capital, and the producer is willing to substitute less productive capital for productive labour.

- Steeper downwards showing higher substitution of capital for labour

Neutral Technical Progress

Under neutral technical progress, the improvement in technology enhances the Marginal Product of labour and the Marginal Product of capital equally. So, when MP_L and MP_K are equal, the $MRTS_{LK}$ equal to MPL / MP_K will also be a constant along the isocost line with K/L. Therefore, the slope of the downward shifting isoquants will be constant and shown by parallel shifts. In the below figure, the downward shifting parallel isoquants are Q, Q^1 and Q^{11} The tangents, 'cc', 'c^1 c^1', and 'c^{11} c^{11}' are parallel. Since the slope of isoquants is constant, the substitution rate between the factors is constant, and the producer will be willing to substitute between factors equally.

- MP_L equals to MP_K and isoquants are parallel downwards

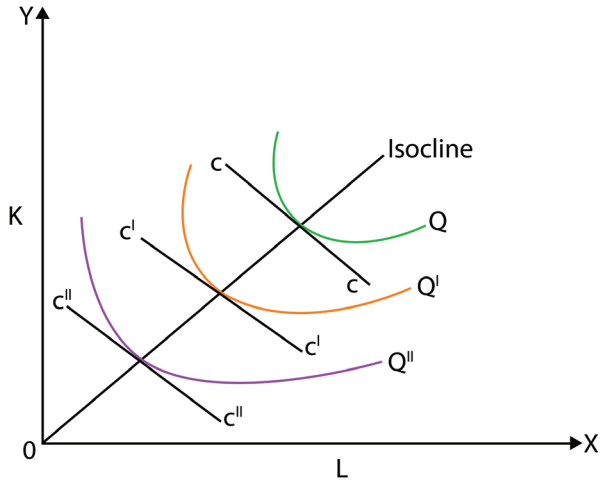


Fig 2.1.5 Neutral Technical Progress

Endogenous Technical Progress and Exogenous Technical Progress

Technical progress is crucial to the economic growth of any firm, industry, or nation. The endogenous and exogenous

- Origin of technical progress

technical progress is classified based on the origin of the development of the technical progress. When the technical progress originates due to the Research and Development within a firm or industry under consideration, the progress can be termed endogenous technical progress. In contrast, if the origin of technical progress is from outside or foreign, the technical progress is termed exogenous.

Summarised Overview

Production represents the supply side of the economy. A production process refers to transforming inputs into producing a useful output. Production function shows a technical relation between inputs and outputs. There are different forms of production functions. Some of the very general forms are homogenous and non-homogenous production functions. The homogeneity of a production function can be understood from the proportionate change in output due to changes in inputs. A homogenous function is a function if each of the inputs is multiplied by k, then k can be completely factored out of the function. The power of the constant represents the degree of homogeneity of the function. It also shows the returns to scale of production. If the degree of homogeneity is one, the production function is a linear homogenous production function, and the returns to scale are constant.

Technical progress is an important determinant of production function. A technological advancement changes the production function upwards. It increases output using lesser input and cost. Technical progress can be classified based on the marginal productivity of factors. A higher marginal product of capital than labour due to technical progress results in capital deepening technical progress, and the reverse leads to labour deepening technical progress. The origin of the technical progress explains the endogenous and exogenous nature of the technical progress.

Self Assessment

1. State a Production Function. Express it mathematically.
2. What are homogenous production functions?
3. Explain the degree of homogeneity.
4. Distinguish between different types of technical progress.

Assignments

1. Evaluate a common production function based on homogeneity of the function.
2. Explain the impact of capital deepening technical progress on the production function in a country.
3. List out the different production functions and try to classify them based on homogeneity and returns to scale.
4. Distinguish between endogenous and exogenous technical progress based on a real situation.

References

1. Koutsyiannis, A (2013), *Modern Microeconomics,* Macmillan Press, London
2. Salvatore, Dominick (2009), *Principles of Microeconomics,* Oxford University Press
3. Pindyck, Robert.S, Rubinfield, Daniel, L, Mehta, Premlal, L (6th edition), *Micro Economics*(8th edition). New Jersey: Pearson.

Suggested Readings

1. Nicholson Walter and Christopher Synder (2022), *Microeconomic Theory: Basic Principles and Extensions* (12th Edition), Cengage

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 2
Empirical Production Functions

Learning Outcomes

After completing this unit, the learner will be able to

- familiarise with different types of empirical production functions
- explain the important properties of Cobb-Douglas and CES production function
- understand the superiority of CES function

Background

We have already discussed that production is a process of transforming input to output. Mathematical representations describe the relationship between input and output based on actual data. Mathematical models represent the empirical production functions by explaining the relation between inputs and output. These functions estimate the effects of changes in the input combination. Take the case of a factory that produces bicycles. A production function could estimate the number of bicycles produced from a given combination of inputs like labour, capital, and raw materials. The empirical productions are mathematically framed from the generalised production function. However, the parameters used in the production function might be different for different production functions. In this unit, we discuss different types of production functions like the Cobb-Douglas Production Function, Constant Elasticity Substitution Production Function, Variable Elasticity of Substitution Production Function, and Homothetic Production Function.

Keywords

Cobb-Douglas Production Function, Constant Elasticity Substitution, Variable Elasticity of Substitution, Homothetic Production Function

Discussion

2.2.1 Empirical Production Functions

- Parameters can be estimated

Empirical production functions are those on the basis of which the empirical studies can be done and parameters can be estimated. Therefore, empirical production function can be estimated using real data collected. The data collected may be time-series or cross sectional data. Based on the estimation of these production functions, future prediction of functional relations explained in the function can be made. Among the empirical functions, Cobb-Douglas Productions Function is the most common function. Let us discuss these functions in detail.

2.2.1.1 Cobb-Douglas Production Function

The Cobb-Douglas production function was published in the article, "A theory of Production" in American Economic Review in 1928 by C. W. Cobb and P. H. Douglas. The general form of Cobb Douglas Production function is given below:

- $Q = AL^{\alpha}K^{\beta}$

$Q = AL^{\alpha}K^{\beta}$..(1)

Q represents output, K is the capital input, L is the labour input, A is the technology, α, and β are the coefficients showing the responsiveness of output to changes in labour and capital respectively i.e., output elasticity coefficients of labour and capital respectively. Here, A, α, and β are constants. α and β are less than unity but positive values.

- Sum of α and β represents the return to scale

α shows the percentage change in output when labour changes by 1 percent, whereas β shows the percentage change in output when capital changes by 1 percent. If $\alpha + \beta = 1$, the production function is under constant returns to scale; if $\alpha + \beta < 1$, the production function shows decreasing returns to scale; and if $\alpha + \beta > 1$, the production function shows increasing returns to scale. Returns to scale can be represented in the Cobb-Douglas production function based on the sum of α and β

Properties of Cobb-Douglas Production Function

1. The production function is a linear, homogenous production function

Here, suppose $\alpha + \beta = 1$, the production function is under

constant returns to scale. Homogeneity of a production function can be expressed as when inputs are multiplied with a constant, say 'k', the output will be increased by the amount equal to the constant, 'k'. Let us explain it.

$Q = AL^{\alpha}K^{\beta}$ ..... (1)

$= A(kL)^{\alpha}(kK)^{\beta}$ ..... (2)

$= Ak^{\alpha}L^{\alpha}k^{\beta}K^{\beta}$ ..... (3)

- Inputs and output increase at same proportion

Under the rules of exponentials, if two exponential values are to be multiplied, if the base is of the same value, the exponents can be added by keeping the same base. This is a product of power rules, $x^m . x^n = x^{m+n}$. In equation (3), 'k' is the same base, with α and β being the powers. Then, α and β can be added, keeping the single 'k' as a base, and the equation becomes:

$= k^{\alpha+\beta} \times AL^{\alpha}K^{\beta}$ ..... (4)

As we are considering constant returns to scale where $\alpha + \beta = 1$, $k^{\alpha+\beta}$ in equation (4) becomes k.

$= k \times AL^{\alpha}K^{\beta}$ ..... (5)

$= k \times Q$ ..... .(6)

Considering equations (2) and (6), it is clear that a constant multiplied by all the inputs of the production function increases the output by the same constant value. Hence, the production function is a linear homogenous production function.

2. Each Factor under the Production Function undergoes Diminishing Returns

$Q = AL^{\alpha}K^{\beta}$ ..... (1)

We can analyse the returns to factors through the marginal productivity of factors. Let us see the Marginal Productivity of Labour. We know that the marginal productivity of labour is the change in total output due to a change in labour input. MP_L is the first-order partial derivative of the production function with respect to labour.

$MP_L = \frac{\partial Q}{\partial L}$ ..... (7)

$= \frac{AL^{\alpha}K^{\beta}}{\partial L}$ ..... (8)

Use the power rule of differential calculus, $x^n = n \cdot x^{n-1}$ in the case of variable, L.

- Marginal Product of factors decreases when the number of factors increases

$MP_L = \alpha \cdot AL^{\alpha-1}K^{\beta}$ ..... (9)

Then, we need to take the second-order derivative of the function.

$\frac{\partial^2 Q}{\partial L^2} = \alpha \cdot \alpha - 1 \cdot AL^{\alpha-2}K^{\beta}$ ..... (10)

In the equation (10), α -1 is a negative number. We have already pointed that α and β are less than unity. Since α is less than one, α -1 will be a negative number. Multiplying this negative number with rest of the equation (10), α. α -1. A $L^{\alpha-2}$ K^{β} becomes a negative number.

i.e., $[\alpha(\alpha - 1)AL^{\alpha-2}K^{\beta}] < 0$ ..... (11)

This means that when labour increases, the Marginal Product of Labour decreases. Therefore, MP_L undergoes diminishing returns when L increases.

Similarly, we can arrive at the same conclusion concerning capital when doing the partial derivative of the production function for capital. So, each factor undergoes diminishing returns under the Cobb-Douglas Production Function.

3. α and β are coefficients representing output elasticity of labour and capital

Let us see the output elasticity with respect to labour.

The elasticity of output concerning labour can be written as the change in output as a ratio of change in labour.

i.e.; $e_L = \frac{\partial Q/Q}{\partial L/L}$ ..... (12)

Rearranging the equation,

$e_L = \frac{\partial Q}{\partial L} \cdot \frac{L}{Q}$ ..... (13)

In equation (13), $\frac{\partial Q}{\partial L}$ is equal to MP_L the first order partial derivative of the production function concerning labour, and is given in equation (9).

$$\frac{\partial Q}{\partial L} = \alpha \cdot AL^{\alpha-1}K^{\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(9)}$$

Above equation can be written as

$$= \alpha \cdot AL^{\alpha}L^{-1}K^{\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(14)}$$

We know Q in the equation (13) is equal to $AL^{\alpha}K^{\beta}$

Now, equation (13) can be written as

$$e_L = \frac{\alpha \cdot AL^{\alpha}L^{-1}K^{\beta} \times L}{AL^{\alpha}K^{\beta}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(15)}$$

L can also be considered as L^1. Here, L^{-1} and L cancel out.

$$e_L = \frac{\alpha \cdot AL^{\alpha}K^{\beta}}{AL^{\alpha}K^{\beta}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(16)}$$

As A L^{α} K^{β} is in both numerator and denominator,

$$e_L = \alpha \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(17)}$$

So, output elasticity with respect to labour is equal to α.

- Responsiveness of output to labour is α and to capital is β

Now, let us see the output elasticity with respect to capital.

Elasticity of output with respect to capital can be written as the change in output as a ratio of change in capital.

i.e., $e_k = \frac{\partial Q/Q}{\partial K/K}$ ..... (18)

Rearranging the equation,

$$e_k = \frac{\partial Q}{\partial K} \times \frac{K}{Q} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(19)}$$

In equation (19), $\frac{\partial Q}{\partial K}$ is the first order partial derivative of the production function concerning capital, and is given as

$$\frac{\partial Q}{\partial K} = \beta \cdot AL^{\alpha}K^{\beta-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(20)}$$

$$= \beta \cdot AL^{\alpha}K^{\beta}K^{-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(21)}$$

As Q in the equation (19) is equal to $AL^{\alpha}K^{\beta}$, equation (19) can be written as

$$e_K = \beta \cdot AL^{\alpha}K^{\beta}K^{-1} \times \frac{K}{AL^{\alpha}K^{\beta}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(22)}$$

Here, K^{-1} and K cancel out

$$e_K = \beta \cdot \frac{AL^{\alpha}K^{\beta}}{AL^{\alpha}K^{\beta}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(23)}$$

as $AL^{\alpha}K^{\beta}$ is in both numerator and denominator,

$$e_K = \beta \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(24)}$$

So, output elasticity concerning capital is equal to β.

4.The elasticity of substitution between capital and labour in the Cobb-Douglas production function while following Constant Returns to Scale is unity

The elasticity of Substitution is an important concept under the Theory of Production since it shows the degree of substitutability between factors or inputs. The degree of substitutability between factors is related to the factor ratio and rate of technical substitution represented in an isoquant. The elasticity of substitution for any production function measures the proportionate change in the ratio of factors of production to the proportionate change in the marginal rate of technical substitution along the isoquant of the concerned production function. For the Cobb-Douglas Production Function, the factors are labour and capital. So, the factor ratio is *K/L,* and the marginal rate of technical substitution is MP_L/MP_K . Then, the Elasticity of Substitution (e_S), also given as 'σ' between K and L can be written as:

$$\sigma = \frac{\partial \frac{K}{L}}{\frac{K}{L}} \div \frac{\partial \frac{MP_L}{MP_K}}{\frac{MP_L}{MP_K}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(25)}$$

We know that Q equals $AL^{\alpha}K^{\beta}$ in the Cobb-Douglas Produc-

tion Function.

So, MP_L *or* $\frac{\partial Q}{\partial L} = \alpha \cdot AL^{\alpha}L^{-1}K^{\beta}$ as given in equation (14)

MP_K *or* $\frac{\partial Q}{\partial K} = \beta \cdot AL^{\alpha}K^{\beta}K^{-1}$ as given in equation (21)

$$\frac{MP_L}{MP_K} = \frac{\alpha \cdot AL^{\alpha}L^{-1}K^{\beta}}{\beta \cdot AL^{\alpha}K^{\beta}K^{-1}}$$

$$= \frac{\alpha \cdot AL^{\alpha}K^{\beta}L^{-1}}{\beta \cdot AL^{\alpha}K^{\beta}K^{-1}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(26)}$$

Here, $AL^{\alpha}K^{\beta}$ in both numerator and denominator cancels out.

$$= \frac{\alpha}{\beta} \times \frac{L^{-1}}{K^{-1}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(27)}$$

L^{-1} can be expressed also as $\frac{1}{L^1}$ and $\frac{1}{K^{-1}}$ as K^1 or K.

$$\frac{MP_L}{MP_K} = \frac{\alpha}{\beta} \times \frac{K}{L} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(28)}$$

$$\partial\left(\frac{MP_L}{MP_K}\right) = \frac{\alpha}{\beta} \times \partial\left(\frac{K}{L}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(29)}$$

e_s between K and L

$$= \frac{\partial\frac{K}{L}}{\frac{K}{L}} \div \frac{\partial\frac{MP_L}{MP_K}}{\frac{MP_L}{MP_K}} \ldots\ldots\ldots\ldots\ldots\ldots \text{(25}$$

Substituting equation (28) and (29) in equation (25)

- $E_S = \sigma = 1$

e_s between K and L $= \frac{\partial\frac{K}{L}}{\frac{K}{L}} \div \frac{\frac{\alpha}{\beta}\partial\left(\frac{K}{L}\right)}{\frac{\alpha}{\beta}\left(\frac{K}{L}\right)} \ldots\ldots\ldots\ldots\ldots\ldots \text{(30)}$

α/β gets cancel out, then

e_s between K and L $= \frac{\partial\frac{K}{L}}{\frac{K}{L}} \div \frac{\partial\left(\frac{K}{L}\right)}{\left(\frac{K}{L}\right)} \ldots\ldots\ldots\ldots\ldots\ldots \text{(31)}$

$= 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(32)}$

Therefore, it is proved that the elasticity of substitution between capital and labour in the Cobb- Douglas Production Function under Constant Returns to Scale is unity.

5. Under the Cobb-Douglas Production Function, the expansion path is linear, and it passes through the origin

Let us see the necessary condition for the producer's equilibrium or constrained optimization condition. It is

$$\frac{MP_L}{MP_K} = \frac{P_L}{P_K} \quad \text{..... (33)}$$

Under the Cobb-Douglas Production function, we have seen the ratio of marginal product of factors as

$$\frac{MP_L}{MP_K} = \frac{\alpha}{\beta} \times \frac{K}{L} \quad \text{.....28}$$

- Expansion path is linear and passes through the origin

Here, substituting equation (28) in (33)

$$\frac{\alpha}{\beta} \times \frac{K}{L} = \frac{P_L}{P_K} \quad \text{..... (34)}$$

Rearranging the equation,

$$\frac{\alpha K}{\beta L} = \frac{P_L}{P_K}$$

$$\alpha K P_K = \beta L P_L$$

$$\alpha K P_K - \beta L P_L = 0 \quad \text{..... (35)}$$

It is evident from the equation that the expansion path of the Cobb-Douglas production function passes through the origin and it is a linear production function.

The Cobb-Douglas Production Function is employed in many fields, such as production, distribution, theories of economic growth, input-output analysis, and linear programming. Given the practical use of the production function, it faces criticism. One of the criticisms is that the function ignores time as a fourth variable. Also, it has a drawback concerning explaining the substitutability of factors alone. The production function ignores the complementary nature of factors. The assumptions of the production function to constant returns to scale, neutral technical progress, and homogenous factors are widely criticised for not being in line with real situations.

- Widely used production function

2.2.1.2 Constant Elasticity Substitution Production Function

- Popularised by Arrow, Chenery, Minhas, Solow

The Constant Elasticity of the Substitution Production Function, popularly known as the CES Production Function, was popularised via the joint article named "Capital and Labour Substitution and Economic Efficiency" published by Arrow, Chenery, Minhas, and Solow in 1961. However, the production function was developed by H. O. Dickinson in his article "A Note on Dynamic Economics" in 1954.

The general form of CES production function is given as:

$$Q = A\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-h/\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(36)$$

- $Q = A\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-h/\beta}$

Here, Q represents output, K is capital stock, L is labour input, A is efficiency parameter, α_1 and α_2 represent factor intensity of capital and labour respectively, β represents substitution of factors, and h represents the degree of homogeneity.

With respect to the value of the parameters considered in the function, A is assumed to be greater than zero (A>0), $\alpha_1$and α_2 to be greater than or equal to zero ($\alpha_1, \alpha_2 \geq 0$), and β varies between -1 and infinity ($-1 \leq \beta \leq \infty$).

Properties of Constant Elasticity Substitution Production Function

1. Under the CES production function, the Elasticity of substitution between capital and labour is $\sigma = \frac{1}{1+\beta}$

We know that the elasticity of substitution with two inputs, viz. capital and labour is given as:

$$\sigma = \frac{\partial \frac{K}{L}}{\frac{K}{L}} \div \frac{\partial \frac{MP_L}{MP_K}}{\frac{MP_L}{MP_K}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(25)$$

For the CES production function, given h, the degree of homogeneity is unity, then the general form of the production function can be represented as:

$$Q = A\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-1/\beta} \quad \text{.....(37)}$$

Let us make the output in exponential form using –β. The following changes make the production function suitable for further calculations.

$$Q^{-\beta} = A^{-\beta}\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-\beta/\beta}$$

Here, $^{-\beta}/_{\beta}$ becomes one.

$$Q^{-\beta} = A^{-\beta}\alpha_1 \cdot K^{-\beta} + A^{-\beta}\alpha_2 \cdot L^{-\beta} \text{..... (38)}$$

To get the equation for MP_L, *take the partial derivative of the above function concerning L.*

$$-\beta Q^{-\beta-1} \cdot \frac{\partial Q}{\partial L} = -\beta A^{-\beta}\alpha_2 \cdot L^{-\beta-1} \text{..... (39)}$$

Since the first portion of the equation (38) RHS has no variable related to L, the partial derivation is zero. See the addition rule of differentiation.

$$\frac{\partial Q}{\partial L} = \frac{-\beta A^{-\beta}\alpha_2 \cdot L^{-\beta-1}}{-\beta Q^{-\beta-1}}$$

-β cancel out from numerator and denominator and $^{1}/_{Q^{-\beta-1}}$ can also be written as $Q^{\beta+1}$

$$MP_L = A^{-\beta}\alpha_2 \cdot L^{-\beta-1} \cdot Q^{\beta+1} \text{ ..... (40)}$$

To get the equation for MP_K, *take the partial derivative of the equation (38) with respect to K.*

- $\sigma = \frac{1}{\beta+1}$

$$-\beta Q^{-\beta-1} \cdot \frac{\partial Q}{\partial K} = -\beta A^{-\beta}\alpha_1 \cdot K^{-\beta-1} \text{..... (41)}$$

$$\frac{\partial Q}{\partial K} = \frac{-\beta A^{-\beta}\alpha_1 \cdot K^{-\beta-1}}{-\beta Q^{-\beta-1}} \text{ ..... (42)}$$

$$MP_K = A^{-\beta}\alpha_1 \cdot K^{-\beta-1} \cdot Q^{\beta+1} \text{ ..... (43)}$$

Since we get MP_L *and* MP_K, *the ratio of* $^{MP_L}/_{MP_K}$ can be written as:

$$\frac{MP_L}{MP_K} = \frac{A^{-\beta}\alpha_2 \cdot L^{-\beta-1} \cdot Q^{\beta+1}}{A^{-\beta}\alpha_1 \cdot K^{-\beta-1} \cdot Q^{\beta+1}} \text{ ..... (44)}$$

$A^{-\beta} Q^{\beta+1}$ cancel out from numerator and denominator.

$= \frac{\alpha_2 L^{-\beta-1}}{\alpha_1 K^{-\beta-1}}$ ..... (45)

$L^{-\beta-1}$ can be represented as $1/L^{\beta+1}$ and $1/K^{-\beta-1}$ can be represented as $K^{\beta+1}$

$$= \frac{\alpha_2 K^{\beta+1}}{\alpha_1 L^{\beta+1}}$$

$\frac{MP_L}{MP_K} = \frac{\alpha_2}{\alpha_1}\left(\frac{K}{L}\right)^{\beta+1}$ ..... (46)

$\partial\left(\frac{MP_L}{MP_K}\right) = \frac{\alpha_2}{\alpha_1}\partial\left(\frac{K}{L}\right)^{\beta+1}$ ..... (47)

Let us consider MP_L/MP_K as R, $\partial\left(\frac{MP_L}{MP_K}\right)$ as ∂R,

K/L *as U,* $\partial K/L$ *as ∂U,* *and* α_1/α_2, as N.

Then, MP_L/MP_K can be written as:

$R = NU^{\beta+1}$ ..... (48)

Consider log of the above function

$\text{Log } R = \log N + (\beta+1)\log U$ ..... (49)

Take partial Differentiation of the log function with respect to U

Remember, $\log x = \frac{1}{x}$ and partial derivation for variables other than U is zero.

$\frac{1}{R}\cdot\frac{\partial R}{\partial U} = (\beta+1)\frac{1}{U}$ ..... (50)

Rearranging the equation,

$$\frac{\partial R}{\partial U}\cdot\frac{U}{R} = \beta + 1$$

Having the reciprocal of the above function,

$\frac{\partial U}{\partial R}\cdot\frac{R}{U} = \frac{1}{\beta+1}$ .....(51)

Substituting the values

$$\frac{\partial\left(\frac{K}{L}\right)}{\partial\left(\frac{MP_L}{MP_K}\right)} \cdot \frac{\frac{MP_L}{MP_K}}{\frac{K}{L}} = \frac{1}{\beta+1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (52)$$

Rearranging the equation:

$$\frac{\partial\left(\frac{K}{L}\right)}{\frac{K}{L}} \cdot \frac{\left(\frac{MP_L}{MP_K}\right)}{\partial\left(\frac{MP_L}{MP_K}\right)} = \frac{1}{\beta+1}$$

$$\frac{\partial\left(\frac{K}{L}\right)}{\frac{K}{L}} \div \frac{\partial\left(\frac{MP_L}{MP_K}\right)}{\left(\frac{MP_L}{MP_K}\right)} = \frac{1}{\beta+1} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (53)$$

The equation (53) is similar to equation of elasticity of substitution given in equation (25)

So, e_s or $\boldsymbol{\sigma} = \frac{1}{\beta+1}$ under CES production function.

2. The elasticity of substitution varies between zero and infinitive

Under CES Production Function, $\sigma = \frac{1}{\beta+1}$. Earlier, We mentioned that β varies between -1 and infinity ($-1 \leq \beta \leq \infty$).

Suppose β = -1, then

$$\sigma = \frac{1}{\beta+1}$$

$$= \frac{1}{-1+1}$$

$$= \frac{1}{0} = \infty$$

- $0 \leq \sigma \leq \infty$ as $-1 \leq \beta \leq \infty$

Suppose β = 0, then

$$\sigma = \frac{1}{\beta+1}$$

$$= \frac{1}{0+1}$$

$$= \frac{1}{1} = 1$$

Suppose $\beta = \infty$, then

$$\sigma = \frac{1}{\beta+1}$$

$$= \frac{1}{\infty+1}$$

$$= \frac{1}{\infty} = 0$$

So, when β varies between -1 and infinity ($-1 \leq \beta \leq \infty$), the σ varies between zero and infinity ($0 \leq \sigma \leq \infty$).

3. CES Production Function is a generalized production function

CES Production Function is a generalized production function. The function changes with the value that the β takes. When β is equal to -1, the elasticity of substitution, σ is equal to infinity. Then, the production function becomes a linear production function. When β equals ∞, the elasticity of substitution, σ equals zero, and the production becomes the Leontief production function having fixed factor proportions. When β is equal to 0, σ is equal to one, and the function becomes the Cobb- Douglas Production function.

4. CES Production Function is homogenous of degree one when 'h' is equal to one

The CES production function is

- CES is homogenous like Cobb Douglas at h=1

$$Q = A\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-h/\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (36)$$

When 'h' is equal to one,

$$Q = A\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-1/\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (54)$$

Let us multiply both inputs by a constant 'k' to see the homogeneity of the function

$$Q = A\left(\alpha_1 \cdot (kK)^{-\beta} + \alpha_2 \cdot (kL)^{-\beta}\right)^{-1/\beta} \ldots\ldots\ldots\ldots\ldots\ldots \quad (55)$$

$$= A\left(\alpha_1 \cdot k^{-\beta}K^{-\beta} + \alpha_2 \cdot k^{-\beta}L^{-\beta}\right)^{-1/\beta} \ldots\ldots\ldots\ldots\ldots\ldots \quad (56)$$

$$= A\left(k^{-\beta}\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)\right)^{-1/\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (57)$$

$$= A\left(k^{-\beta}\right)^{-1/\beta}\left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-1/\beta} \ldots\ldots\ldots\ldots\ldots\ldots \quad (58)$$

In equation (58), $\left(k^{-\beta}\right)^{-1/\beta}$ becomes $k^{\beta/\beta}$ which is equal to k.

$$Q = Ak \cdot \left(\alpha_1 \cdot K^{-\beta} + \alpha_2 \cdot L^{-\beta}\right)^{-1/\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (59)$$

So, when constant k is multiplied by each input of the CES Production Function, it is possible to factor out the constant and express the production function as the multiply of the same constant. Hence, like the Cobb-Douglas Production Function, the CES Production Function is also a linear homogenous production function when 'h' is unity, and output can be proportionately increased in response to a similar input increase.

5. Each Factor under CES Production Function undergoes Diminishing Returns

- Second -order partial derivative shows the diminishing returns

Like the factors under the Cobb-Douglas Production Function undergo diminishing returns as the number of the factors increases, the factors Capital and Labour under the CES Production Function also undergo diminishing returns with an increase in their stock. The second-order partial derivative of the CES Production Function concerning labour and capital shows the diminishing returns of MP_L and MP_K respectively.

We have seen some of the important properties of the CES Production Function. The CES Production is considered superior to Cobb-Douglas Production Function in many respects. The following sub-sections show the superiority of the CES Production Function.

Superiority of CES Production Function

Following are the superiority of CES production fuction

a. We have already seen under the properties of the CES production function that it is a generalised production function. With changes in the value of β, the elasticity of substitution between factors changes, forming different types of production functions. The CES Production Function becomes a linear production function when the elasticity of substi-

- Cobb-Douglas is a specialised case of CES Production Function

tution, σ, is infinity. When σ acquires the value of zero, the CES production function becomes a Leontief Production Function of a fixed proportion of factors. When σ equals one, the CES Production Function becomes a Cobb-Douglas Production Function. Hence, the CES is a generalised function, with Cobb-Douglas being one of the specialised cases of the CES Production Function.

b. CES production function has a greater number of parameters than the Cobb-Douglas production function. Hence the range of analysis is greater for CES than the Cobb-Douglas production function.

c. CES Production Function is easier to calculate than the Cobb-Douglas production function.

d. CES Production Function is free from many of the unrealistic assumptions held by the Cobb-Douglas production function.

e. CES Production Function depicts the implications of relative factor shares in the National Income based on the elasticity of substitution, σ.

2.2.1.3 Variable Elasticity of Substitution (VES) Production Function

- Generalisation of CES

A generalised production function for the CES production function is the VES Production function. Lu and Fletcher introduced the function. The major assumption of the function is that the elasticity of substitution is dependent on the ratio of factors linearly. The production functions allow a varying elasticity of substitution with a ratio of factors. The logarithmic function can be represented as the per unit labour of real wage and K-L ratio.

$$Y = AK^{AV}(L + ba\ k)^{(1-a)v}$$

Here, when v becomes equals to one, the VES becomes CES production function.

- σ is constant along product line

Y can also be written as

$Y = AK^{AV}(L + ba\ k)^{(1-a)v}$ in the intensive form that Y = f(k), Y = Y/L, k = K/L.

In the equation, if b equals zero, the VES function becomes equal to Cobb-Douglas Production Function. In VES function, the elasticity of substitution is constant only along the line from origin.

2.2.1.4 Homothetic Production Function

The monotonic transformation of the homogenous function makes a homothetic production function. Under homothetic function, the expansion path and isoclines are straight lines from the origin. Along this straight line, the ratio of marginal product of labour for capital is constant. Here, for the homogenous function, the MRTS is a function of the ratio of input quantities. Cobb-Douglas and CES production functions are homothetic functions.

- Along the line from origin, MRTS is equal

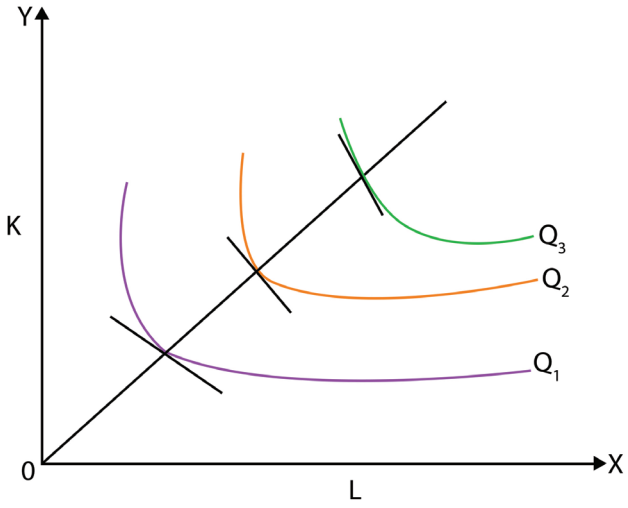


Fig 2.2.1 Homothetic Production Function

Summarised Overview

Empirical productions allows estimation of parameters. The Cobb-Douglas Production Function is a commonly used empirical production function that generally assumes a constant return to scale when the sum of output elasticity of factors is equal to one. The elasticity of substitution is equal to unity. The Constant Elasticity Substitution Production Function is a generalised production function. It can take the form of the Cobb-Douglas production function, linear production function, or Leontief function based on the value of the elasticity of substitution and degree of homogeneity. The CES production function is considered superior to the Cobb-Douglas Production function mainly due to the generalised nature of the CES function. The Variable Elasticity of Substitution (VES) Production Function allows the elasticity of substitution to vary as the relative price of inputs changes. The Homothetic Production Function assumes that the ratio of inputs remains constant along the line from the origin regardless of the output level.

Self Assessment

1. Explain Cobb-Douglas Production Function.
2. Prove that the Cobb-Douglas Production Function is homogenous.
3. Explain the elasticity of substitution of the Cobb-Douglas Production Function.
4. Explain the elasticity of substitution of the CES function.

Assignments

1. Estimate the parameters of the Cobb-Douglas Production Function.
2. Explain how the CES production function is considered as the generalised function.
3. Compare Cobb-Douglas and CES production function

References

1. Verma K. N. (2016), *Microeconomic Theory*, Vishal Publishing CO., Jalandhar-Delhi
2. Koutsyiannis, A (2013), *Modern Microeconomics*, Macmillan Press, London

Suggested Readings

1. Salvatore, Dominick (2009), *Principles of Microeconomics,* Oxford University Press
2. Nicholson Walter and Christopher Synder (2022), *Microeconomic Theory: Basic Principles and Extensions* (12th Edition), Cengage

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 3
Modern Cost Theory

Learning Outcomes

After completing this unit, the learner will be able to

- explain modern cost theory
- distinguish between L-shaped scale curve and U-shaped long-run curve
- familiarise with engineering cost curves

Background

Cost is a derived function from the production function. When the production function shows the method of production, the cost function represents the cost of producing output under each method. The cost function allows us to compare the profitability of different production methods available at present. You have already learned in your under graduation level that the cost is classified into short-run and long-run costs. Since, in the short run, some factors of production are fixed, the cost of production, under short-run, includes both fixed and variable costs. The total costs here are a sum of fixed and variable cost. However, in the long run, as all factors are variable, all costs are variable.

The overall cost calculated in both the short run and long run is a multivariable function. The factors affecting costs are the level of output, price of inputs, and level of technology. Understanding cost function is important in the theory of production. Hence, we have a detailed analysis of cost in terms of theories. Theories of cost are divided into traditional and modern cost theories. You have learned the traditional cost theories during under graduation time. This unit discusses the modern theory of cost.

Keywords

Average Fixed Cost, Average Variable Cost, Average Total Cost, L shaped Scale curve, Engineering cost curves, Returns to Scope

Discussion

2.3.1 Modern Cost Theory

- 'U' shaped cost curves under Traditional Theory

Modern Cost Theory is an improvement on Traditional Cost Theory. Under Traditional Cost Theory, the shape of most of the average cost curves are found to be 'U' shaped. Try to remember the different types of costs and related cost curves under Traditional Cost Theory. There are long-run and short-run costs and respective cost curves under which you deal with Average Fixed Cost, Average Variable Cost, Average Total Cost, Marginal Costs, and their cost curves. Except for the Short-run Average Fixed Cost Curve, all the cost curves are in 'U' shape. However, the 'U' shape of the cost curves is criticized under empirical and theoretical grounds and led to the development of Modern Cost Theory.

- Flat stretch in the Average Variable Cost and L-shaped long-run cost curve

George Stigler put forward one of the major changes in the shape of Traditional Cost curves. He introduced the flat stretch over a range of output in the case of representing Short-run Average Variable Cost. The flat stretch in the Average Variable Cost depicts the flexibility in the productive capacity of plants built by the firms. This is the reserve capacity. You have learned about excess capacity under Monopolistic Competition under Market Structure in your under graduate time. The flat stretch in the Average Variable Cost cannot be portrayed in a 'U' shape curve. The shape of the long-run cost curve under Modern Cost Theory is also different. In the long run, with a large scale of production, economies of scale operate. Modern management science methods can overcome any diseconomies on the managerial front. Also, technical economies allow the total cost per unit of output to fall continuously, especially along the range of output produced and operated by firms. This shapes the modern long-run cost curve as 'L' shape. Let us explain these in detail.

Modern Cost theory is also explained under Short-run and

Long-run costs. The following sub-section deals with Short-run and Long-run costs in detail.

2.3.1.1 Short Run Costs in Modern Cost Theory

We have learned earlier that the costs are classified as Average Fixed Cost, Average Variable Cost, Average Total Cost, and Marginal Costs. The Following portions deal with each cost and the respective cost curves.

Average Fixed Cost

- Cost of physical and personal organisation of the firm

Average Fixed Cost includes the cost of fixed factors of production. It includes the cost of building of the plant, maintenance cost of the building and land on which the building stands, remuneration to administrative staff, expenses of the machinery and depreciation expenses of the machinery, remuneration to staff who are paid on fixed-term ways and those who are directly involved in the production. Therefore, fixed cost includes the cost of physical organisation and personal organisation of a firm. The factors considered here are indirect factors, and the variable factors, such as labour, and raw materials, are referred to as direct factors.

- Size of the plant depends on the size of fixed factors

A firm plans the size of its plant by fixing the fixed or indirect factors. The reason is that these fixed factors, such as the land for the building of the plant, machinery, etc., set the production limit. These factors cannot be expanded as easily as the increase in direct factors such as raw materials and labour. So, it is important to fix the fixed factors to set the size of the plant to produce the level of output planned to be produced by the firm. This means that, the fixed factors and, hence, the size of the plant are determined based on the output planned to be produced. Here, a rational firm will plan to have enough flexibility and efficiency in the plant to produce the required output. The flexibility will be achieved by fixing the size of the plant with enough 'reserve capacity' so that the plant's capacity will be greater than required to produce the expected output.

The reasons for keeping a reserve capacity are as follows. There are chances of seasonal and cyclical fluctuations in the economy. This may affect the demand for the product. In real situations, it is better to have reserve capacity at the plant size to increase output corresponding to demand rather than having a stockpiling or stock inventory policy. This also helps the

- Smooth production under seasonal and cyclical fluctuations, repairs of machinery, changing taste

- Accommodation of highly flexible machinery allows reserve capacity

firms to hold their customers from going to rivals when there is a spike in demand. Also, any sort of repairs of machinery will be dealt without affecting the smooth production of the required output when the plant has reserve capacity. Another important benefit of keeping reserve capacity is to have some changes or alterations in the product in line with the changing tastes and preferences of the customers.

Technology also plays an important role in keeping the reserve capacity of the firms. Take the case of a machinery, such as a turbine. Considering the small size of output planned to be produced by a firm, only a small amount of other related machines must be needed. However, a combination of a basic machine, such as a turbine, and a smaller amount of related machines does not lead to full employment of the basic machine. Still, a firm buys a basic machine so that it allows greater flexibility in production when demand increases, thus allowing greater reserve capacity at hand. A firm also keeps reserve capacity in the form of physical and personal organisation. A reserve capacity in the form of larger land and building for the plant under physical organisation is kept to face future needs. Reserve capacity can also be kept on an administrative or organisational level to address the future increase in operations of the firm.

A rational firm will not choose a plant size and its fixed factors based on the lowest cost in the present but based on the flexibility that shall be required in the future. This is shown in the Average Fixed Cost Curve shown below.

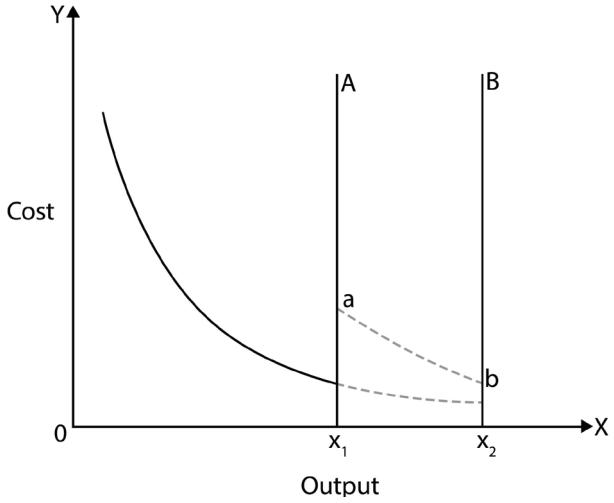


Fig 2.3.1 Average Fixed Cost Curve

- Reserve capacity affects the shape of the AFC Curve

The figure shows that the firm has the maximum capacity with largest capacity units of machinery under the short run until the boundary shown by 'B'. However, there is limited expansion with small unit machinery shown by 'A.' The firm can expand the output till 'B' through the increase in the number of hours of work of laborers. This is shown through the continuous dotted line of AFC. Moreover, the output can also be shown by buying additional small unit machinery, shown by the upward shift of AFC and declining through 'a to b'.

Average Variable Cost

- Cost of Variable factors

The Average Variable Cost includes cost incurred while employing variable factors. These costs are the cost of labour, which increases with an increase in output, the cost of raw materials, and the expenses of daily machinery operations. We have already come across the shape of the Average Variable Cost curve as having a flat stretch over a range of output. This contradicts the 'U' shape of the traditional cost curve. The flat stretch represents the existence of reserve capacity over the range of the output. The shape of SAVC is shown below.

- SAVC is saucer shaped

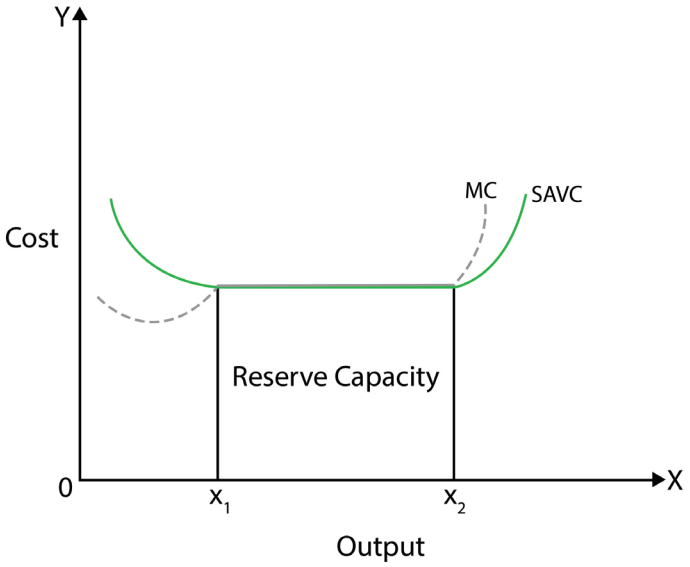


Fig 2.3.2 Average Variable Cost

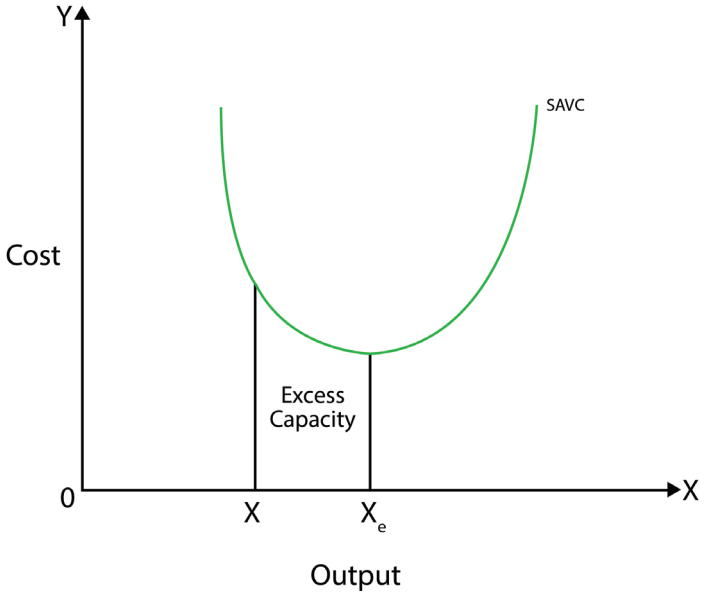
SAVC curve under Modern theory has a broad U shape, forming a saucer-type shape. The flat stretch shown over the range of X_1 X_2 shows the planned reserve capacity. Over this range, an increase in output from X_1 to X_2 does not increase the cost of production. The firm can produce an output close

to X_1 in a certain period and close to X_2 during another period, depending on the situation in the economy. Generally, a firm may operate between the output range of X_1 and X_2. Mostly, firms operate at their two-thirds capacity, leaving an output produced closer to X_2.

Over the flat stretch, the SAVC is equal to MC. In the figure, it is clear that before the range or left of X_1, MC is below the SAVC, and beyond the range or right of X_2, the MC is above the SAVC. The falling portion of the Average Variable Cost shows the fall in cost. This is due to the increase in the productivity of variable factors in correspondence with the efficient utilization of fixed factors. Similarly, the increasing portion of Average Variable Cost shows the increase in cost. An increase in cost with an increase in output is due to overtime wage payment, loss of productivity due to overtime labour, and cost associated with an increase in wear and tear of machinery as a result of time operations.

- Over the stretch, SAVC is equal to MC

The reserve capacity shown in a saucer-shaped modern SAVC differs from the excess capacity in the 'U' shaped SAVC under traditional theory. The excess capacity is shown below.



- Excess capacity refers output as suboptimal level, whereas reserve capacity shows the optimal level

Fig 2.3.3 Excess Capacity under 'U' shaped SAVC

In traditional theory, the optimum production capacity for a firm is present at a single point, the lowest point on the 'U' shaped curve. Under traditional SAVC, the optimum capacity is shown in the figure as X_e. If the firm produces at X, the

range between X and X_e is considered excess capacity. The excess capacity is different from the reserve capacity in the sense that along the excess capacity, the marginal cost is different for different output level, whereas, along the reserve capacity, the marginal cost is the same over the range of output where SAVC is flat.

Average Total Cost

The Average Total Cost includes the Average Fixed Cost and Average Variable Cost. The shape of the Average Total Cost curve is shown below.

- SATC falls up to end of reserve capacity and then rises

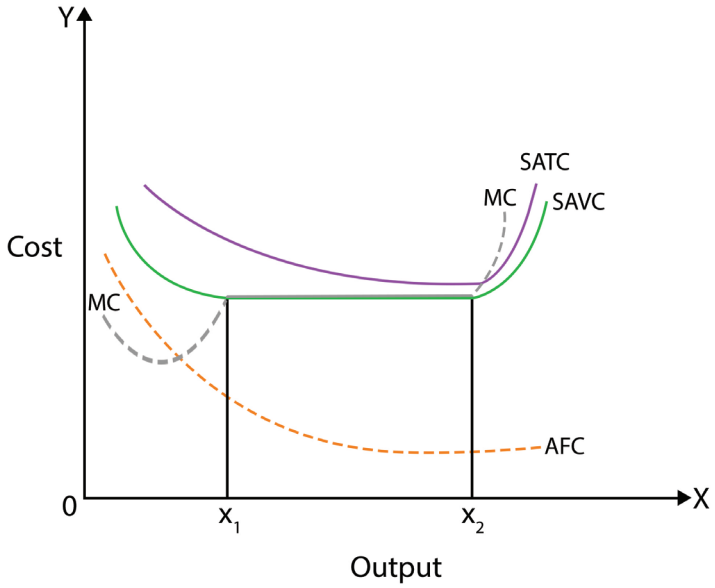


Fig 2.3.4 Average Total Cost Curve

The shape of the SATC curve is shown as it continuously falls until the point X_2, where the reserve capacity ends, and then it increases. The SATC falls until X_2 due to the effect of the fall in the Average Fixed Cost Curve (AFC) till the end of the reserve capacity, X_2. After X_2, the SATC starts rising due to the effect of rising SAVC. The Marginal Cost Curve, MC intersects the SATC at its minimum. This intersection point is to the right of X_2, the end of the reserve capacity.

2.3.1.2 Long Run Costs and L shaped Scale Curve

We are aware that, in the long run, all costs change. The

- Shape of LAC curve under Modern Cost Theory is 'L' shaped

shape of the long-run cost curve in Modern Cost Theory is said to be 'L' shaped in contrast to the 'U' shaped long-run cost curve under Traditional Cost Theory. Under Modern Cost Theory, the long-run cost is classified into production and managerial costs. In the long run, with an increase in the production of output, the managerial cost increases. However, the production costs decrease with increasing output. The increase in managerial cost will be offset by the decrease in production costs, leading to an overall long-run cost fall with an increase in scale and long-run cost curve to have an 'L' shaped scale curve.

Production Costs

- Fall in production cost causes 'L' shaped cost curve

When output increases in the long run, the production cost decreases steeply in the beginning. Then, it falls gradually with the increase in the scale of production. The fall in production cost and the resulting 'L' shape of the cost curve are due to the technical economies of large-scale production. Given the technology in the overall industry, the technical economies experienced or benefit of technology can be fully utilized with an increase in the scale of production even though during the initial increase in production, the full economies or benefit of the technology can be experienced partially. This makes the scale of production to a minimum optimal scale. With the given technology itself, at the larger scale of production, economies of scale operate when there is an increase in skill due to decentralized operations, a fall in the cost of repairs at certain levels of output, and production of multi-products, allowing not to buy some of the related products otherwise purchased from outside. With technological improvement, there must be greater scale of production with lower costs.

Managerial Costs

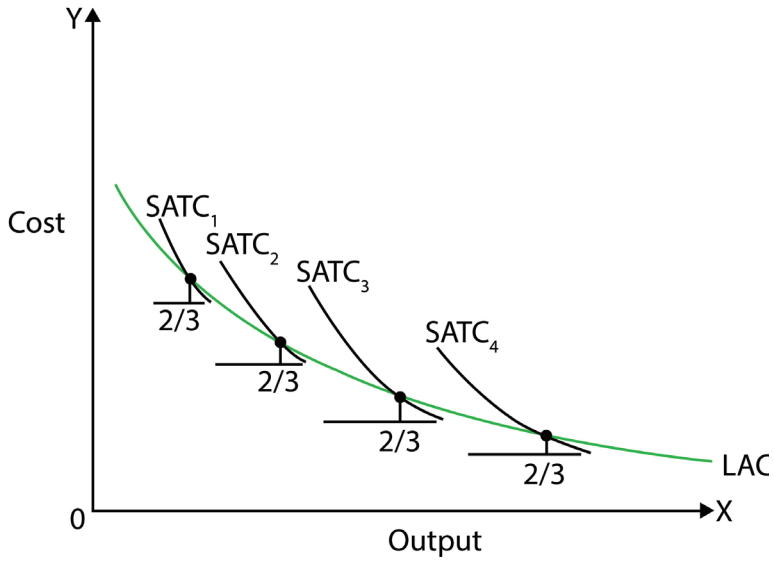
- Managerial cost increases slowly at a higher scale of output

The managerial cost is different for different plant sizes as each has its own administrative and organizational measures to properly work the plant. The levels of management correspond to its management techniques, which apply to the respective range of output. The cost of the management techniques falls first up to a certain scale of output and rises slowly when the scale of output rises.

The production costs fall sharply at the beginning and then smoothly at higher scales of output. Managerial costs increase slowly at higher scales of output. However, the fall in production

or technical costs is greater than the rise in managerial costs, leading to a general fall in the long-run cost. The long-run cost curve is shown below. Here, there are short-run average costs for each period of the short run. Each short-run average cost includes corresponding administrative, production, and other costs. We have already mentioned that usually, the firms produce at the two-thirds portion of the optimum capacity.

- Fall in production cost offset the increase in managerial cost



- LAC is not an envelope of SATC, but SATC intersects with LAC

Fig 2.3.5 LAC

The figure shows the 'L' shaped LAC curve. Here, four plant sizes are shown with falling costs. The corresponding SATC are joined to derive the LAC curve. The joining points of SATC are where two-thirds of the production take place. It is important to note that the LAC is not the envelope of SATC curves as we see in the traditional LAC curve. Here, SATC intersects with LAC.

The following figure shows the position of LMC and LAC.

- LMC below LAC when LAC is falling continuously

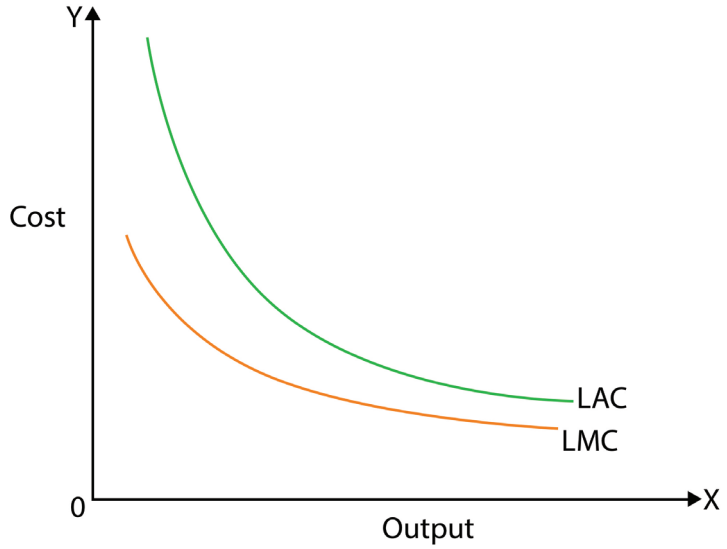


Fig 2.3.6 LAC and LMC

The figure shows that, as long as the LAC curve is continuously falling, the LMC is also continuously falling and lying below the LAC at all the output levels.

The following figure shows the relation between the Minimum Optimum Scale and shape of LAC and LMC.

- LAC falls till minimum optimal scale, then remains constant

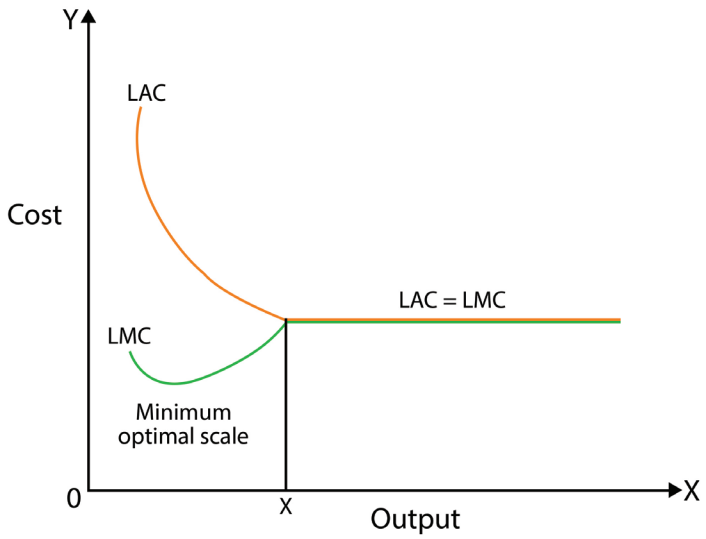


Fig 2.3.7 Minimum Optimum Scale, LAC, and LMC

The minimum optimal scale in the figure shows the amount of output produced when all types of economies are materialised and reaped. The figure shows the minimum optimal scale when the continuous fall in LAC ends. So, after the optimum

production scale, the LAC maintains a constant level, as shown by the horizontal range along the LAC. The LMC lies below the LAC until the LAC is continuously falling and the minimum optimum scale is reached. After the minimum optimum scale, the LMC is equal to the LAC. It is argued that the more realistic shape of the Long-run cost curve is 'L' rather than 'U' shaped.

Learning Curve

One of the reasons for the downward slope of the long-run curve is the concept of learning by doing. Learning by doing is introduced by K.J. Arrow. It emphasizes that an individual will increase the skill in productive work by repeating the work being done. When the worker performs the same type of activity continuously, it enhances the ability to perform it more efficiently. This leads to enhanced efficiency in production and increased production at an increased rate. In addition to production activities, the continuous performance of managerial activities enhances the managerial abilities of an individual. The acquirement of skill and experience in productive and managerial skills through repeated performance of activity reduces the cost of production and makes the LAC continuously fall.

- Performing an activity continuously improves skill

The learning curve shows the proportion of cost reduction per unit of output with the increase in overall output in each period. Under the learning curve, the relationship between output and the cost of production can be written as

$$C = \alpha Q^{\beta}$$

- $C = \alpha Q^{\beta}$

Here, C is the cost of input of Qth output level; Q is the total unit of output produced; α is the cost per unit of output during the beginning of production; β is the rate of reduction in cost per unit of output during each successive period.

- Inverse relationship between output and cost due to learning by doing

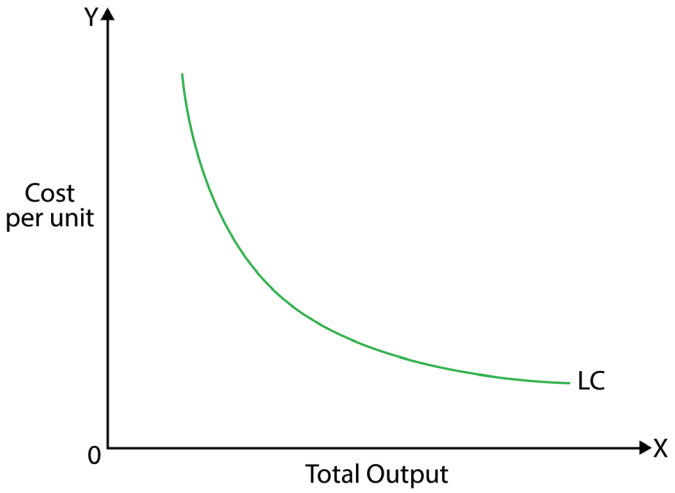


Fig 2.3.8 Learning Curve

In the figure, the Learning curve is represented as LC. The downward-sloping learning curve shows an inverse relation between the total output produced, including the learning, and the cost per unit of output. The negative slope of the curve represents a negative value for β.

2.3.2 Engineering production function cost curves

- Substitution of factors at kink

Engineering cost is derived from the engineering production functions. These production functions are production functions requiring a limited number of methods of production. Since the production methods are limited, substituting factors are also limited, leading to the generation of kinked isoquants. Here, the substitution between the factors is represented at the kinks of the production function. It is important to understand that one production technique is substituted for another at the kink. Along a particular isoquant, there is the substitution of factors indirectly. The following figure shows the kinked engineering production.

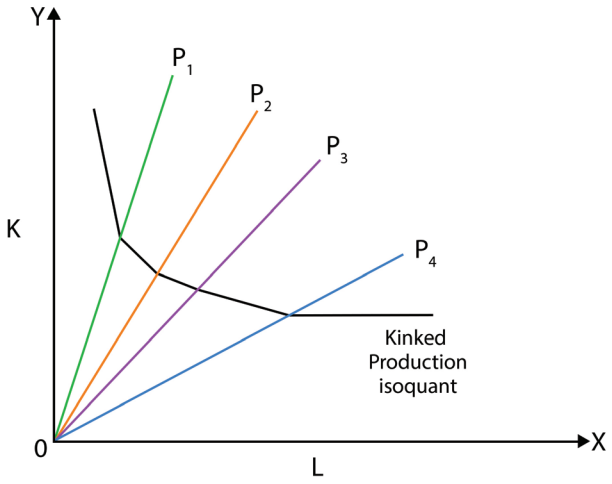


Fig 2.3.9 Engineering Production isoquant

2.3.2.1 Short-run Engineering Cost

To derive short-run engineering cost curves, it is assumed that there is reserve capacity in the plant and factors of production are fixed that require a minimum outlay. The total cost curve is shown below.

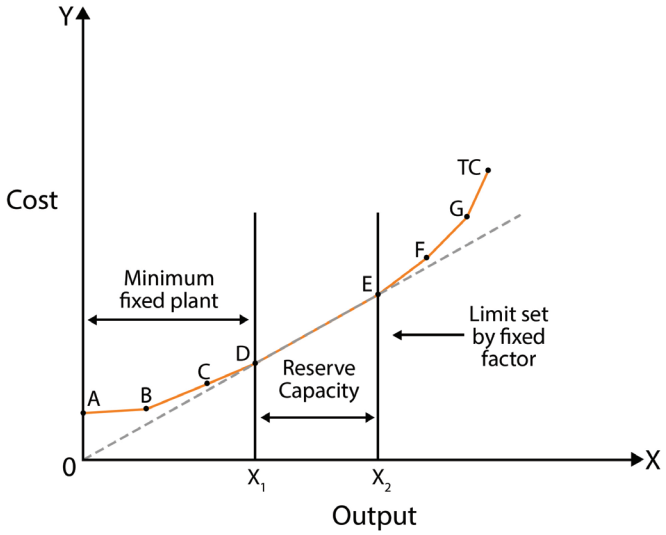


Fig 2.3.10 Short Run Total Cost Curve

During the range of OX_1, the total cost curve consists of different segments, which are linear and slope constant. The average cost of the segments of TC is shown below.

- Total and Average costs are calculated at segments along the curves

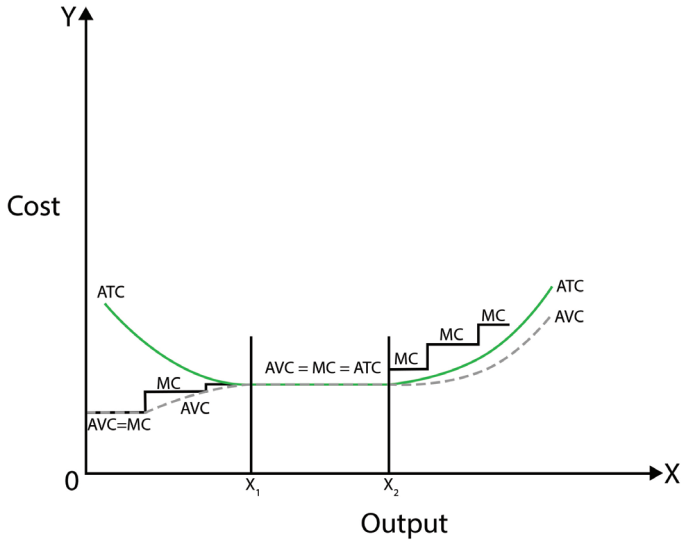


Fig 2.3.11 Average Cost

Compare the above two figures 2.3.10 and 2.3.11. During the segment of AB, the MC is equal to AVC. For the BC segment, MC is greater than AVC. The second figure shows that the MC increases at each segment, and MC is above AVC. During the range of AD, the ATC falls, and along EG, ATC rises. Along the range of reserve capacity, the total cost is constant, and MC, AVC, and ATC are equal.

2.3.2.2 Long run Engineering Cost

The technical cost of production is generally included in the engineering costs. Therefore, the administrative costs and resultant large-scale diseconomies are usually not affected in engineering costs.

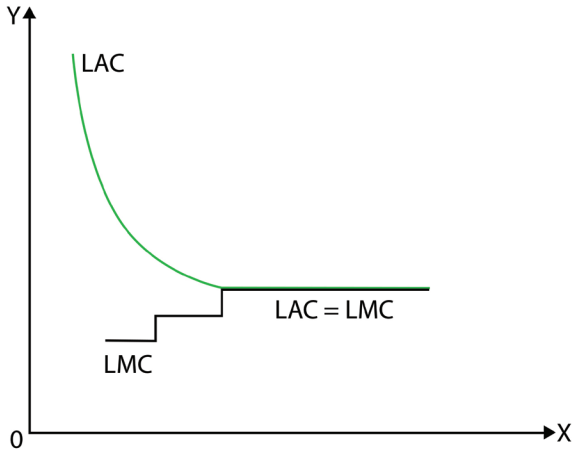


Fig 2.3.12 Long run Curve

Here, the LMC is shaped below LAC until Minimum optimal scale.

- Lesser diseconomies of scale reduce long -run costs

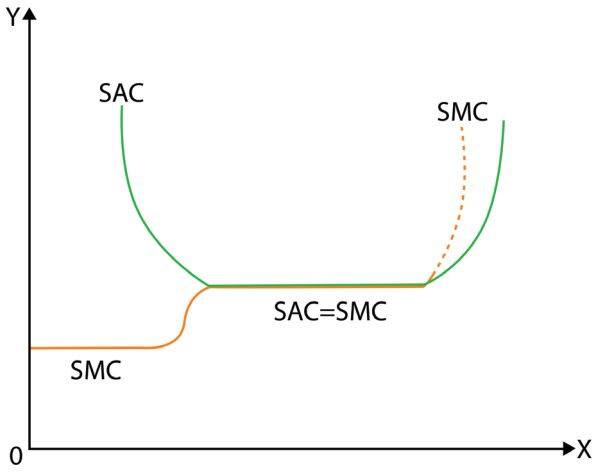
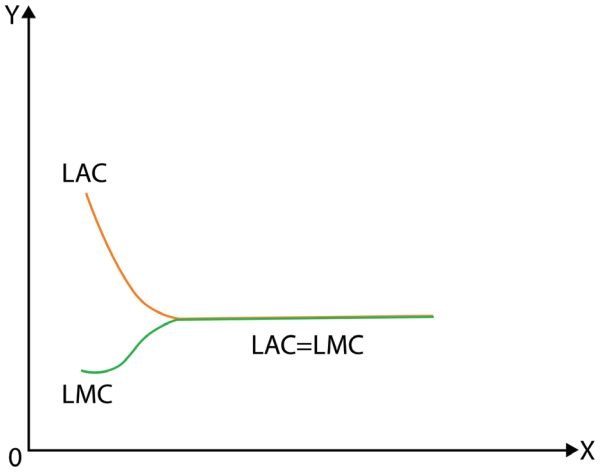


Fig 2.3.13 Short Run Unit Cost with Reserve Capacity

During the range of reserve capacity, the SAC is equal to the SMC. SMC is lower than SAC to the left of reserve capacity, and to the right of reserve capacity, SMC is above SAC.



2.3.14 Long Run Unit Costs without Diseconomies of Scale

The above figure shows the long run cost where diseconomies of scale is not present. The LAC curve is L shaped with LMC lies below until the minimum optimum point.

2.3.3 Returns to Scope

- Cost effectiveness in simultaneously production of multiple products

Returns to Scope refers to simultaneous production of products. This reduce the cost of producing the products collectively instead of producing them individually. This is possible when these products can be produced using the same type of inputs or production technology. The products under production can be referred as co-products or compliments in production. Under such situations the Long run Average and Marginal costs decreases with increase in the production of variety of goods simultaneously and multiple products can be produced cost effectively.

- Fall in cost due to production of single good in Returns to Scale and multiple products in Returns to Scope

Returns to Scope is different from the Returns to Scale. Under returns to scale, the Long run Marginal Cost falls with the increased production of the same good. Here, production of same good increases the efficiency of production which inturn reduces the long run costs. However, the returns to scope too experiences fall in long run costs, but due to different reason. As we have discussed earlier, the simultaneous production of goods that are possible to prduce complimetarily makes the long run costs to fall.

- Co-production

Under Returns to Scope, the production of multiple products occurs in the way of producing one good as a byproduct of the production of another good. The byproduct may be of the importance of a final good for a section of customers. Finding the use of the byproduct and customers for it makes efficient production under returns to scope. Consider the case of growing sugarcane. A firm can produce sugar, jaggery through the processing of sugarcane. The left overs of the process can be used as cattle feed, for the production of biogas, organic manure in agriculture.

- Production process is complementary

Common or interaction of number of production processes cause economies of scope. Take the case of training programme for engineering students. Usually, there will be collaboration between colleges and the industrial units for conducting training programmes. This collaboration helps both the industrial units and colleges. Through the collaboration, colleges can reduce the cost of instruction and the industrial units gets skilled but low cost labour. Here, the products produced i.e., engineers and the output in the industrial unit are not related in the form of having common inputs, but the production of together reduces the cost.

- Mergers and Acquisation creates economies of scope

Mergers and Acquisation are one way of materialising economies of scope. Merging of similar line of companies can share the common inputs used for the production of different product lines produced by both the companies. This reduces the cost of production. Also, merging reduces the cost in the form of using the space for the common purposes. For example, merging of retail chains having related product line. The retails shops may be producing different products, but related. Combing both the retail chains can effeciently manage the inputs and space so that it reduces the cost of inputs, ware house facilities, and use the managerial abilities for efficiency of production of both the product lines.

Summarised Overview

The traditional cost theory propagates 'U' shaped cost curves both for short run and long run except in the case of Average Fixed Cost Curve. However, under the empirical studies, it is questioned. Under modern theory of cost, the major difference in the shape of cost curve is examined with respect to saucer shaped Average Variable Cost and L shaped long run scale curve. Presence of reserve capacity is the main factor behind this difference in the shape of curves under traditional and modern theories. There is excess capacity under traditional theory which depicts the change in cost with change in output whereas under reserve capacity, along the range, increase in output will not increase the cost.

The L shape of the long run curve is due to the fall in production cost in long run. Here, LAC is not the envelope of SAC's , but formed by the intersection of SACs. Since economies of scale is present in long run, the falling LAC become 'L' shaped having a horizontal range where all the economies are materialised. The learning curve is explained in relation with the long run where improvement in skill happens with learning by doing, and learning curve is negatively sloped showing the inverse relation between total output produced and per unit cost. The engineering cost curves are mostly devoid of administrative diseconomies of scale. Also, they face limited method of production. Hence, the relevant isoquant has kink. The relatively lesser diseconomies makes long run engineering costs to fall in long run. Economies of Scope is an important concept explaining efficiency in production and cost minimisation through production of multiple products simultaneously. This is contrast to the economies of scale which addresses the cost minimisation through the long run production of single product.

Self Assessment

1. Explain the shape of AFC using reserve capacity.
2. Compare the shape of AVC in traditional and modern theory
3. Compare excess and reserve capacity.
4. Why is long run curve under modern theory not an envelope of SACs
5. Write a note on economies of Scope.
6. Explain short run and long run engineering cost curves.

Assignments

1. Explain the concept of the L-shape scale curve. How does it relate to the engineering production function and cost curves?
2. Discuss the factors that affect the shape of the learning curve. How can managers utilise the concept of learning curves to improve their operations?
3. Analyse the impact of technological progress on production function and cost curves. How does technological progress affect the shape of the long run curves?
4. Compare and contrast the concepts of economies of scale and returns to scope.

References

1. Salvatore, Dominick (2009), *Principles of Microeconomics,* Oxford University Press
2. Koutsyiannis, A (2013), *Modern Microeconomics,* Macmillan Press, London

Suggested Readings

1. Nicholson Walter and Christopher Synder (2022), *Microeconomic Theory: Basic Principles and Extensions* (12th Edition), Cengage

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UNIT 4
Case Studies of Cobb-Douglas Production function

Learning Outcomes

After completing this unit, the learner will be able to

- understand the application of Cobb-Douglas Production function
- familiarise with empirical production functions
- examine the share of factors using empirical data under Cobb-Douglas Production function

Background

The Cobb-Douglas Production Function is a commonly used empirical production function that generally assumes a constant returns to scale when the sum of output elasticity of factors are equal to one. The elasticity of substution is equal to unity. Generally, the Cobb-Douglas Production shows the share of factors viz. labour and capital in total production. The empirical analysis of the production function using real life data depicts the share of the factors of production. Cobb-Douglas Production is a widely used function since the parameters can be increased to more than two factors. The production function is extensively used to show the share of factors in agricultural sectors. There are many empirical studies using Cobb-Douglas Production function to analyse the share of factors in production and thereby use the result in policy analysis.

Keywords

Cobb-Douglas Production Function, Endogenous Technical Change, Exogenous Technical Change, Lagged Variables

Discussion

2.4.1 Case study – Cobb-Douglas Production Function

The Cobb-Douglas production is widely used in many fields such as production, distribution, economic growth. It is also used in input-output models and linear programming. Douglas conducted time series and cross sectional empirical studies under manufacturing sectors in the countries like USA, Canada, New Zealand, South Africa, and Australia in 1942.

He found out the production function for the USA using the empirical data during the period of 1899 to 1922. The function is

$$Q = 1.35\ L^{0.63}\ K^{0.30}$$

- Cobb-Douglas production function used in input-output model, linear programming

For South Africa, Cross sectional data are used. The function is

$$Q = 55.25\ L^{0.65}\ K^{0.37}$$

In India, a similar attempt was made by M N Murthy and S K Sastry. They used data of 320 firms in the year 1952. The production function is

$$Q = 0.68\ L^{0.53}\ K^{0.50}$$

In the case of USA, the output elasticity of factors add upto only 0.93 causing diminishing returns to scale. For other nations, the output elasticity is slightly over one.

It is possible that the function can be extended to situations where the number of inputs are greater than two. The Cobb-Douglas production can be used in the agricultural sector where inputs like land, irrigation, fertiliser are employed.

The production function in such cases is given below:

$$Q = A\ L^{\alpha}\ K^{\beta 0}\ N^{\beta 1}\ I^{\beta 2}\ F^{\beta 3.}$$

Here, N represents land, I represents irrigation, and F represents fertilisers.

2.4.2 Case Study – Cobb-Douglas Production Function and R&D

Zaman and Goschin calculated the elasticities of factors of production under Cobb-Douglas production function to understand the role of technical progress in the growth of Romania. The data from 1990 to 2007 were used for the empirical study. The impact of research and development in terms of endogenous technical progress and exogenous technical progress is done.

2.4.2.1 Cobb-Douglas Production Function and Exogenous technical progress

Under exogenous technical progress, the Cobb-Douglas production is represented adding the Hicksian Neutral technical change. Then, the production function can be written as

$$Y = A K^{\alpha} L^{\beta} e^{\lambda t}$$

α, β, λ are greater than one. Here, α represents output elasticity of capital and β represents output elasticity of labour. $e^{\lambda t}$ is related to Hicksian neutral technical change. λ is related to technology and t shows the time factor. Since there is neutral technical change and exogenous technical progress, it does not change the substitutability between the factors. In the study, parameters in the production function are estimated using the Eveiws Software.

The result of the study is

$$GDP = 0.021K^{0.3564} L^{0.7783} e^{0.0105t}$$

The model was made to lagged one by using lag of one year for capital and labour. In the case of technological variable, $e^{\lambda t}$, variants of 1 to 3 years was used. The model is

$$GDP = K^{0.4098} L^{03377} e^{0.0105t}$$

The above equation showed empirically that the result of lagged variants of technology is not different from the initial model. The lagged variable are used since the investment represented in the form of capital and technology requires time to reach the full potential.

The regression results of the function shows that the values of the parameters considered are significant.

The factor share results shows that under exogenous technical change, it has a smaller share to GDP of 0.92 percent when there is no lag and 1.4 percent when there is lag. The study shows that the result needs to have important effect on the decision making at the government level. Since technological progress is considered as an important factor of economic growth considering its effect on the growth of developed countries, it is important to make investment decisions to boost technological advancement since the result shows that the effect is modest.

2.4.2.2 Cobb-Douglas Production Function and Endogenous technical progress

Under endogenous technical progress, the empirical data for Romania for 1990 to 2007, given under the production function is

$$GDP = K^{0.4259} L^{0.3428} R^{-0.0176}$$

- Results of empirical study helps better policy making

L and K are expressed as one year lag, and R as 3 year lag, then the function is

$$GDP = K^{0.5138} L^{0.3033} R^{-0.0744}$$

R shows the expenditure on R&D annually. The study focussed on lag model as the lag shows the full potential of investment and technological change.

The analysis of the function is given. It shows that the share of capital in the GDP growth is 69.18 percent with lag and 54.16 percent without lag. In the case of share of labour, the study found that, it is 40.84 percent with lag and 43.60 percent without lag. The share of technical change is -10.2 percent with lag and -2.24 percent without lag. The negative share indicates under performance of the sector considering technical change. This shows that in Romania, though GDP increased after the 1990, the technical progress has slow increase.

Summarised Overview

Cobb-Douglas production function is a widely used production function having practical use in growth theories, production, and distribution theories. The function is largely used in the agricultural sector with slight modification in the production function incorporate the inputs used in the sector. Under such cases, the function has more than two variables in the function. The empirical analysis of the function is done in many countries like USA, Canada, India. The Cobb-Douglas Production function can also be used to examine the role of technical progress in the growth of GDP. The empirical analysis of factor shares, share of technological change, both endogenous and exogenous change in the growth of GDP in Romania for the period 1990 to 2007 shows that Cobb-Douglas Production function has wide dimensional applicability.

Self Assessment

1. Give mathematical expression of Cobb-Douglas Production.
2. What are lagged variables?
3. What is the reason for using lagged variables in empirical analysis?
4. What are endogenous and exogenous technical change?

Assignments

1. Cobb-Douglas Production function can be extended to use technical progress. Find out the empirical studies of countries in this context.
2. Consider CES production function. Try to find out the empirical studies related to the function.
3. Explain the statistical analysis fit to evaluate the Cobb-Douglas Production to find out the share of factors.

References

1. Verma K.N.(2017), *Microeconomic Theory*, Vishal Publishing Co., Jalandhar-Delhi.
2. https://ipe.ro/rjef/rjef2_10/rjef2_10_2.pdf

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MASTER OF ARTS ECONOMICS

Market Structures

Block 3

UNIT 1
Monopoly

Learning Outcomes

After reading this unit, the learner will be:

- familiarise with different degrees of price discrimination
- able to distinguish between intertemporal price discrimination and peak-load pricing
- introduced to tying and bundling

Background

The term monopoly used in economics describes a market structure where a single seller has complete control over the supply of a product or service, along with barriers to entry. In other words, a monopoly is a market where there are no close substitutes for the good or service being provided, and the monopolist has the power to set the price and output level. The concept of monopoly has been around for centuries, with examples of monopolies existing in various industries throughout history. One of the earliest and most well-known examples is the East India Company, which had a monopoly on the trade of spices and other goods between Europe and Asia in the 17th and 18th centuries. In independent India, BSNL as the sole telecommunication provider during the early years, can be considered as an example of monopoly.

In modern times, many governments have attempted to regulate or break up monopolies in order to promote competition and prevent abuse of market power. Antitrust laws and regulatory bodies have been established in many countries to ensure that monopolies do not engage in practices such as price-fixing, exclusionary conduct, or other forms of anti-competitive behaviour.

Keywords

Market power, Barriers to entry, Price discrimination, Dumping, Peak load pricing, Two-part tariff, Tying, Bundling

Discussion

3.1.1 Monopoly

- Single seller with no close substitutes

Monopoly is a market structure in which a single seller or a group of sellers have complete control over the supply of a good or service, and there are no close substitutes for it. This gives the monopolist significant market power, which can lead to higher prices and reduced output, as the monopolist has the ability to set prices at a level that maximises its profits. While monopolies can benefit the monopolist in terms of profits, they can lead to inefficiencies, reduced consumer welfare, and lower overall economic growth.

- Barriers to entry

One of the key features of monopoly is barriers to entry. Whenever there are barriers to entry, it results in the creation of monopoly profits and power. There can be natural reasons, which can create barriers to entry-for example, economies of scale, patents and licenses, or access to critical inputs that can create entry barriers. There can also be situations in which the firms can create artificial barriers so that it is difficult for competitors to join the industry. Since you have studied monopoly in your graduation programme, we will discuss the advanced areas of monopoly in this unit.

3.1.2 Price Discrimination

- Charging different prices for the same commodity

Price discrimination refers to the situation of charging different prices for the same commodity from different consumers. Here, the commodity or product is the same with small changes in respect of package, location etc. In the case of cost of production, it may be the same. Even if the costs of production of commodities sold at different prices are different, the difference in the price charged is higher than the difference in the cost of production.

• Separate market for discrimination

Price discrimination is a feature of monopoly market situation. Let us look into certain assumptions that are made under price discrimination.

- The market must be divided into sub-markets with different price elasticities.
- There must be effective separation of the sub-markets, so that no reselling can take place.

There are mainly three degrees of price discrimination. They are

a. First Degree Price Discrimination or Perfect Price Discrimination

b. Second Degree Price Discrimination

c. Third Degree Price Discrimination

3.1.2.1 First Degree Price Discrimination

• Charge buyers separately

If there is only one grocery shop in your locality, the shop owner will be able to charge the maximum price a consumer is willing to pay for commodities. Under such a circumstance, the shop owner takes away the entire consumer surplus of the consumer. So, first degree price discrimination refers to charging of the maximum of the willingness to pay or the reservation price leading to no consumer surplus. First degree price discrimination is also known as the perfect price discrimination. When the consumers are charged the maximum price by the monopolist (depending on their willingness to pay), it is called first degree price discrimination. It takes away the total surplus in the economy. It is possible to charge reservation price when it is able to consider each buyer separately.

We can show the first degree price discrimination using the following figure.

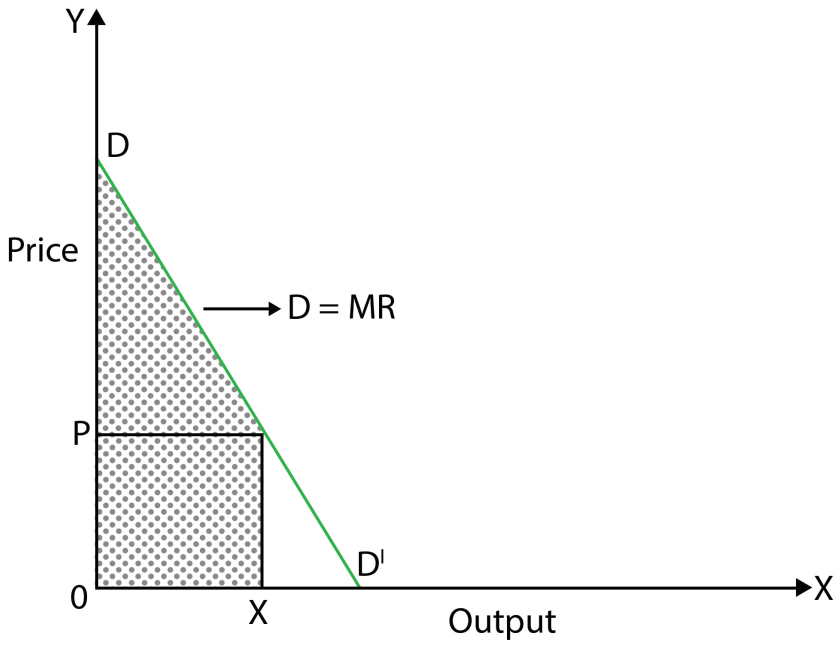

Fig 3.1.1 First Degree Price Discrimination

- Capture full consumer surplus

The figure depicts that the seller is able to charge the maximum amount or reservation price. In such a situation, D = AR = MR and price is charged on the DD1 curve. Here, each increment to revenue i.e., MR is equal to the price under first degree price discrimination, and we know that the price is always equal to AR or D in the case of monopoly price determination. Here, all the consumer surplus is taken by the producer by charging each unit as per the reservation price.

3.1.2.2 Second Degree Price Discrimination

When consumers are charged different prices based on the quantity consumed or based on different groups, it is second degree price discrimination. Some of the examples of second degree price discrimination are charging discounted price

- Charging different prices to different blocks

to bulk consumers and normal price to normal consumers; giving rewards for regular customers; difference in the rate of booking of tickets for railways and other services based on the age etc. In all these situations, price is charged differently for different group of consumers. Another common example of second degree is charging electricity consumption. Electricity bill is imposed on consumers based on the unit of consumption. There are different slabs and corresponding rate in electricity consumption. Individuals belonging to each slab is charged a separate rate. So, electricity consumers are grouped into different slabs based on their consumption and charged differently. Charging different prices for the same commodity according to different blocks or units consumed is the second order price discrimination.

The following figure represents the second order price discrimination.

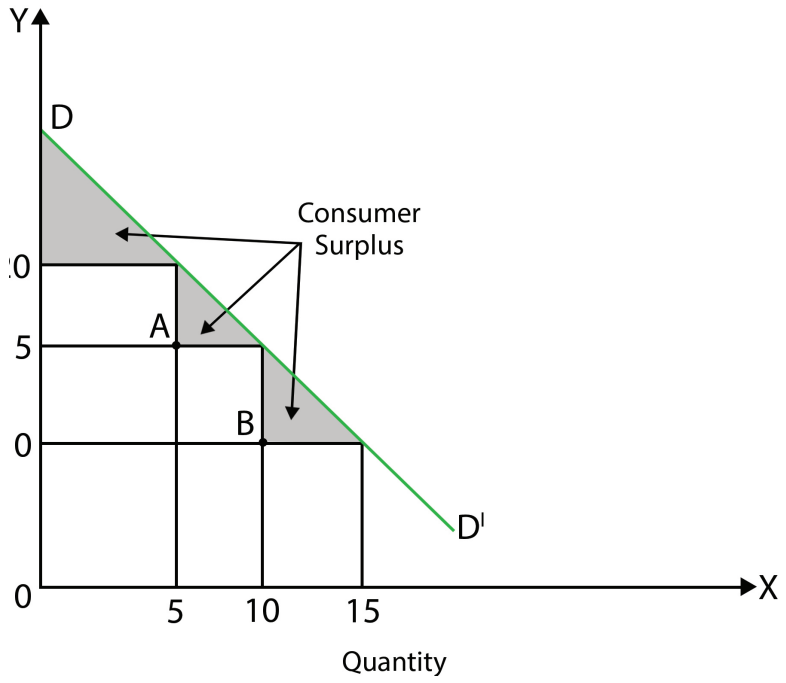

Fig 3.1.2 Second order price discrimination

- Captures partial surplus

Under Second-order price discrimination, quantity is divided into separate blocks, and the price is charged accordingly. Here, for the first five units, 20 rupees are charged, then for the next additional block, 15 rupees are charged, and for the last block, 10 rupees are charged. In second-order price discrimination, the consumer has a surplus, and they are not charged with the reservation price.

3.1.2.3 Third Degree Price Discrimination

- Different prices for different sub-markets

Under third degree price discrimination, the entire market of the monopolist is divided into sub-markets based on the elasticity of demand. The monopolist charges different prices for the same product in different sub-markets. Higher prices are charged in markets in which there is lesser elasticity of demand. With lesser elasticity, demand for the commodity is less responsive to changes in price. So, the monopoly firm can charge higher prices. Markets are separated strictly and no resale of the commodity is possible. The monopolist must also be able to assess the elasticity of demand in different sub-markets so that price discrimination is possible.

The following figure shows the price discrimination when there are two sub markets having different price elasticities of demand.

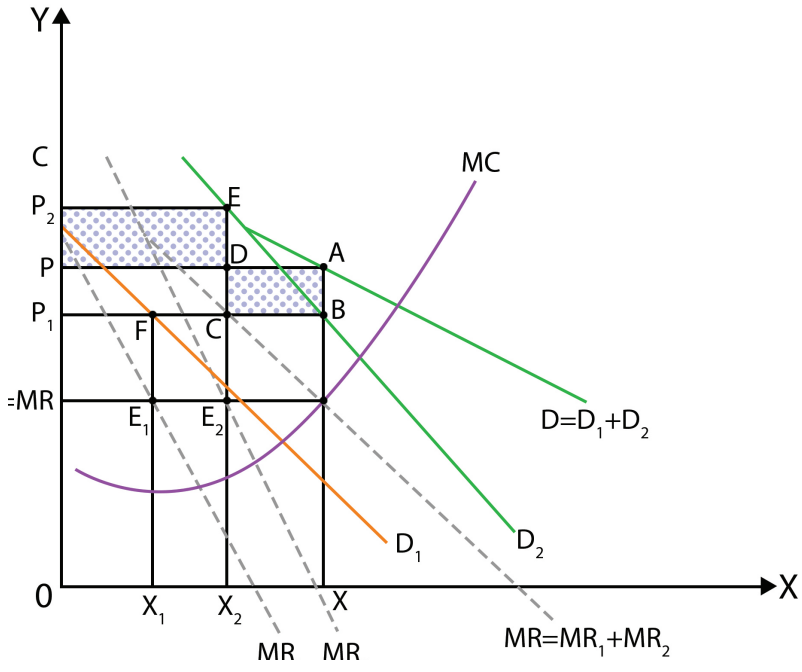

Fig 3.1.3 Third Degree Price Discrimination

- $MR_1 = MR_2 = MC$

In the above figure, D_1 and D_2 are the demand curves of two sub-markets having different price elasticities of demand. The elasticity of D_1 is greater than the elasticity of D_2. The combined demand is the horizontal summation of the individual demand curves. Each demand curve has corresponding MR curve and the total MR is the horizontal summation of individual MR curves. MC is the marginal cost curve which is same for both the markets. Here, it is important to decide the total output to be produced and how much to sell in each market. The output produced is shown by the intersection of MC with the total MR curve. The intersection point is E. The output produced is OX and price is P. If a uniform price, P is charged in both the markets, the total revenue will be OPAX. Under price discrimination, different price is charged in two markets to achieve maximum profit. Profit is maximised when MR is equal to MC. For both markets, MC is the same whereas MR is different. The profit maximising condition in first market is MR_1 equals to MC and second market is MR_2 equals to MC. So, the total profit is maximised when MR_1, MC and MR_2 are equal.

- Equilibrium in submarkets - E_1 and E_2

Graphically the equilibrium between both the MRs and MC can be shown by a horizontal line drawn from the equilibrium point E to Y-axis that measures the price. This line intersects with MR_1 at E_1 and MR_2 at E_2. E_1 and E_2 are the equilibrium points in the two submarkets. While extending vertical lines from E_1 and E_2 to corresponding demand curves D_1 and D_2, it gives the markets price P_1 and P_2 respectively. When the same vertical line is extended to X-axis, we get the output sold at each market. OX_1 is the output sold at first market and OX_2 is the output at second market.

Now, let us see the total revenue when price discrimination is materialised. It is given as

$$P_1 (OX_1) + P_2 (OX_2) = OX_1 FP_1 + O X_2 E P_2 \ldots\ldots\ldots (1)$$

We have already seen that the total revenue when P is charged in both market is OPAX. This OPAX can be written as

$$OPAX = OX_2 DP + X_2XBC + CBAD \ldots\ldots\ldots\ldots\ldots (2)$$

In the figure,

$$OX_1 FP_1 = X_2XBC \ldots\ldots,. (3)$$

$$O X_2 E P_2 = \quad OX_2 DP + PDEP_2 \ldots\ldots\ldots (4)$$

Then, revenue at price discrimination shown by the equation (1) can written as

$OX_1 FP_1 + O X_2 E P_2 = X_2XBC + OX_2 DP + PDEP_2$ … (5)

Subtracting equation (2) from equation (5) gives the difference between total revenue from price discrimination and total revenue from common price, P.

$X_2XBC + OX_2 DP + PDEP_2 - (OX_2 DP + X_2XBC + CBAD) = PDEP_2 - CBAD$ …… (6)

- Total revenue and profit higher under price discrimination

As $PDEP_2$ is greater than CBAD, total revenue from price discrimination is greater than total revenue from charging P price. As cost is same, the profit is greater under price discrimination.

3.1.3 International Price Discrimination and Dumping

Price discrimination between domestic and international markets is called international price discrimination. International price discrimination is also called dumping. Dumping is the practice of exporting goods to another country at a price lower than its normal value, typically lower than the price in the domestic market of the exporting country. Dumping explains a situation in which a domestic market has less price elasticity of demand, and the foreign market has a higher price elasticity. The price elasticity of demand is higher in foreign markets since the producers face competition for their products from similar products from other nations. Greater choices and alternatives in the foreign market make the price elasticity of demand higher. With a higher price elasticity of demand in foreign markets than in domestic, a higher price, if charged in foreign markets will leads to loss of consumers. So, a firm charges a lower price in the foreign market and a higher price in the domestic market for the same commodity.

- Charging lower prices abroad and higher prices domestically

In domestic markets, there is usually less competition from foreign companies and products as the domestic markets are partially restricted from entering foreign products due to the imposition of import tariffs and trade barriers. This restriction in the domestic market, unlike the foreign market, compartmentalizes the two markets. Moreover, this separation of markets makes it difficult to resell the product. So, it is

- Compartment alization of the market makes resale difficult

difficult for a low-priced product in a foreign market to be exported back or re-exported to the domestic country to sell it at the same low price instead of the high price in the domestic country.

In terms of dumping there are three types of dumping. They are persistent dumping, predatory dumping, and sporadic dumping.

- Lower price abroad for longer time

1. **Persistent Dumping:** Persistent dumping is the practice of exporting goods to a foreign market at a price lower than the price charged in the home market for an extended period. This type of dumping can cause significant harm to the domestic producers in the importing country and may lead to anti-dumping measures.

- Temporary sale to drive competitors out of the market

2. **Predatory dumping**: Predatory dumping is related to charging different prices abroad and domestically, as a method of driving the competitors. It is pointed out earlier that the foreign market has more competition in terms of the presence of companies from different countries. So, firms charge a lower price abroad than domestically for the same commodity to drive the foreign competitors out of the market. Once foreign competitors are forced to withdraw from the market due to a lack of demand, the firm increases the price of the commodity to reap the benefit of the monopoly that the firm enjoys in the current period. So, predatory dumping refers to charging lower prices abroad than the domestic market for a temporary period to drive foreign competitors out of the market.

- Occasional sales during overproduction

3. **Sporadic dumping**: Sporadic dumping also refers to temporary sales. However, it is not to drive away the competitors but to sell the surplus in production. So, sporadic dumping refers to the occasional sale of the product at a lower price abroad than domestically to sell out the unexpected overproduction of the commodity without reducing the domestic price. Here, the price in the domestic market is not reduced since it forms the permanent market.

There are anti-dumping measures to counter the practice of dumping. The governments take measures to protect their markets from the unfair practice of selling other countries commodities at lower prices when similar commodities

- Anti-dumping duties reduce the price differential

are produced within the country at relatively higher prices. Mostly, the anti-dumping measures are practised in the form of anti-dumping duties. These duties imposed on the foreign commodities increase the already lower prices of the commodities. This reduces the price differential between the foreign commodities and domestic commodities.

- sporadic dumping and persistent dumping are beneficial for consumers

Usually, it is not easy to determine the type of dumping practised. Restriction on predatory dumping is justified. But, there are chances of demanding protection by domestic producers against any form of dumping of foreign products. Filing of complaints against dumping acts against the import of foreign products. This leads to an increase in domestic production and profit. In the case of sporadic dumping and persistent dumping, it is beneficial for consumers since they get to purchase commodities at lower prices. It is said that the benefit of consumers via availing of products at a lower price is higher than the loss of domestic producers from the competition from foreign products.

- Export subsidy also referred as dumping

We can relate to many real-life experiences of practicing dumping. Industrial nations are blamed for dumping the agricultural surplus in other countries. The agricultural support programs in many European nations allowed European Economic communities to resort to persistent dumping of their surplus. Another real-life experience was connected to the accusation of the United States and European nations regarding the dumping of steel, computer inputs, and televisions by Japan to their countries. It is important to note that export subsidies, too, are a type of dumping. This is illegal under international treaties.

3.1.4 Intertemporal Price Discrimination and Peak Load Pricing

- Charging different prices based on different demand

The intertemporal pricing and peak-loading pricing are two different types of price discrimination. The intertemporal price discrimination refers to charging different prices by forming separate groups of consumers based on their different demand functions. The peak-load pricing refers to charging different prices in different periods. i.e., charging higher prices in peak periods and lower prices in other periods. This is done due to constraints in capacity during peak periods when demand is high. This capacity constraint leads to higher marginal cost for which a higher price is charged. In both cases, the prices

charged are different, but for different reasons.

3.1.4.1 Intertemporal price discrimination

- Separating consumers based on separate demand

It is already mentioned that, under intertemporal price discrimination, consumers are divided into different groups based on their demand, i.e., into groups of consumers having higher demand and consumers having lower demand. Let us illustrate the intertemporal price discrimination using the case of a new mobile phone in the market. The mobile company knows that there are mainly two categories of consumers of this technologically advanced mobile. One is highly technology buffs who want to experience the new changes immediately. They value the mobile very much and do not wait to purchase it. The other group of consumers is those with a normal product value. This is a broader group of people who are willing to wait to purchase the phone until the price gets lower.

Let us see the charging of different prices under different demand:

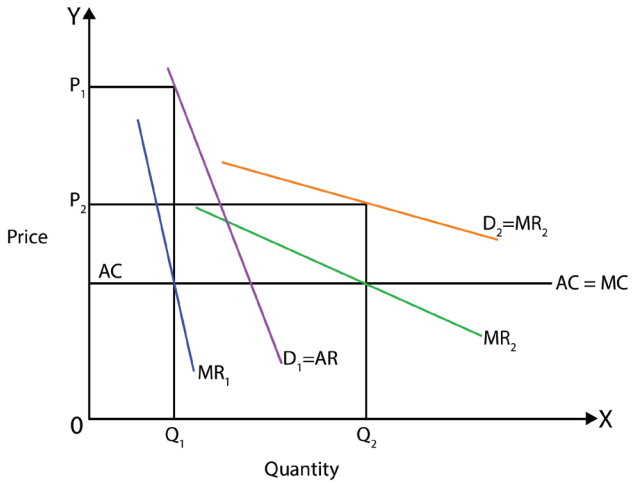

Fig 3.1.4 Intertemporal Price Discrimination

In the figure, D_1 is the inelastic demand curve, and D_2 is the elastic demand curve. The respective MR_1 and MR_2 have elasticity similar to the elasticity of the demand curves. The inelastic curve is the demand curve for the small section of technology buffs who want to experience the new technology immediately. They are willing to pay a high price for the new mobile phone. The elastic curve is the demand curve for the broader group of consumers willing to wait for the price to fall to purchase the phone. They are ready to forgo the phone if the price is high. So, the mobile company charges a higher price initially so that the technology buffs who are ready to pay high prices purchase the phone. The company charges a lower price later for the larger group of consumers on the D_2 demand curve. Here, P_1 is the higher price on the D_1 demand curve, and P_2 is the lower price on the D_2 demand curve. As the average cost of producing a phone is the same at both the situations of charging high and low prices shown by the horizontal AC=MC curve, when P_1 is charged under the D_1 curve, the company earns the surplus of the consumers having high demand for the phone.

- Captures consumer surplus by charging high prices for inelastic demand

One example of intertemporal price discrimination is charging a high price during the publication of the initial edition, where a hardcover of the edition is printed. Later, a paperback cover edition is printed at a lower price. Usually, people think that the price difference between a hardcover and a paperback cover edition is due to the difference in marginal cost. However, there is not much difference in the marginal costs of printing both the type of books when the book is edited and the typeset is completed. The initial publication of a hardcover copy of the book is charged a high price as the high-demand consumers are willing to pay a high price. Later, a lower price is charged for the paper cover copy of the book, considering the readers who have elastic demand for the book.

- No difference in marginal cost for hardcover and paperback cover copies of a book

3.1.4.2 Peak-Load Pricing

We know that peak load pricing refers to charging different prices at different times. A higher price is charged during the time of peak demand, and a lower price during the time of normal demand. As there is a capacity constraint in the production of the product, during times of increased demand, the cost of production increases, leading to a higher price. Here, charging a higher price is for economic efficiency intended to reduce the difference between the cost of the product and the price of it. So, the charging of a higher price under peak-loading

- Capacity constraints increase marginal cost at peak demand

price is consistent with the economic efficiency and not with the capture of consumer surplus as done under intertemporal price discrimination.

- Charging electricity consumption

Let us explain the imposition of peak load pricing using the widely used example of charging electricity consumption. During rush hours, such as summer afternoons and weekend days in amusement parks and resorts, the consumption of electricity is very high due to the greater demand during that time. The capacity of electricity production is given, the higher demand and resultant higher production lead to higher marginal cost of production.

Let us explain the peak-load pricing using the figure.

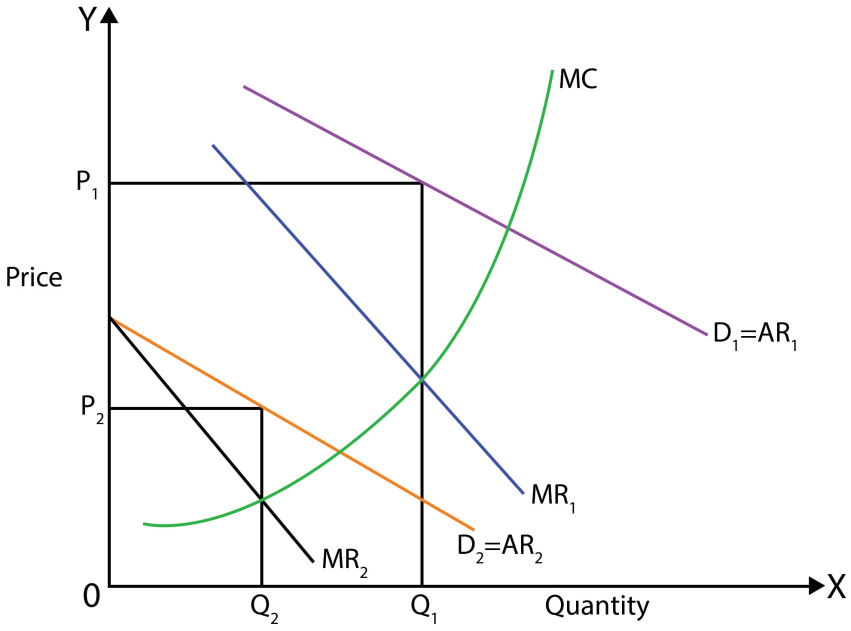

Fig 3.1.5 Peak-Load Pricing

In the figure, D_1 represents the demand curve at peak time, and D_2 represents the demand for the normal period. Here, we can see that MC is rising. The price is determined at the intersection of MC and MR. P_1 is the higher price during the peak period when MR_1 equals the higher MC. P_2 is the lower price when MR_2 is equal to lower MC. The higher demand for the product, for example, higher demand for electricity at peak period, is shown by the Q_1 quantity, which is higher than the Q_2 quantity at the lower demand. Charging a higher price corresponding to a higher cost is efficient. In this situation, the sum of producer and consumer surplus is greater.

- Economic efficiency in charging higher prices for higher cost

If the electricity production is a regulated monopoly, the price in the peak and normal period will be set by the regulating agency at the D_1 and D_2 demand curves where the MC curve intersects. Therefore, the price-fixing will not be based on the intersection of MR and MC curves. Here, a gain in efficiency will be benefited by the consumers.

- Under regulated monopoly, consumer experiences efficiency gain

3.1.5 Two-Part Tariff

A two-part tariff is a means of price discrimination where the consumer surplus is captured by charging two prices: a fee to buy, the right to purchase a product, and an additional fee for purchasing each unit of the product. We can explain the two-part tariff with the example of charging prices at amusement parks. Usually, in an amusement park, one has to pay an entry fee first, and then have to pay a price for riding in each game. That is, there is an entry fee and usage fee. Here, amusement park owners always face the question of whether to charge a higher price as an entry fee and a relatively lower fee for each ride or a lower price as an entry fee and a higher fee for each ride.

- Two types of fee – fee upfront for the right to buy the product and fee for each unit of product

The following figure shows how the fee are fixed in a two-part tariff situation.

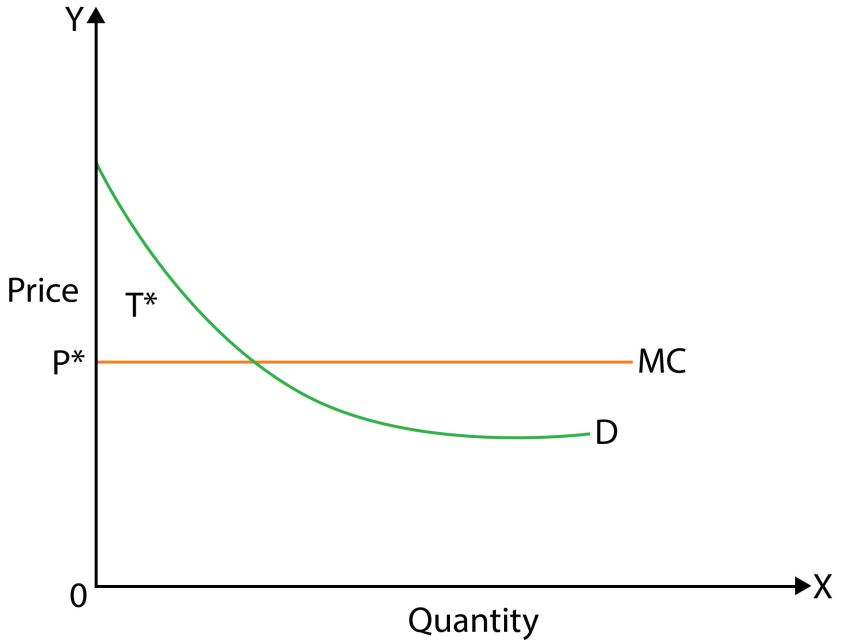

Fig 3.1.6 Two-Part Tariff

- Entry fee charged is equal to consumer surplus

The figure shows the two-part tariff case when there is only one consumer. Here, the firm knows the demand curve of the consumer. The firm always tries to capture the surplus of the consumer. The figure shows that the firm charges a price of P* as the usage fee for each ride. The price is set equal to MC. The entry fee is T*. It is equal to the consumer surplus when a P* price is charged as a usage fee. Here, all the consumer surplus is captured by the firm.

Now, let us consider the situation when there are two consumers.

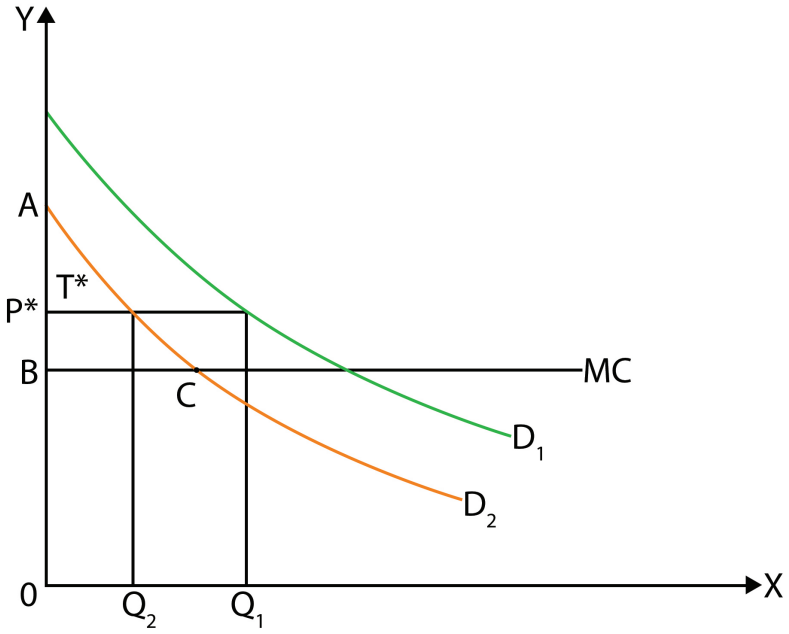

Fig 3.1.7 Two-Part Tariff with two consumers

- Usage fee is greater than MC with more consumers

With two consumers, firms can set only one entry and usage fees. However, it is not necessary to set the usage fee equal to the marginal cost. Here, the firm charges a usage fee greater than the MC. The entry fee is fixed equal to the consumer surplus when P* price greater than MC is charged. The firm's profit equals $2T^* + (P^*-MC) (Q_1+Q_2)$. $2T^*$ represents the T* entry fee paid by two consumers. The profit value is two times the consumer surplus denoted by the area of ABC under the situation of one consumer. The firms must have the information of the demand curve for both the consumers to fix the usage fee and the entry fee.

3.1.6 Tying and Bundling

The term tying is a general concept that refers to the need for

- Buying or selling products in combinations

buying or selling the products in some combination. Bundling in its pure form comes under tying. "Bundling is the practice of selling two or more products as a package." However, tying refers to many other forms than bundling. Tying usually refers to buying or selling a combination of products where one product is important for the use or consumption of the other product.

3.1.6.1 Tying

- Requiring to purchase one product for the purchase of other

"Tying is the practice of requiring customers to purchase one product to purchase another". An important example of tying is related to purchasing a copying or Xerox machine. In the 1950s, Xerox Corporation, USA, was the only producer of photocopier machines. With that monopoly power, they made it compulsory for the franchises and those leasing to purchase paper to take the copies from machines to be brought from the Corporation. This is called metering the demand. Here, those who use the machine more will purchase more paper. So, they can charge prices according to the demand. The software companies demanded to tie their web browsers to computer operating systems is also a form of tying. The big brands like McDonald's requiring its franchises to use all the products from McDonald's only, comes under Tying. In many such instances, the court cases lead to the relaxation of the practice of tying.

- Big brands try to keep the name, quality, and uniformity of products everywhere

Tying is sometimes required to keep the proper functioning of the product or keep the quality of the product. In the case of big brands, it is used to ensure the quality and thereby, the brand name. The brands ask for tying to ensure uniformity in the product sold in all its franchises. This is mostly the reason claimed by brands for the requirement to buy associated products from them only. You might have seen that some petrol pumps or fuel stations sell oils of their brand or big brands only.

3.1.6.2 Bundling

- Products sold as a package to address different tastes

Bundling is a form of tying which requires the consumer to buy one product and another, not as part of completing the use of one product or to keep the quality or uniformity, but because the monopolist cannot do price discrimination when customers have different tastes. Here, the products are not combined but as a package of two different products. The most important example is leasing movies to theatres by the

production house.

- Charging products together captures consumer surplus than doing separately

Suppose two movies are released almost in the same period from the same production house. Two theatres, A and B, are willing to lease the movie. If the production house cannot do price discrimination, it has to lease movies at a price lower, which both the theatres are willing to lease. Separately, suppose the house charges 10,00,000 for the 1st movie and 3,00,000 for the 2nd movie. So, the total is 13,00,000. But, if theatre A is willing to pay 15,00,000 for both the movies together and theatre B only 14,00,000, then house lease both the movies together at 14,00,000. Thus, leasing both movies together as a bundle, the production house can capture some of the surplus of theatres rather than charging the movies separately.

Summarised Overview

A monopoly is a market structure characterised by a single product seller with no close substitutes and barriers to entry. Monopoly power refers to the ability of a monopolist to control price and output in the market. A bilateral monopoly occurs when there is a single buyer and a single seller of a product. Price discrimination refers to charging different prices to different buyers for the same product or service. International price discrimination involves setting prices for the same product in different countries. Dumping occurs when a firm sells a product in a foreign market at a lower price than it charges at its domestic market. Inter-temporal price discrimination involves charging different prices at different times. Peak load pricing is a pricing strategy in which higher prices are charged during peak demand periods. A two-part tariff involves charging a fixed fee and a per-unit fee for a product or service. Tying and bundling refer to selling two or more products together as a package deal.

Self Assessment

1. Explain Monopoly.
2. Elaborate on the three types of price discriminations.
3. Write a short note on a) persistent dumping b) predatory dumping c) sporadic dumping.
4. What is two-part tariff?
5. Distinguish between Tying and Bundling.

Assignments

1. Explain the concept of monopoly power and its effects on market outcomes.
2. What is price discrimination? Provide examples of different types of price discrimination, including international price discrimination and inter-temporal price discrimination.
3. Explain peak load pricing and how it is used by firms. Provide an example of a company that uses peak load pricing.
4. What are tying and bundling? Provide examples of how firms use these pricing strategies.

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1. Salvatore, Dominick (2009), *Principles of Microeconomics*, Oxford University Press.
2. Koutsyiannis, A (2013), *Modern Microeconomics*, Macmillan Press, London
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4. Varian H.R (2010), *Intermediate Micro Economics: A Modern Approach*, East– West Press Edition 10. Snyder, Christopher &Nicholson, Walter (2012), Microeconomic Theory-Basic Principles and Extensions, Cengage learning

Suggested Readings

1. Mankiw, Gregory.N (2012), *Principles of Microeconomics*, 6th Edn, Cengage Learning
2. Krugman, Paul & Wells, Robin (2005), *Micro Economics*, Worth Publishers, New York

Space for Learner Engagement for Objective Questions

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UNIT 2
Monopolistic competition

Learning Outcomes

After reading this unit, the learner will be able to:

- explain monopolistic competition
- know the equilibrium with new entries into the market
- familiarise the role of advertising in monopolistic competition

Background

Monopolistic competition is a market structure in which many firms sell differentiated products that are similar but not identical. Each firm has some market power and faces a downward-sloping demand curve. As a result, firms can charge a price higher than their marginal cost but lower than the price charged by a monopoly. This creates a trade-off between market power and efficiency. In monopolistic competition, firms may engage in non-price competition, such as advertising, to differentiate their products and attract customers. The presence of many firms and product differentiation leads to excess capacity, which means that firms are not producing at the lowest possible average cost.

Keywords

Product differentiation, Selling cost, Product group, Advertisement, Excess capacity

Discussion

3.2.1 Monopolistic competition

- Imperfect competition

Monopolistic competition is a market structure that falls between perfect competition and monopoly. In a monopolistically competitive market, many firms produce similar but not identical products. Each firm has some degree of market power, meaning they can influence the price of their product. However, because many firms are in the market, each firm's market power is limited. The entry and exit of firms in the market are relatively easy, so there is no significant barrier to entry. This type of market is characterised by non-price competition, such as advertising, branding, and product differentiation. In monopolistic competition, firms typically earn a profit in the short run, but in the long run, economic profits are driven as new firms enter the market.

- Similar to perfect competition with many firms and free entry

The monopolistic market structure is similar to perfectly competitive market as there are many firms in the market, and there are no barriers to entry into the industry. However, there are differences from perfect competition. Under perfect competition, firms do not affect the market price. They are just price takers. However, for monopolistic competition, firm has a market power since firms produce differentiated products. The differentiated products are marketed through the advertising strategy of firms. Products that are used daily viz. soaps, toothpaste, tea, coffee, etc. are some of the examples of monopolistic industries. Most important characteristics of monopolistic markets are product differentiation, absence of barriers to entry or exit, and selling cost or role of advertisement in marketing.

3.2.2 Chamberlin Model

- Product group with closely related products

In a monopolistic market structure, analysing the industry poses challenges due to the production of differentiated products. The heterogeneous nature of these products makes it difficult to aggregate them into a unified market supply and demand analysis. With product differentiation, firms can charge different price for their differentiated product. Here, Chamberlin used the concept of product group. Product group consists of products that are related closely. These closely related products can be considered substitutes from both

technological and economic perspectives. For the product groups, the elasticity of demand for each product is high and the demand changes greatly with the price of related products. So, the cross elasticity in product groups or in the industry is high.

- Downward sloped demand curve

Each firm has some market power but faces competition from other firms producing similar goods. In this model, the firm's demand curve slopes downward but is more elastic than in a monopoly. He argued that firms could create monopolistic power by producing different goods from their competitors. This could be achieved by branding, advertising, packaging, or other means that make the product unique. The differentiated product creates a monopoly for the firm because it faces less competition than it would if it produced a homogeneous product.

- Advertisement – Marketing strategy for differentiated products

Chamberlin's model shows that in the short run, firms in a monopolistically competitive industry can earn excess profits as they have some pricing power due to product differentiation. However, in the long run, new firms can enter the market and compete for excess profits, resulting in a situation where all firms earn normal profits. The model explored the impact of advertising on the monopolistically competitive industry. Advertising could be a way for firms to differentiate their products and create a loyal customer base. However, advertising could be wasteful, if it does not necessarily create new customers but merely encourages existing customers to switch brands.

3.2.3 Equilibrium with New Firm Entering the Industry

- Entry causes left ward and more elastic demand curve

In the long run, if there are no barriers to entry, new firms will be attracted to the industry that is earning positive economic profits. This increase in the number of firms in the industry will result in a decrease in demand for each firm. As a result, the demand curve facing each firm will shift leftward and become more elastic. In the short run, existing firms may continue to earn profits due to their established customer base and brand recognition. However, as new firms enter the industry, the demand curve facing each firm will shift leftward and become more elastic. As a result, firms will be forced to lower their prices to remain competitive and maintain their market share.

- Long run equilibrium is not at lowest point of LAC

Eventually, in the long run, the entry of new firms will drive profits down to zero. This is because the market will become saturated with firms producing and each firm's demand curve will be perfectly elastic. At this point, firms will only earn a normal rate of return on their investment, and there will be no economic profits. In this case, the long-run equilibrium will be characterised by firms producing at a level where their marginal cost equals their marginal revenue, with price equal to the average total cost. This is similar to the long-run equilibrium of a perfectly competitive market. However, in monopolistic competition, each firm will produce a differentiated product with some degree of market power. This will result in a mark-up over marginal cost, and firms will not produce at minimum average total cost. The equilibrium with new firms entering the industry with price competition and free entry is characterised by the entry and exit of firms until all firms earn zero economic profits in the long run.

The figure below shows the equilibrium with new firms entering the industry.

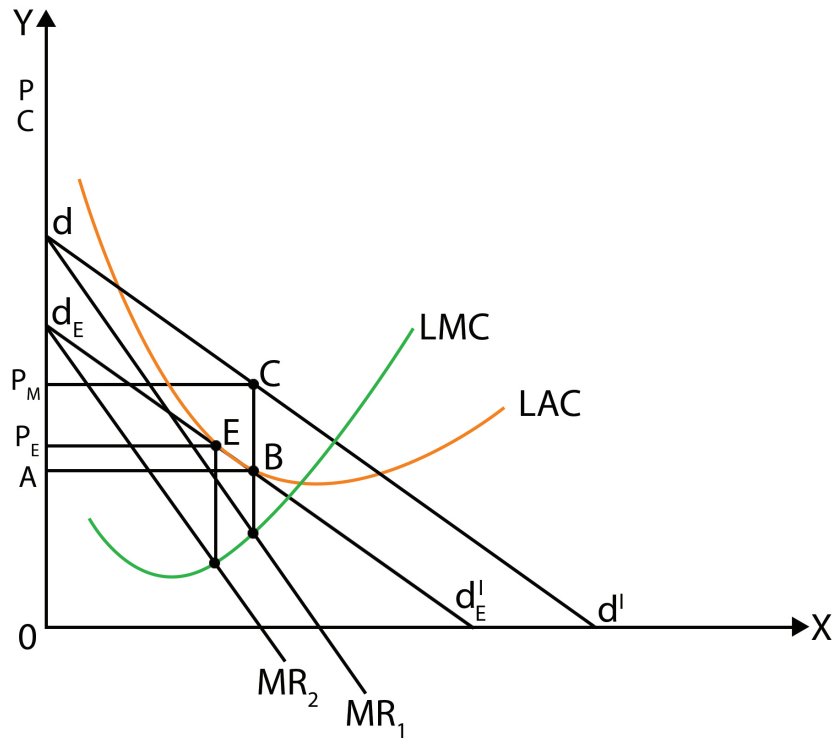

Fig 3.2.1 Equilibrium with New Firms Entering Industry

- Equilibrium at LAC and demand curve tangential

During the short-run, firm makes abnormal profit equal to $ABCP_M$. Here, the price P_M is determined by the intersection of marginal cost and marginal revenue and equilibrium point is C. This profit attracts new firms to enter into the market in the long run. New competitors in the market make the demand curve dd^1 to shift left wards. It is assumed that the cost curves do not change. Hence, each shift in demand curve makes a price adjustment. The shift in demand curve and resultant shift in price continues till the demand curve is tangential to the LAC curve. The leftward shifted demand curve, $d_Ed^1{}_E$ is tangential to LAC at E. The price is P_E. Since price is equal to average cost, there is no profit and no new entry of firms. However, it is important to note that the long run equilibrium is not at the lowest point of LAC as in perfect competition.

3.2.4 Excess Capacity

- Production at less than optimum level

In monopolistic competition, excess capacity refers to a situation where firms are producing below their optimal output level. This can occur because firms are producing at a lower output level than the output level that would minimise their average cost. Therefore, the equilibrium output produced by a monopolistic firm is less than the optimal level and price is greater than the perfectly competitive level. In monopolistic competition, firms have some degree of market power and can somewhat differentiate their products. As a result, they can charge a higher price than their marginal cost. Moreover, selling cost also led to charging a higher price. This pricing strategy can lead to excess capacity in the long run. To understand this, consider the following scenario. A monopolistically competitive firm produces at a level where its marginal revenue equals its marginal cost. At this output level, the firm can charge a price higher than its marginal cost. However, the firm is not producing at the level that minimises its average cost. This means that the firm has excess capacity. The presence of excess capacity in monopolistic competition can be explained by the fact that firms can charge a price that is above their marginal cost. This allows them to earn a profit even if they are not producing at their optimal output level. However, excess capacity can lead to inefficiencies and lower profits in the long run.

The following figure shows the excess capacity in monopolistic market structure.

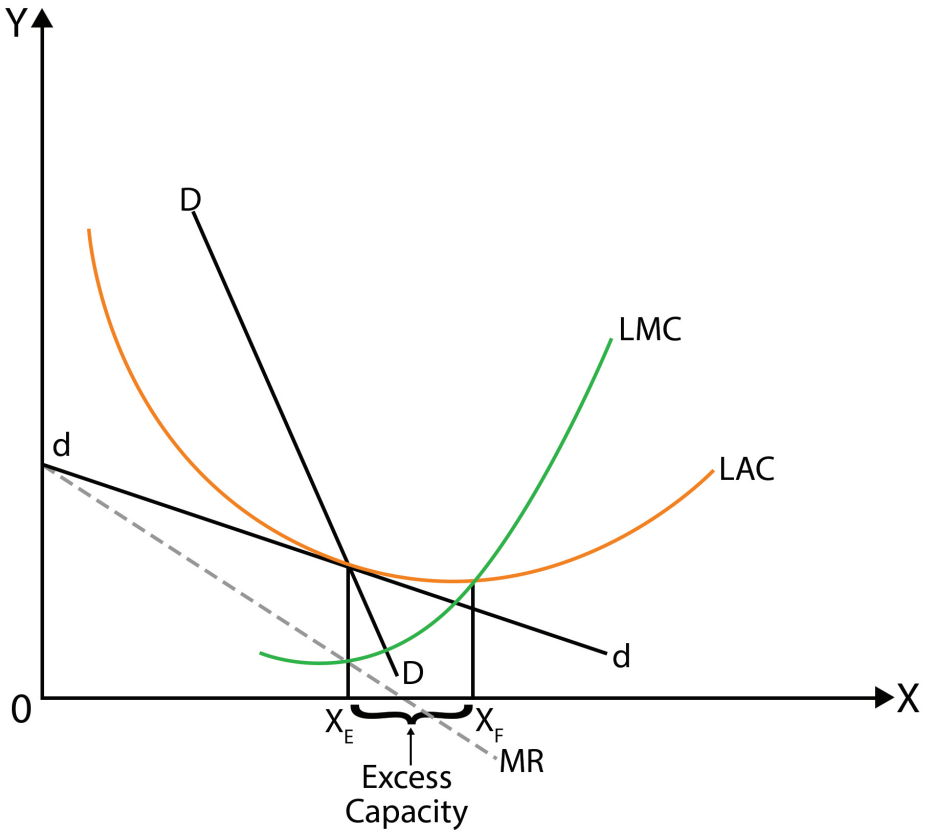

Fig 3.2.2 Excess capacity

In monopolistic competition, firms produce differentiated products and have some market power to set prices. However, they face competition from other firms producing similar but not identical products. This leads to excess capacity in the long run, meaning that firms produce below their minimum efficient scale. In the figure, the optimum output level determined at the lowest point of LAC curve is X_F. DD is the initial demand curve. As we have explained earlier, in the long run, entrance of new firms makes the demand curve more elastic. The demand curve shifts left wards making dd demand curve. The long run equilibrium is determined where the LAC is tangential

to the dd demand curve. X_E is the output produced in long run. The difference between the actual production, X_E and the optimum level, X_F is the excess capacity. Therefore, firms will have excess capacity in the long run and will not produce at the lowest point of their LAC curve. This excess capacity is represented by the gap between the quantity produced and the efficient production scale. The cost of this excess capacity is passed on to consumers through higher prices, which is why prices are higher in monopolistically competitive markets than in perfectly competitive markets.

- Difference between actual output and optimum level output

3.2.5 Mark Up Over Marginal Cost

Mark-up over marginal cost refers to the pricing strategy used by firms operating in monopolistic competition to set prices higher than their marginal cost of production. In monopolistic competition, firms have some market power due to differentiated products, which allows them to charge prices above their marginal cost of production. The degree of market power of a firm is measured by the difference between the price and the marginal cost of production, known as the mark-up. This mark-up allows the firm to earn a higher profit margin on each unit of output sold.

- Price above marginal cost

Several factors, including the degree of product differentiation, the elasticity of demand, and the extent of competition in the market influence the mark-up over marginal cost. The more differentiated the product is, the higher the mark-up a firm can charge. Similarly, if the demand for the product is relatively inelastic, firms can charge a higher mark-up. In contrast, if the market is highly competitive, firms may not be able to charge a significant mark-up over their marginal cost. The mark-up over marginal cost can result in an inefficient allocation of resources, as firms are incentivised to produce less than the socially optimal output level. This is because the mark-up allows firms to earn a profit even if they produce less than the socially optimal output level.

- Depends on product differentiation, elasticity of demand, extent of competition

3.2.6 Debate Over Advertising

Advertising is an important feature of monopolistic competition. It can help firms differentiate their products from competitors and create brand loyalty among consumers. However, there is a debate over whether advertising benefits or

- Provides information but can be deceptive

harms consumers and society. Advocates of advertising argue that it provides information to consumers about the different products available in the market, their features and benefits, and helps them make informed choices. Advertising can also lead to economies of scale and lower consumer prices as firms can reach a larger audience with their products. Additionally, advertising can support the growth of small businesses and create jobs in the advertising industry. Critics of advertising argue that it can be deceptive and manipulative, leading consumers to make irrational choices based on emotional appeals rather than rational considerations. Advertising can also lead to higher prices for consumers, as firms spend large amounts of money on advertising campaigns that are ultimately passed on to consumers through higher prices.

- Creates brand loyalty

Advertising can be a way for firms to differentiate their products and create brand loyalty among consumers. Advertising should be subject to regulation and that the costs and benefits of advertising should be carefully considered. The debate over advertising in monopolistic competition is ongoing. While advertising can provide information to consumers and support economic growth, it can also be manipulative and lead to higher consumer prices.

Summarised Overview

Monopolistic competition is a market structure where many firms sell differentiated products, giving them some market power to influence the price. Chamberlin's large group model is a model that explains the behaviour of firms in monopolistic competition. In monopolistic competition, firms operate with excess capacity and have a markup over marginal cost. Excess capacity refers to the difference between actual output produced and the optimum level of output that is determined at the minimum point of LAC. Advertising is an important market strategy under monopolistic competitive world. The debate over advertising under monopolistic competition is another aspect. Supporters argue that advertising helps firms differentiate their products, attract customers, and increase sales. However, critics argue that advertising creates artificial wants, increases the cost of products, and may result in wasteful competition.

Self Assessment

1. Explain monopolistic market structure and its basic characteristics.
2. What is Chamberlin's (large group) model of monopolistic competition?
3. Explain the equilibrium with new firms entering the industry and the impact of price competition and free entry on the market.
4. What is the concept of markup over marginal cost? How does it affect the pricing decisions of firms under monopolistic competition?

Assignments

1. Why do firms under monopolistic competition face excess capacity? Explain with the help of a diagram.
2. Discuss the debate over advertising in the context of monopolistic competition. Does advertising create or reduce competition? Provide examples to support your answer.
3. Compare and contrast the long-run equilibrium conditions of a perfectly competitive and monopolistic competitive market. How do excess capacity and the presence of differentiated products affect these conditions?

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1. Salvatore, Dominick (2009), *Principles of Microeconomics*, Oxford University Press.
2. Koutsyiannis, A (2013), *Modern Microeconomics*, Macmillan Press, London

Suggested readings

1. Pindyck, Robert.S, Rubinfield, Daniel, L, Mehta, Premlal, L (6th edition), *Micro Economics*(8th edition). New Jersey: Pearson
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UNIT 3
Oligopoly and Theory of Games

Learning Outcomes

After going through this unit, the learner will be able to

- explain different non-collusive models of oligopoly
- distinguish between different collusive models of oligopoly
- familiarise with the theory of games
- get introduced to prisoner's dilemma

Background

Oligopoly market structure is characterised with few firms producing a products. These products produced may be differentiated or non-differentiated. Firms may produce homogenous or heterogenous products. Sellner defines oligopoly as "few firms producing homogenous or heterogenous products". The actions of a firm in an oligopoly market affects the actions of rival firm. This feature of oligopoly markets contrasts perfect competition and monopolistic competition, where the share of each firm in the total market share is too little. Oligopoly markets has two important forms viz. collusive oligopoly and non-collusive oligopoly. Under collusive oligopoly, firms collectively decide on output and pricing. OPEC is a famous example of collusive oligopoly. Under non-collusive oligopoly each firm decides strategic moves in the market independently. The strategic decisions of an oligopolist can be understood from the concepts of game theory. Oligopoly markets are closer to the real-world markets like firms under telecom sector. Let us look into oligopoly in detail.

Keywords

Non-collusive oligopoly, Collusive oligopoly, Cartels, Price leadership, Theory of Games, Strategies, Prisoner's Dilemma, Nash Equilibrium

Discussion

3.3.1 Oligopoly

Oligopoly markets have only a few sellers, and the market structure lies between pure monopoly and monopolistic competition. In other words, under Oligopoly market, few sellers have control over the market and they make the pricing decisions of the product. The market for automobiles, soft drinks, bottled water, telecom industry are some of the examples. They have certain common characteristics. In all these cases, a few firms recognize their strategic interdependence. Following are the characteristics of oligopoly markets.

- Few firms selling homogenous or heterogenous products

a. **Few Firms:** Only a few firms have a large share in the total production. So, firms are price makers.

b. **Differentiated or Homogenous Products:** The goods sold are homogeneous or differentiated products.

c. **Barriers to entry:** In the long run, as there are barriers to entry, most of the firms earn considerable profits. Due to economies of scale, it is not profitable for many firms to exist in the market. The need to spend a lot of money on brand creation may also discourage potential players from joining oligopoly markets. In addition, the existing firms may take strategic actions to prevent the entry of new firms. Market strategy under oligopolistic firm is difficult because pricing, output, advertising, and investment decisions always depend on the rival's reaction.

d. **Price Rigidity:** The oligopolist tries to stick to the prevailing market prices to maintain market share and not lose customers.

3.3.1.1 Non-Collusive Oligopoly

In non-collusive oligopoly models, the firms operating in an oligopoly behave as rivals. There are three important non-collusive models viz. Cournot Model, Bertrand Model, and

Chamberlin small group model. Let us look at each of these models.

1. Cournot Model

Cournot model is one of the earliest duopoly model developed by the French economist. Duopoly market model are where there are two firms in the market. The major assumptions of the Cournot model are:

- Zero cost, perfect information, quantity constant

1. The duopolies market has same products.
2. Zero cost of production.
3. Both firms have information regarding the shape of the demand curve. The demand curve is a straight line with a negative slope.
4. Duopolies think the rival or the competitor keeps the quantity constant. So, each duopoly acts on the basis of this assumptions.

Let us consider the two duopolies as Firm A and Firm B. The following figure shows the Cournot model.

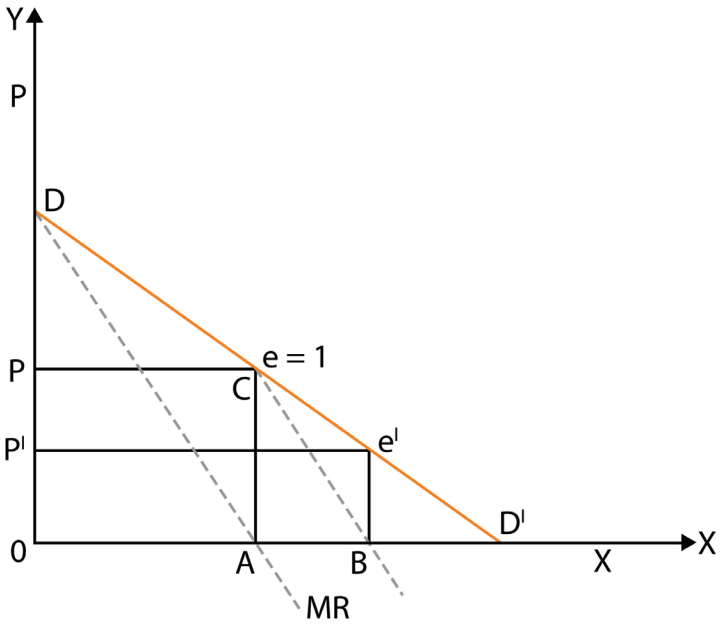


Fig 3.3.1 Cournot Duopoly Model

- naive behaviour

Here, Firm A is the first entrant to the market and B follows. DD^1 is the demand curve. Firm A produces A quantity at P price where MR is equal to MC (MC is equal to zero as per the assumption). At this point, the elasticity of demand is unity. When firm B enters the market, the firm will be faced with a demand curve, C D^1. Output of firm A is fixed at OA. So, firm B produces half of the demand which is equal to AB. The combined output under Cournot model becomes OB and price becomes P^1. Under the assumptions of the model, both the firms think that the rival will keep their quantity constant. When firm A experiences that the price has fallen, inorder to keep the price as P level, firm A reduces their output thinking that firm B will keep the quantity constant. However, to this action of firm A, firm B reacts by increasing output. As a counter action, firm A reduces the quantity. Due to the action and reaction of rivals, the total market output becomes equal to two-third of the total market and individual firms produces one-third of the total market. If there are n firms, each firm produces 1/(n+1) of the total market and jointly produce n/(n+1) of the total market. Each firm maximises their profit through their actions and reactions, but market profit is not maximised. The naive behaviour of not learning from past experiences with the actions and reactions of rival firms makes firms to achieve only a lesser profit than they could jointly acquire if recognised the interdependence.

Reaction Curve under Cournot Model:

The reaction curve of firm A shows the firm A's response to the quantity supplied by firm B and vice versa. Reaction curve is derived from the iso profit curve. An iso profit curve is a curve having equal profit. Given are the characteristics of an iso profit curve.

i. Iso profit curve of each firm is concave to the axis representing the firm's quantity.

ii. Lower the iso profit curve, higher the level of profit.

iii. When firm A is given at X-axis, the highest point of each higher iso profit curve lies left of the previous one. For firm B, highest point lies to the right of the previous curve as firm B is measured on Yaxis.

Following are the iso profit and reaction curves.

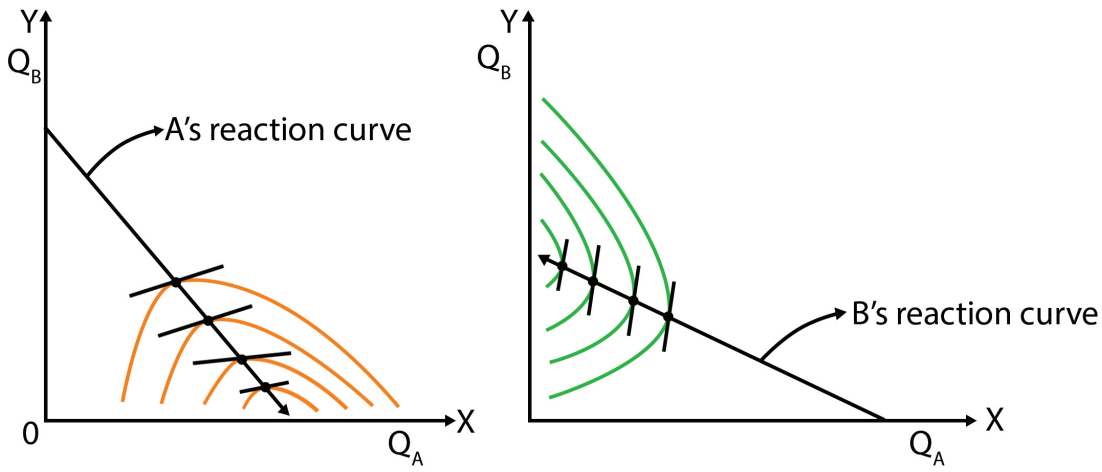


Fig 3.3.2 Iso Profit and Reaction Curves of Firm A and B under Cournot Model

- Reaction to rivals quantity decisions

First panel of the figure shows the isoprofit map of firm A and second panel shows the isoprofit map of firm B. Reaction curve of firm A and B are the locus of highest points of their respective iso profit curves.

Cournot equilibrium is determined at the intersection of the reaction curve of firm A and B. The following figure shows the Cournot equilibrium.

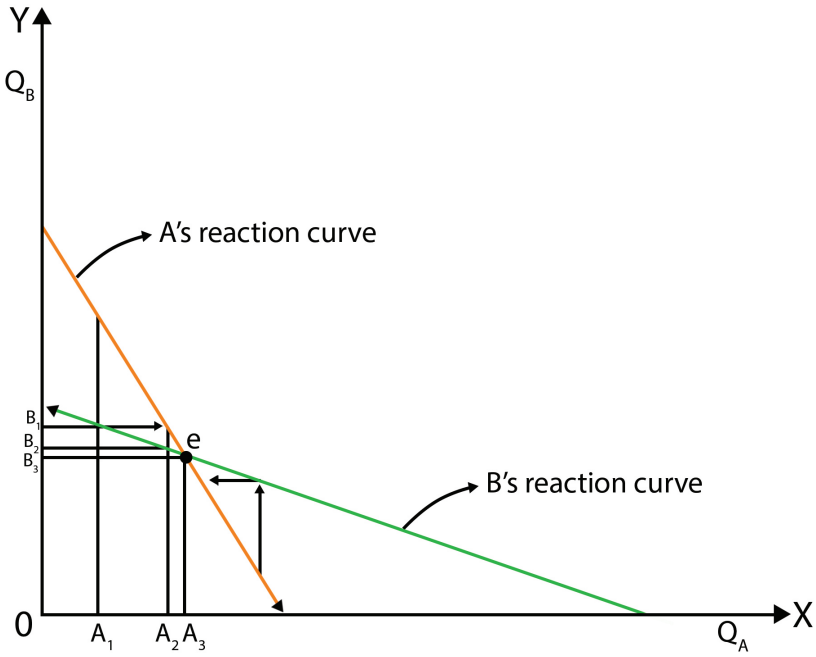


Fig 3.3.3 Cournot Equilibrium

- Steeper reaction curve for firm A

The reation curve of A is steeper than reation curve of B. Cournot equilibrium is at the point 'e' where the reation curves of both A and B intersects. The cournot equilibrium is stable at point 'e'.

2. Bertrand Duopoly Model

- Assume rival keep the price constant

In the Cournot Model, the firms chose quantities. Actions and reactions of firms are based on the decisions of quantity produced. However, there are market situations where firms fix their prices and let markets determine the quantity of output to sell. Such situations are explained in the Bertrand Model. In Bertrand's model, the duopolies think the rival will keep the price constant rather than the quantity constant, unlike the Cournot's model. When a firm chooses its price, it thinks of the price set by its rival in the industry. There is a pair of prices that maximizes profits given the choice made by the other firms.

When firms sell the same products, the Bertrand equilibrium is the same as the equilibrium under perfect competition (P=MC). Price cannot be less than MC since one of the firms will increase its profits by producing less. Both these firms will sell at an output at P>MC. Let the initial price be p*. If Firm1 lowers its price by a small amount Δp_1 and the firm 2 keeps the price at p*, all consumers would like to purchase from Firm1.

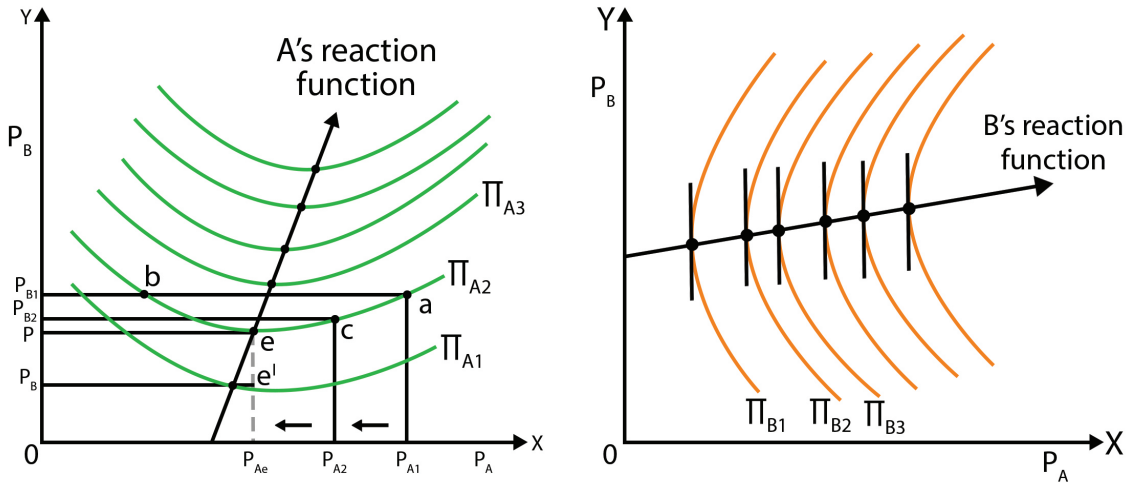
- Price set above MC

So, as a response, Firm 2 also reduces the price. Firm 2 can also make the same predictions about Firm 1. If Firm 2 reduces the prices, Firm 1 will follow. Thus, any price higher than MC cannot be an equilibrium price under the Bertrand Model.

Reaction Curve under Bertrand Model

- Iso profit curves are convex to the axis

Under Bertrand model, iso profit curve of a firm is convex to the axis where the price of the firm is measured. Here, lower iso profit measures lower profit. Reaction curve derived from iso profit curve under Bertrand model is shown below.



3.3.4 Iso Profit and Reaction Curves of Firm A and B under Bertrand Model

First panel shows the isoprofit map of firm A and second panel shows the isoprofit map of firm B. Isoprofit curves of firms are convex to the axis measuring their price. Here, unlike Cournot case, higher isoprofit curves of Betrand model measures higher profit. Reaction curve of firm A and B are locus of lowest points of their respective isoprofit curves.

Equilibrium under Bertrand is at the intersection of the reaction curve.

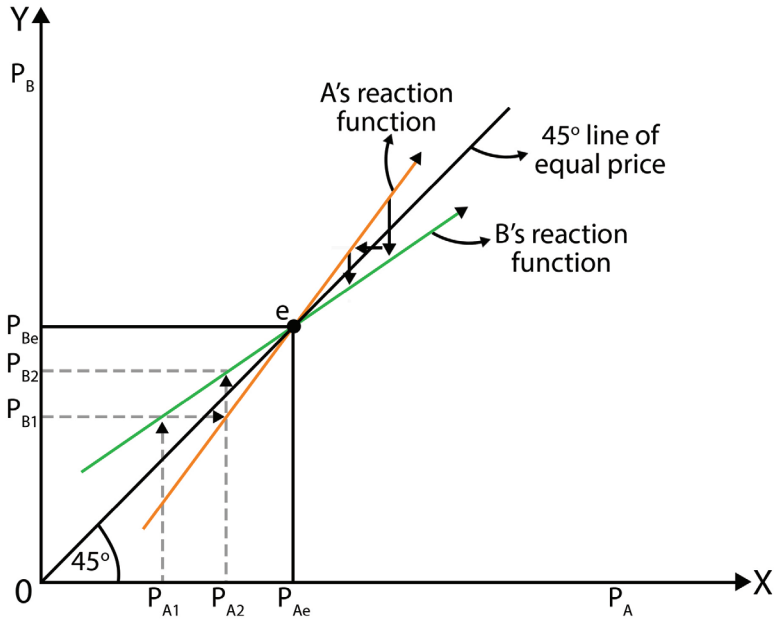


Fig 3.3.5 Equilibrium in Bertrand Model

The equilibrium point 'e' shows a stable equilibrium. If firm A charges P_{A1}, firm B charges P_{B1}. Reaction of firm A will be by rising price to P_{A2} and firm B respond by charging P_{B2}. This action continues till 'e' is reached.

- Criticism - need behaviour

Both Cournot and Betrand model are criticised for firms's having naive behavioural patterns of not learning from past experiences.

3. Chamberlin's Small Group Model

- Charging monopoly price ensures stable equilibrium

Chamberlin believe that a stable equilibrium is possible in oligopoly model if the firms recognise their interdependence and act on it. He suggests that by fixing a monopoly price by both firms, a stable equilibrium can be attained even with out a collusion. If the firms do not recognise the interdependence and act on it, the industry will either reach Cournot equilibrium or Bertrand equilibrium.

The following figure shows the fixing of monopoly price under duopoly model.

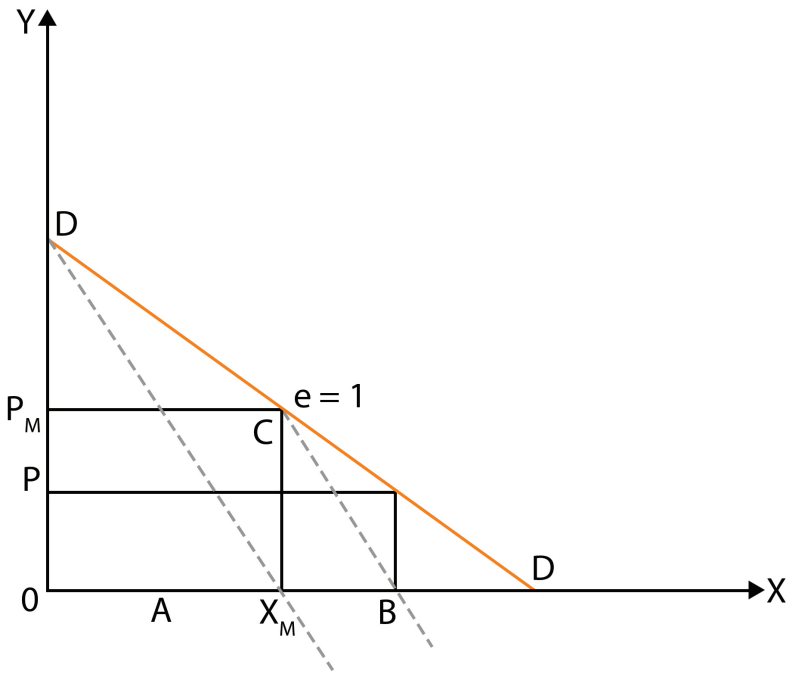


Fig 3.3.6 Chamberlin Model

- Recognising interdependence make stable equilibrium

The present figure shows that when firm A is the first entrant to the market, A produces OX_M of output and price is P_M. When the rival firm B enter, it produces the half of the remaining demand curve CD. The output produced by firm B is X_MB. Then the total output becomes OB and price reduces to P. If firm A recognise the interdependence, it reduces the output to the half of OX_M i.e., OA. Then, output produced by firm A is equal to OA where the quantity is similar to X_MB, the output of firm B. The price increases to P_M. If firm B recognise that the higher price P_M is better for both the firms and remain producing X_MB, the total output of the industry will be OX_M ($X_MB = AX_M$) and price will be monopoly price, P_M.

3.3.1.2 Collusive oligopoly

Under a collusive oligopoly, firms cooperate in deciding price and output in the market. Major collusive oligopoly models are cartel and price leadership models. The following sub-sections describe these models.

1. Cartel

Cartels are one of the commonly known collusive oligopoly

- Joint agreement to control quantity to maximise profit

model. A joint arrangement between producers determines how much quantity each firm can produce. Sellers engage in collusion when they cooperate to raise their joint profits. A cartel is an agreement among several producers to follow output restrictions to increase their joint profits. It is the best example of a collusive oligopoly. In reality, we see that at many times, cartels break as each of the firms would be incentivized to break its agreed output restriction and produce more than the agreed-upon quantity. The Organisation of Petroleum Exporting Countries (OPEC) is an international agreement among oil-producing nations that has successfully increased world oil prices above competitive levels. OPEC is a widely considered example of the cartel. In this section, we discuss about the joint profit maximising cartels and market sharing cartels.

A. Joint Profit Maximising Cartels

Cartels are formed to reduce the uncertainty in the market situations. Here, maximisation of joint profit is considered as the prime motive. A central authority is managed for taking decisions regarding total quantity and price that must be collectively produced and charged respectively by the cartel. This central agency decides the allocation of production among the cartel members. Details of market demand and MR are generated using market information. MC is the horizontal summation of individual marginal costs. The following graphical representation of joint profit maximising cartel reflects the multi-plant firm where the central agency acts like the multi-plant. A two member cartel, Firm A and Firm B under joint profit maximisation is represented below.

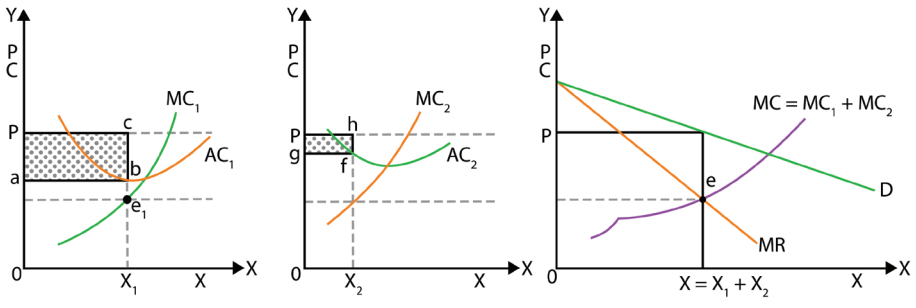


Fig 3.3.7 Joint Profit Maximisation Cartels

First panel shows the Firm A, second panel shows Firm B, and third panel shows the total market situation. D is the market demand. Price, P is determined at the intersection of MR and MC at 'e' as shown in the third panel of the figure. The horizontal line from 'e' is extended to second and first panel. The equilibrium under firm A and firm B is determined at the intersection of corresponding MC_1 and MC_2 with the extended horizontal line. At equilibrium, Firm A produces OX_1 output and firm B produces OX_2 output. The firm having lesser cost produces greater amount of output than the firm having higher cost. The shaded area shows the profit earned from the monopoly price, P fixed by the cartel.

B. Market Sharing Cartels

Market sharing cartels are very common. Firms share markets by agreements. In this section, we discuss market sharing cartels on quotas. Under quota, an agreement on the quantity sold by each member is formed. If the cost of production is same and there are only two firms, each firm sell half of the total market demand at the monopoly price. This is shown in the below figure.

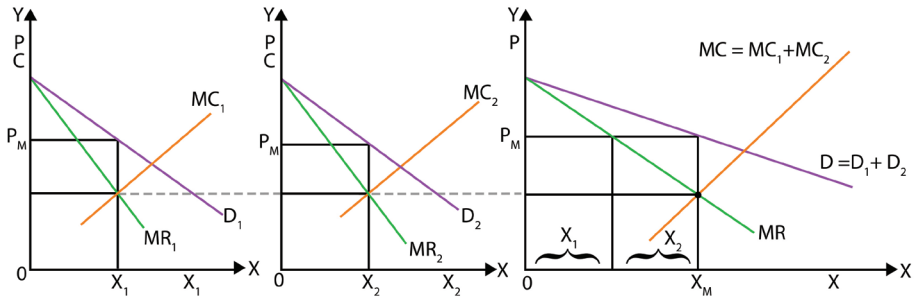


Fig 3.3.8 Market Sharing Cartels on Quotas

The price is P_M and the quota is ½ X_M for each firm. Quota of each firm at the final stage depends on its cost and its bargaining power. During the bargaining time, statistical data on past sale is used to conduct effective bargaining

2. Price Leadership

- Leader fix price and others follow

Price leadership are common models in oligopoly. Here, one firm becomes the leader and sets the price. Other firms follow or accept the price set by the leader firm. This avoids uncertainty. Price leadership can be practised by setting either agreements or without any agreements. For homogenous products sold at a common locality, the price mostly set is similar. However, for differentiated products, the price may be different. There are different forms of price leadership viz. Price leadership by low cost firm, price leadership by dominant firm, and barometric price leadership.

A. Low Cost Price Leadership

- Avoids uncertainty and allows freedom

Under low cost price leadership, the firm having low cost of production sets the price and others firms accepts the lower price. There are certain advantages in fixing price like this. They are, it avoids uncertainty related to competitor's reaction and allows members to have freedom regarding their products and selling activities. In this model, the market sharing by firms may be equal or un-equal. The price is determined at MC = MR.

The following figures shows the low cost price leadership. The left panel shows the low cost price leadership with equal market share and right panel shows the low cost price leadership with unequal share.

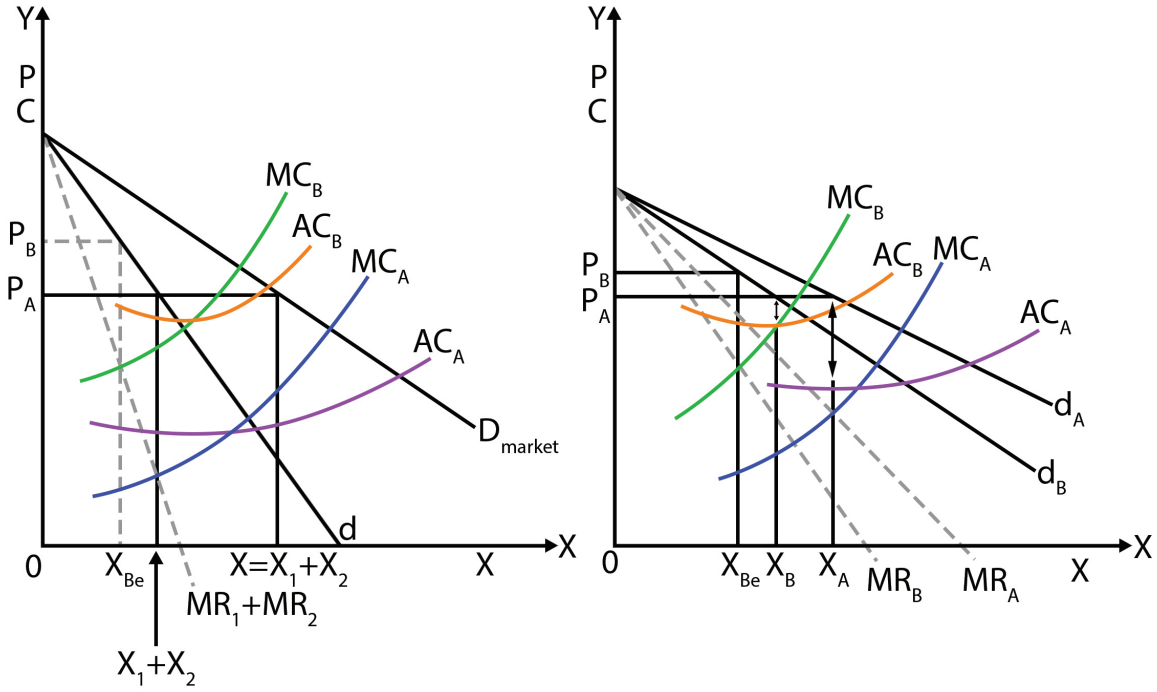


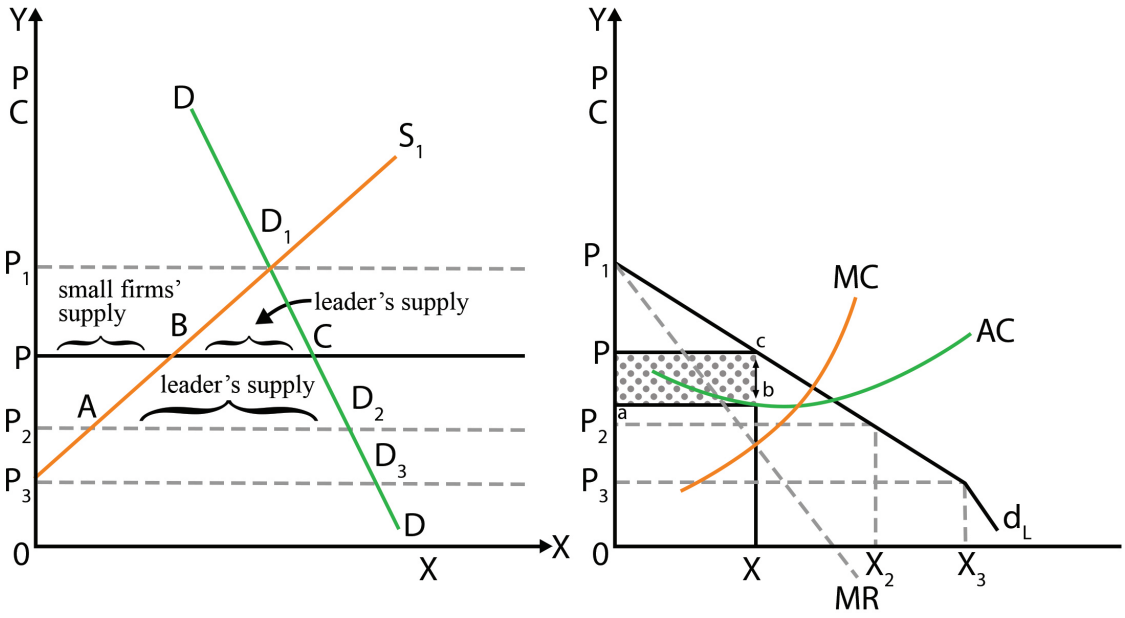
Fig 3.3.10 Low Cost Price Leader Firms with Equal and Unequal market shares

- Agreement to affect the low cost price

P_A is the price charged by the low cost firm. Others follow this price. Here, firm B follow this price even though the price does not maximise the profit. Firm B gets higher profit if it charges P_B. but, the firm follows the low price to avoid price war. In reality, it is important to get into an agreement to fix the low cost price. There may be situations where the high cost firm may keep the low price but produce less thereby pushing leader low cost firm to non-profit position.

B. Dominant Firm Price Leadership

The dominant firm that has a considerable share of market forms the leader. Small firms with lesser market share follow the dominant firm. The dominant firm knows the market demand curve. It generates MR from demand curve. The equilibrium price is determined at MC equals MR.



3.3.11 Dominant Firm Price Leadership

At each price, dominant firm supply the section of market share that is not supplied by the small firms. At P_1 price, only small firm supply the market share. When price falls to P, the market shared will be supplied by both dominant and small firms. When price falls to P_2 and P_3, the share of dominant firm increases and share of small firms reduces. The reason is that, when price falls, small firms were forced exit the market as the lower price could not cover their cost of production. The dominant firm derives demand curve and MR curve, fixes price where MC is equal to MR. P is the equilibrium price as shown in the right panel. Connecting the right and left panel with respect to P price, PB is the small firms share and BC is the dominant firm's share.

- Equilibrium price determines the share of dominant and small firm

C. Barometric Price Leadership

Under barometric price leadership, a firm is considered to act as a barometer of the market. A firm having better knowledge of market situations is selected as the leader firm. The selection of the firm is based on the ability to forecast the economic situations correctly. The agreement of selecting a particular firm may made formally or informally. This price leadership is

- Good forecaster of market

formed due to some reasons. Usually, it is difficult to make a big firm as leader from among the other big firms. Also, taking the service of a barometer helps in predicting the market situations better and fixing price accordingly.

3.3.2 Theory of Games

We have seen that the firms in an oligopoly market are interdependent. Even if the firms or rivals in the market recognize the interdependence or not, the actions taken by one firm affect the rival firm. Because of this interdependence, knowing the action of a firm is important for the other firm to make appropriate market decisions. There exists uncertainty regarding the actions of the rival firms, and the traditional analysis under oligopoly is not capable enough to explain or evaluate the uncertainty and interdependence. The collusive models limit pricing models that cannot provide a common theory to explain the decision-making process under oligopoly situations.

- Traditional analysis is not enough to explain decision-making under oligopoly

The Theory of Games was introduced as a new approach to studying the process of decision-making under oligopoly situations. Von Neumann's and Morgenstern's "Theory of Games and Economic Behaviour" in 1944 was the earliest attempt at game theory. Later, there are many contributions to the game theory approach as a general explanation of the decision-making process in oligopoly. The recent development of the applicability of the game theory is viewed as its ability to use computerized experiments on oligopoly behaviours. However, it is impossible to conduct the same in real-world business situations. The game theory is still not fully evolved to explain oligopoly decision-making and is in the process of evolving.

- Von Neumann's and Morgenstern

3.3.2.1 Strategies

We know that under any market conditions, a firm achieves its goals to maximize its profit or increase its production through the interrelated working of some of the important variables like the price of the commodity, the quantity of the commodity, the style of the product, research and development, advertisements, ways of selling, etc. These are the instruments or policy variables to achieve a goal for the firm. The course of action related to using these policy variables is very important for making profitable decisions. So, a specific course of action with clearly defined values for the policy variables is known as a strategy.

- Strategy - Specific course of action for variables

- Different strategies for different conditions

Consider an example. Setting a price of 500 rupees for a product, making an expenditure of 20,00,000 for research and development, updates in the packaging of the product, and selling it in various outlets include one strategy of the firm. Changing prices, expenditure on R&D, packaging changes, etc., forms another strategy. Firms adopt different strategies based on the rival's strategies and market conditions.

- Payoff is the net gain from strategy considering the counter strategy

While explaining strategies, it is important to know that the result of the strategy used by the firm is known as payoffs. The payoff is a "net gain from the strategy the firm uses considering the counteract of the rival firm." For example, if a firm used its strategy to increase its profit, the payoff is the net profit after the effect of the counterstrategy by the rival firm. Since there are different strategies, there are different payoffs considering the counterstrategies. A payoff matrix is a table showing the payoffs of the firm as a combination of strategies and counter strategies. Suppose Firm 1 has five strategies C_1, C_2, C_3, C_4, C_5. The rival firm, Firm 2, has strategies viz. D_1, D_2, D_3, D_4, D_5, and D_6 counters to the five strategies of Firm 1 and vice versa. Thus, considering the five strategies of Firm 1 and 6 of Firm 2, the total payoff for each firm is 30 (5 multiplied by 6).

Let us see the payoff matrix given below.

Firm I Strategies \ Firm II Strategies	D_1	D_2	D_3	D_4	D_5	D_6
C_1	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	G_{16}
C_2	G_{21}	G_{22}	G_{23}	G_{24}	G_{25}	G_{26}
C_3	G_{31}	G_{32}	G_{33}	G_{34}	G_{35}	G_{36}
C_4	G_{41}	G_{42}	G_{43}	G_{44}	G_{45}	G_{46}
C_5	G_{51}	G_{52}	G_{53}	G_{54}	G_{55}	G_{56}

Fig 3.3.1 Payoff Matrix of Firm 1

- Choose a strategy with a calculation of the counterstrategy

Here, G_{11} is the payoff of Firm 1 when the firm strategy is C_1, and the counterstrategy of Firm 2 is D_1. G_{55} is the payoff of Firm 1 when the strategy of Firm 1 is C_5, and the counterstrategy of Firm 2 is D_5. It is like chess, where each firm has a countermove from the rival. One firm is not certain about the counter-move of the rival, but there will be counter-movement from the rival. With the calculation of the possible counter strategies of the rival, a firm can choose a strategy that will maximize its expected gain.

3.3.2.1 Static Game and Dynamic Game

Static game refers to making strategies simultaneously without considering the movement of the rival firms, whereas dynamic game refers to making strategies considering the counter strategy of the rival. Here, the strategy will be sequential, where one strategy happens after the other.

3.3.2.2 Zero-Sum Game

- Net gain from strategies is zero

Consider discussing the condition of a duopoly market where only two firms exist. When one firm attempts to increase its market share and gain from the strategy, the other will lose in the game and face a reduction in its market share. One firm's gain reduces the other's gain, leading to a total gain equal to zero. This refers to a zero-sum game. Here, we discuss the zero-sum game under the certainty model.

- Strategies based on expecting the worst from its rival

Under the certainty model, we assume that the firms have a clear goal, and to achieve this goal, they resort to strategies. The firm's strategies are known to rivals; therefore, firms know the payoffs. Each firm forms its strategy here, 'expecting the worst from its rival.' That is, the firm believes that the rival will have the best possible counterstrategy, which will be the worst possible one affecting its payoff. Let us explain the zero-sum game based on increasing the market share. So, the payoffs are the share of markets from the two strategies adopted. The payoff matrix for Firm 1 and Firm 2 are given.

The payoff matrix of Firm 1 is given below.

Firm I Strategies	Firm II Strategies				
	D_1	**D_2**	**D_3**	**D_4**	**D_5**
C_1	0.10	0.20	0.15	0.30	0.25
C_2	0.40	0.30	0.50	0.55	0.45
C_3	0.35	0.25	0.20	0.40	0.50
C_4	0.25	0.15	0.35	0.60	0.20

Fig 3.3.2 Payoff Matrix of Firm 1 under Zero Sum Game

Let us explain the strategies of Firm 1. The firm 1's strategies are given as C_1, C_2, C_3, C_4. The corresponding counter strategies are D_1, D_2, D_3, D_4, D_5. The payoff matrix of firm 1 has to be viewed through rows. While choosing the optimum strategy, firm 1 considers the payoffs at each strategy and the counter strategy. We have discussed the assumption that the firm expects the worst from its rival. This is explained here.

1. Suppose Firm 1 adopts strategy C_1; the worst outcome or payoff it expects, consider the counter move is 0.10, when the strategy of Firm 2 is D_1.
2. When firm 1 adopts strategy C_2, the worst payoff is 0.30 when firm 2 adopts strategy D_2.
3. When firm 1 adopts strategy C_3, the worst payoff is 0.20 when firm 2 adopts strategy D_3.
4. When firm 1 adopts strategy C_4, the worst payoff is 0.15 when firm 2 adopts strategy D_2.

- Maximum of the minimum payoff

This shows that the firm chooses the minimum or worst outcomes or payoffs considering each strategy. Among the four strategies of firm 1, it selects the 'best of the worst.' That is, the firm chooses the maximum among the minimum. This is called the 'maximin' strategy. The maximin strategy is when it opts for strategy C_2 at payoff 0.30.

Now, let us see the payoff matrix of Firm 2.

Firm I's Strategies \ Firm II's Strategies	D_1	D_2	D_3	D_4	D_5
C_1	0.90	0.80	0.85	0.70	0.75
C_2	0.60	0.70	0.50	0.45	0.55
C_3	0.65	0.75	0.80	0.60	0.50
C_4	0.75	0.85	0.65	0.40	0.80

Fig 3.3.3 Payoff Matrix of Firm 2 under Zero Sum Game

Firm 2 also behaves like Firm 1 only. The above figure gives the choices of the strategies of Firm 2. The firm 2's strategies are D_1, D_2, D_3, D_4, D_5. The corresponding counter strategies are C_1, C_2, C_3, C_4. The payoff matrix of firm 2 has to be viewed through columns. While choosing the optimum strategy, firm 2 also considers the payoffs of each strategy and the counter strategy and expects the worst from its rival. This is explained here.

1. Suppose Firm 2 adopts strategy D_1; the worst outcome or payoff it expects considering the counter move is 0.60 when the strategy of Firm 1 is C_2.
2. When firm 2 adopts strategy D_2, the worst payoff is 0.70 when firm 1 adopts strategy C_2.
3. When firm 2 adopts strategy D_3, the worst payoff is 0.50 when firm 1 adopts strategy C_2.
4. When firm 2 adopts strategy D_4, the worst payoff is 0.40 when firm 1 adopts strategy C_4.
5. When firm 2 adopts strategy D_5, the worst payoff is 0.50 when firm 1 adopts strategy C_3.

- Maximin strategy for Firm 2

This shows that firm 2 chooses the minimum or worst outcomes or payoffs considering each strategy. Among the five strategies of firm 2, it selects the 'best of the worst.' The 'maximin' strategy is D_2 at a payoff of 0.70.

- Maximin under each payoff matrix allows the use of a single payoff matrix for finding an equilibrium strategy

Considering the maximin strategy of firms 1 and 2, it is C_2 for firm 1 and D_2 for firm 2. This shows that the maximin strategy of firm 1, C_2 is when it expects the counterstrategy of D_2 from firm 2. Likewise, the maximin strategy of firm 2, D_2, is when it expects the counterstrategy of C_2 from firm 1. Since C_2 and D_2 belong to the same payoff cell, it is possible that the choice of strategy can be analyzed, and the equilibrium strategy of both can be evaluated from the same payoff matrix.

Let us see the combined matrix using Firm 1's payoff matrix.

Firm I's Strategies \ Firm II's Strategies	D_1	D_2	D_3	D_4	D_5
C_1	(0.10)	0.20	0.15	0.30	0.25
C_2	[0.40]	(0.30)	[0.50]	0.55	0.45
C_3	0.35	0.25	(0.20)	0.40	[0.50]
C_4	0.25	(0.15)	0.35	[0.60]	0.20

Fig 3.3.4 Combined Matrix under Zero Sum Game

Here, this payoff table can be used for the decision-making of both firms 1 and 2. Firm 1 goes through the rows of the table, whereas Firm 2 goes through the table's columns for decision-making. The payoffs selected for each strategy for firm 1 are shown in circles and firm in squares. Since this is the payoff matrix of firm 1, the firm can use the *maximin* strategy for decision-making. In the case of firm 2, since it uses the payoff matrix of firm 1 only while going through the columns, firm 2 takes the maximum payoff of firm 1 instead of the minimum payoff the firm chooses while dealing with its payoff. Because the maximum payoff of firm 1 is the worst payoff of firm 2. Thus, following through the columns, under the D_1 strategy, 0.40 is the worst outcome for firm 2 as it is the maximum payoff for firm 1. For the D_2 strategy, the worst payoff for firm 2 is 0.30 since the payoff is the maximum outcome along the column and the maximum outcome of firm 1 forms the worst

outcome of firm 2. Similarly, for the D_3 strategy, the worst payoff is 0.50. For D_4 strategy, the worst payoff is 0.60; for D_5, it is 0.50. We have seen that Firm 2 chooses the maximum payoffs in the payoff matrix of Firm 1 for decision-making. Among the maximum payoffs, firm 2 chooses the minimum value, 0.30. So, when firm 2 uses the payoff matrix of firm 1, the strategy is a *minimax* strategy instead of a *maximin* strategy under its payoff matrix. The *minimax* strategy refers to selecting the minimum value of the maximum payoffs chosen by firm 2 under payoff matrix 1. Therefore, when a combined payoff matrix is used using the payoff matrix of firm 1, firm 1 uses the *maximin* strategy, and firm 2 uses the *minimax* strategy. In effect, the rule of behavior is the same; the firm expects the worst from the other firm.

- **combined payoff matrix - firm 1 uses the *maximin* strategy, and firm 2 uses the *minimax* strategy**

In the payoff matrix, it is clear that, while using the *maximin* strategy by Firm 1, the equilibrium strategy is C_2, and using the *minimax* strategy, the equilibrium strategy for Firm 2 is D_2. The outcome for firm 1 is 0.30. Since the sum of the payoff of strategy and corresponding counter strategy add up to 1, the outcome for firm 2 is 0.70. You can verify the value with the payoff matrix of firm 2 corresponding to the D_2 strategy. Combining C_2 for firm 1 and D_2 for firm 2 gives an equilibrium point, and both firms prefer a solution. At this point, the value is shown in circles and squares. This solution is known as 'saddle point.' The strategies preferred by firm 1 and firm 2 as C_2 and D_2 are called dominant strategies.

- The equilibrium strategy is dominant strategy

3.3.2.3 Non-Zero-Sum Game

The non-zero-sum game is also explained in the background of a duopoly market where the firms try to maximize their profit. Here, changing prices is the strategy of firms. Since the firms have close substitutes, changing prices decides the share of the market and the profit earned by each firm. So, the price is considered the instrumental variable here, and profit forms the payoff matrix instead of the market share, which forms the payoff matrix in a zero-sum game. Hence, one firm's gain needs not to be the other firm's loss, forming a non-zero sum instead of a zero-sum.

- Gain of rivals need not be mutually exclusive

Let us consider that the prices charged by the firms are rupees 5 and 3. Then, the payoff matrix of the Firm 1 is given below.

Firm I's Strategies	Firm II's Strategies		
		$P_D = 5$	$P_D = 3$
$P_C = 5$		$\Pi_C = 90$	$\Pi_C = 50$
$P_C = 3$		$\Pi_C = 150$	$\Pi_C = 80$

Fig 3.3.5 Firm 1's Payoff Matrix under Non-Zero-Sum Game

- ***Maximin* strategy by Firm 1**

Like in a zero-sum game, the firms always expect the worst from rivals. We know that Firm 1 chooses the *Maximin* strategy. If Firm 1 opts for rupees 5, considering the worst strategy from Firm 2, the minimum gain expected by Firm 1 is a profit of 50. If setting rupees 3 as the price strategy, then the minimum gain expected considering the worst strategy of Firm 2 is profit 80. Since Firm 1 adopts the *Maximin* strategy, Firm 1 chooses the maximum among the two minimum gains, equal to profit, 80. The price adopted to get profit 80 is 3. So, Firm 1 adopts a price strategy, P= 3.

Now, let us look into the payoff matrix of the Firm 2.

Firm I's Strategies	Firm II's Strategies		
		$P_D = 5$	$P_D = 3$
$P_C = 5$		$\Pi_D = 110$	$\Pi_D = 120$
$P_C = 3$		$\Pi_D = 60$	$\Pi_D = 100$

Fig 3.3.6 Firm 2's Payoff Matrix under Non-Zero-Sum Game

- ***Maximin* strategy by Firm 2 while having individual payoff matrix**

Firm 2 also expects the worst from rivals. While having the individual payoff matrix, Firm 2 also chooses the *Maximin* strategy (when considering the payoff matrix of Firm 1 by Firm 2, Firm 2 follows the *Minimax* strategy). If Firm 2 opts for rupees 5, considering the worst strategy from Firm 1, the minimum gain expected by Firm 2 is a profit of 60. If setting rupees 3 as the price strategy, then the minimum gain expected considering the worst strategy from Firm 1 is profit 100. Under the *Maximin* strategy, Firm 2 chooses the maximum among the two minimum gains, equal to profit, 100. The price adopted to get a profit of 100 is 3. So, Firm 2 also adopts the price strategy, P= 3.

Considering the strategy used by both firms, both end up selecting a unique price strategy, P=3. So, P equals 3, which is the dominant strategy. Though both firms follow a unique strategy, they end up in a worse situation than selecting the other strategy, which is a price equal to 5 rupees.

The combined payoff matrix is shown below.

Firm I's Strategies	Firm II's Strategies: $P_D = 5$	Firm II's Strategies: $P_D = 3$
$P_C = 5$	$\Pi_C = 90$, $\Pi_D = 110$; Joint $\Pi = 200$	$\Pi_C = 50$, $\Pi_D = 120$; Joint $\Pi = 170$
$P_C = 3$	$\Pi_C = 150$, $\Pi_D = 110$; Joint $\Pi = 210$	$\Pi_C = 80$, $\Pi_D = 100$; Joint $\Pi = 180$

Fig 3.3.7 Combined Payoff Matrix in Non-Zero-Sum Game

- ***maximin* strategy does not give an optimal solution under a non-zero-sum game**

The combined payoff matrix shows that the joint profit will increase if both firms charge a higher price. If price five is charged, the profit of firm one will be 90 instead of 80, the profit of firm two will be 110 instead of 100, and the combined profit will be 200 instead of 180. So, under a non-zero-sum

game, the *maximin* strategy followed by firms does not give an optimal solution, unlike in the zero-sum game.

3.3.2.4 Prisoner's Dilemma

- Uncertainty in rival's behavior resort to sub-optimal solutions

Under a non-zero-sum game, we have seen that the *maximin* and *minimax* strategy will lead to sub-optimal solutions when rivals do not collude—the general case of problems when sub-optimal solutions are referred to as the Prisoner's Dilemma Games. Let us explain the prisoner's dilemma to understand how the actions of rival firms under uncertain situations lead to suboptimal positions.

- Creating dilemma by not having communication

The famous example of the prisoner's dilemma is as follows. Two robbers committed a big bank robbery and were arrested by the police. The evidence available was not enough to press charges against them. Police wanted the robbers to confess to the crime. So, both criminals were interrogated separately without giving them any chance to communicate with each other. While interrogating, both criminals were allowed to confess the crime, leaving no punishment, and the other who did not confess would end up with heavy punishment. In the event of not confessing, both will go free. If both criminals confess, they will get a punishment similar to the law, for example, ten years. The robbers have two options, viz. confess or not confess. Since no communication is possible between them, they will be in a dilemma to choose the options.

- Uncertainty in decision making

If one criminal confesses, he can go free if the other does not. If the criminal does not confess and the other confesses, the criminal will end up in jail for 20 years. If both criminals confess, they will be sentenced to 10 years of prison life, and if both do not confess, they can go free. However, the issue is that the criminals have no way to communicate to decide on the option to choose. So, each criminal faces uncertainty concerning the option the other might be taking, which seriously impacts the punishment the one will get.

The payoff matrix of the criminals is given.

		Criminal 2's Strategies			
		No Confession		**Confession**	
Criminal 1's Strategies	**No Confession**	C_1	C_2	C_1	C_2
		0	0	20	0
	Confession	C_1	C_2	C_1	C_2
		0	20	10	0

Fig 3.3.8 Payoff Matrix of Prisoner's Dilemma

- Dominant strategy gives a worse choice with no communication with parties

C_1 and C_2 refer to the case of criminals 1 and 2, respectively. If both of the criminals do not confess, they can go free. If C_1 confesses and C_2 does not confess, C_1 will face a 20-year prison, and C_2 can go free. Conversely, if C_2 confesses and C_1 does not confess, C_2 will face a 20-year term in prison, and C_1 can go free. If both criminals confess, they will be sentenced to 10 years. Here, since both criminals cannot communicate, both will take the best strategy they can, considering the worst from the other. i.e., both think that the other may confess, and by not confessing, the criminal may end up in a 20-year sentence. So, the best strategy is to confess. Confessing is a worse position for criminals as they end up in a 10-year prison term. Therefore, the dominant strategy gives a worse position in the Prisoner's Dilemma. Without trusting each other, both end up in a worse position. The same case applies to oligopolies.

3.3.2.4 Nash Equilibrium

- Optimal Choice

Nash Equilibrium is a set of choices for which each player's choice is optimal given the choice of other players. This means each player is doing their best; it can give what its competitors are doing. It is an outcome where no player has a superior strategy. The concept is named after John Nash. In equilibrium, each firm maximizes its price given the price of its rivals, and therefore it has no incentive to change its price. The Nash equilibrium is useful for understanding markets where firms produce substitute goods and compete by setting prices.

Summarised Overview

An oligopoly is a market structure characterized by a few dominant firms whose decisions impact the industry. Non-collusive oligopoly models, such as Cournot's duopoly, Bertrand's duopoly, Chamberlin's small group model operate without explicit cooperation between firms, leading to complex pricing strategies and output decisions. On the other hand, collusive oligopoly models, such as cartels and price leadership models, involve cooperation between firms in setting prices and output levels. The Theory of Games was introduced as a new approach to studying the process of decision-making under oligopoly situations. Game theory is explained using the strategies of the rival firms. There are zero sum and non-zero sum games that explains how strategies of one firm affects the economic decision of the other. Prisoner's Dilemma and Nash Equilibrium are important concepts that are widely acknowledged now-a-days. Understanding the different models and their implications is crucial for market participants to navigate oligopolistic markets challenges and opportunities.

Self Assessment

1. What are isoprofit curves? Explain the properties of isoprofit curves under Cournot and Betrand model.
2. Write a note on Chamberlin small group model.
3. Elucidate the joint profit maximizing and market sharing cartels.
4. What are price leadership models? Explain the various of types of price leadership models.
5. What is dominant strategy?
6. Explain zero and non-zero sum game.

Assignments

1. Compare and contrast the Cournot and Bertrand duopoly models and explain the assumptions and outcomes of each. Which model do you think is more realistic in explaining the behaviour of oligopolistic firms?
2. Research and discuss real-world examples of non-collusive oligopoly markets. How do these markets differ from perfectly competitive markets, and what are some of the key factors that contribute to oligopolistic behavior?

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1. Salvatore, Dominick (2009), *Principles of Microeconomics*, Oxford University Press.
2. Koutsyiannis, A (2013), *Modern Microeconomics*, Macmillan Press, London

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UNIT 4
Case Studies of Different Market Structures

Learning Outcomes

After reading this unit, the learner will be able to:

- familiarize with practical cases of imperfect markets
- get aware of how the oligopoly market functions in the real world in the context of game theory
- get introduced to the price setting problems in the real world

Background

Monopolistic competition is a market structure in which many firms sell differentiated products that are similar but not identical. Each firm has some market power and faces a downward-sloping demand curve. Oligopoly markets have only a few sellers, and the market structure lies between pure monopoly and monopolistic competition. In other words, in the Oligopoly market, few sellers have control over the market and make the pricing decisions of the product.

Keywords

Case Studies, Imperfect Markets, Game Theory, Nash Equilibrium, Price Setting Problems

Discussion

3.4.1 Case Study – Imperfect Markets

Imperfect markets refer to market situations of monopoly, monopolistic competition, and oligopoly market conditions. Though perfect monopoly is not a real situation, we can discuss many monopolistic and oligopolistic market situations in the real world.

3.4.1.1 Case Study – Monopolistic Market Situations

Advertising is an important strategy in the monopolistic market situation. Let us discuss a real-life case of how advertising and regulations related to advertising have affected the actions of rivals in a monopolistic market condition. In the USA, before 1981, guidelines were baring using the name of rival's products in advertisements. When the guideline was withdrawn in 1881, firms started advertising the quality of their product by openly comparing it with the rival's product by mentioning the real name of the rival's product. Trade Commission in the USA, the Federal Trade Commission considered this move as the right step towards ensuring quality products at lower prices due to increasing competition through this advertising strategy.

As a result of such an advertising law and related advertising strategy of firms, the price of eyeglasses was reduced in States with such advertisements. The technique was very effective in the rivalry between Burger King and Mcdonald's when Burger King started advertising by openly mentioning the name of McDonald's. The advertisements were legally handled by firms whose names were mentioned in the advertisements. Some examples include Wilkinson Sword by Gillette, AT&T by MCI, and Ralston Purina by Alpo Pet Foods. These legal battles cost huge sums of money per month. So, firms may try to avoid such expenses through cautious advertising. However, there are instances that firms may not come to truce in some cases.

- Advertising laws affect the market strategy of Monopolistic firms

3.4.1.2 Case Study – Cartels in Oligopoly Market Situation

You have already learned about cartels under Oligopoly. They are producer organizations of a commodity with members colluded to fix prices in such a way as to maximise the profit. One of the most famous cartels in the world is OPEC. OPEC (Organisation for Oil Producing Nations) is considered a successful example of increasing petroleum prices and profit by limiting the supply of petroleum. The members of OPEC are Algeria, Iran, Indonesia, Iraq, Libya, Kuwait, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela. Ecuador and Gabon were members of OPEC but left it.

During 1973, the world faced supply shocks in petroleum due to the Arab-Israeli war and the Iranian revolution in 1980. OPEC raised the petroleum price to 40 dollars per barrel from 2.50 per barrel. However, this made conservation efforts in developed countries using fuel-efficient automobiles, increasing fuel field exploration in the North Sea, Alaska, and Mexico.

Even though OPEC acts as a Cartel, the perfect agreement among the members is seldom present. The densely populated low-oil reserves countries like Nigeria, Iran, and Indonesia wanted to charge high prices and make short-run profits. But, the high oil-rich countries prefer to have long-run profit and thus favors charging a low price. OPEC could not control the fall in oil prices in the 1980's. However, OPEC was considered the reason for increased petroleum prices in the 1970s. The oil price fluctuations largely depended on the global market demand for petroleum and the political stability of the Middle East. The role of OPEC in oil prices is connected with how successfully the cartel cooperates with non-OPEC countries in fixing the fuel supply and the price.

- OPEC, though famous as a Cartel, needs to cooperate out of the Cartel to be successful

3.4.1.2 Case Study – Market Sharing Cartels in Oligopoly Market Situation

Ivy Cartel is a market-sharing cartel formed among the eight Ivy League colleges in the USA. The financial officers of the colleges, along with MIT, formed yearly gatherings to share the details of tuition trends, financial aid packages for students, and faculty salaries. This way, the colleges shared their market, increasing tuition fees, student financial aid

packages, and faculty salaries. With respect to providing aid to top students, they decided not to outbid each other. This Ivy Cartel was charged illegally by the US Justice Department when a failed attempt of the cartel to bring Stanford to the cartel was brought to court.

- Information sharing and forming market sharing cartels are a profitable market strategy

Though the colleges claimed not guilty, they agreed with the Justice Department to stop colluding on the abovementioned matters. The result of such an agreement was viewed in the fall in private college tuition after 1990. However, later decrees of the US Court about the matter allowed discussion of financial aid policies except individual aid for specific students. Nowadays, it is a common practice that private colleges engage in 'Financial aid leveraging.' We can view market-sharing cartels through information sharing and fixing pricing by cooperation in marketing goods and services.

3.4.2 Case Study – Prisoner's Dilemma under Game Theory

Incurring loss due to non-cooperation is the fundamental idea of the Prisoner's Dilemma. The Airline fare war in the USA during 1990 can be quoted as an example. The first step in the fare war started with introducing a simplified airline price structure introduced by the largest air carrier in the USA, American Airlines. Reducing the types of fares to just four instead of sixteen made a fall in price to 38 percent on average. The rival airlines announced a similar step as a response. The strategy of American Airlines and the others were taken in the expectation of better prospects from increased air travel but did not.

- Prisoner's Dilemma cause heavy losses

Further fare wars followed this step. To improve their bad financial position, the TWA airline cut the air price by 10 to 20 percent. Similar strategies from others overall reduced the price to 50 percent. Though air travel has increased, all air carriers faced losses. So, USA Airlines was in a Prisoner's Dilemma without cooperation among the airlines. Even increasing the air price was unsuccessful since travellers were unwilling to take the higher price.

3.4.3 Case Study – Nash Equilibrium

Nash Equilibrium refers to players choosing a strategy considering the strategy chosen by the other player. The

strategy of the other player will be the dominant strategy. The Nash equilibrium in the computer company in the USA is a real-life case. Dell Computer Company started in 1984 and became the fourth largest computer company in the USA in 2000. The market strategy of Dell was commendable. They could conduct successful mail order computer chain by quick and low-cost delivery of computers through the mail, providing computer professionals for servicing in minimum time. It was as simple as ordering branded food items online. Reducing intermediaries, Dell was able to have lower selling and administrative expenses than competitors like Apple and IBM. Through the mailing computer strategy, they formed a dominant strategy.

The other computer companies thought the customers were willing to pay high to feel the product in hand by themselves by visiting retail shops and buying it. Dell's quick and efficient service delivery made it possible to reduce uncertainty and thereby reduce the fear of customers ordering computers by mail. In the USA, after the dominant strategy of Dell, the percentage of computer delivery through mail has increased substantially. Traditional companies have to change their strategy to run. At the beginning of 2002, IBM even announced quitting the industry. Traditional companies tried to adapt to the changing strategy. Considering the dominant strategy of Dell, competitors like Apple, IBM, and Compaq followed the same strategy and had their departments dealing with mail orders. The phone line facilities were developed in line with this for efficient servicing and customer care. This shows that the Computer Industry in the USA experienced a Nash Equilibrium through its Dominant Strategy. In 2002, Dell had 14 percent of the world personal computer market and 25 percent of the USA market.

- Following the successful strategy

3.4.4 Case Study – Price Setting Problems

Fixing prices is an important strategy in the business world. The strategies are related to marginal analysis in the oligopolistic world. One of the real cases that can be explained to show the price-setting problem is fixing air fares by airline companies. The air carriers use computer software forecasting techniques to fix seat prices. The strategy uses techniques to remove the maximum willing price the consumer will pay for each seat. Here, the strategy is to fix different prices for normal consumers and business travelers. The business travelers book

tickets for the last time. The strategy of airline carriers is to take away the last amount of rupees, especially from business class.

As a part of managing seats, especially the inventory seats, the airlines fix the price of seats by giving low discount fares and not non-refundable fares. Nowadays, airlines face fewer chances of overbooking and fewer no-shows. An increase in non-refundable seats allows us to provide discount seats weeks before the time, and it is better than putting the seats for last-minute sale to fill up the seats.

- Price fixing based on past data and profit motive

In the case of charging business travelers, airlines from past experiences understand the huge booking for Friday afternoon flights and bookings made on the same day only. They reserve seats for such bookings. During the weekdays, the seats will be charged under discounts, especially for leisure travelers.

Summarised Overview

The Prisoner's Dilemma is a famous example of a non-zero-sum game where cooperation can lead to mutual benefit, but individual incentives often lead to a suboptimal outcome. Nash Equilibrium is a solution concept that identifies the outcome where no player can benefit by changing their strategy given the strategies of the others. Game theory has many applications, including economics, political science, and biology. Important issues in game theory include equilibria's existence and uniqueness, incomplete information's impact, and the role of trust and reputation in promoting cooperation. Competition and cooperation are two fundamental strategies in game theory, with players choosing between them based on their individual goals and the nature of the game.

Self Assessment

1. Explain Prisoner’s Dilemma.
2. Discuss Nash Equlibrium.
3. Explain Monopolistic market situation.

Assignments

1. Analyze the Prisoner's Dilemma game and explain how it highlights the importance of cooperation and mutual trust between players. How can players overcome the dilemma and achieve a better outcome?
2. Choose a real-life scenario where game theory can be applied. Explain the game, the players involved, and the potential strategies they could use. What would be the expected outcome, and why?
3. Discuss the important issues in game theory, such as the role of information, the limitations of rationality, and the impact of repeated interactions. Provide examples to support your arguments.

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1. Salvatore, Dominick (2009), *Principles of Microeconomics*, Oxford University Press.
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MASTER OF ARTS ECONOMICS

Managerial Theories of the Firm

Block 4

UNIT 1
A Critical Analysis on Neoclassical Theory of Firms

Learning Outcomes

After completing this unit, the learner will be able to:

- know about assumptions that underpin the Neoclassical Theory of firms
- evaluate the limitations of the Neoclassical Theory of firms
- gain insights into the concept of full cost pricing
- understand the criticisms against marginal analysis

Background

The Neoclassical Theory emerged in the late 19th and early 20th centuries as a response to the shortcomings of classical economics. It forms the foundation of modern microeconomics and centers around the principles of supply and demand in competitive markets. Neoclassical economics focuses on supply and demand as the driving forces behind producing, pricing, and consuming goods and services, providing an alternative to classical economics. An important early assumption of neoclassical economics is that utility to consumers, rather than the cost of production, is the key factor in determining a product's or service's value. This idea was developed in the late 19th century by economists such as William Stanley Jevons, Carl Menger, and Léon Walras.

The neoclassical theory of firms focuses on how companies make production and pricing decisions to maximise profits within a competitive market. Consider a company named " Techno," which produces laptops. Techno aims to maximise its profits by determining how much to produce and at what price to sell its laptops. In the neoclassical framework, firms aim to maximise their profits, which is the difference between total revenue and total costs. Total revenue is calculated by multiplying the price at which the laptops are sold by the quantity sold. Total costs include explicit costs (like labour, raw materials, and overhead) and implicit costs (like the opportunity cost of the owner's time and resources).

Let us say Techno faces a competitive market where there are many buyers and sellers of laptops, and the laptops are considered homogeneous – meaning they are identical in terms of quality and features across all sellers. Techno's profit-maximising decisions involve finding the output level where its marginal cost (the cost of producing one additional unit) equals the market price. This is because, in a competitive market, firms are price takers – they can sell as much as they want at the prevailing market price but cannot influence the price through their individual decisions. To illustrate, suppose Techno calculates that its marginal cost to produce a single laptop is Rs.50000, and the market price per unit for laptops is also Rs.50000. In this scenario, Techno would find it profitable to produce and sell more laptops as long as the marginal cost remains equal to the market price. This is where the firm maximises its profit.

Neoclassical theory also highlights the concept of efficiency in perfect competition. Firms like Techno produce at the point where price equals marginal cost, ensuring that resources are allocated optimally and no other allocation could generate more total welfare. This example demonstrates how the Neoclassical Theory of firms focuses on profit maximisation, optimal production levels, and pricing decisions in competitive markets.

Keywords

Neoclassical Theory, Theory of Firms, Full Cost Pricing, Marginalism, Kinked Demand Curve

Discussion

4.1.1 Critique of Neoclassical Theory of Firms

- In neoclassical theory people have complete information

Neoclassical theory, a foundational economic framework, attempts to explain the behavior of firms based on assumptions of profit maximisation, perfect competition, and rational decision-making. The theory also assumes that people act independently, maximising utility or profits based on complete information. Around 1939, discontent with the traditional neoclassical firm theory grew due to dissatisfaction with its assumptions and marginal behaviour rules. In the UK, Hall and Hitch's empirical findings triggered a wave of discussions on the shortcomings of the traditional theory. Simultaneously, in the US, Richard Allen Lester, Fritz Machlup, H.M. Oliver, Robert Gordon, and Milton Friedman independently engaged

in similar discussions during the mid-to late-1940s. However, critics argue that this theory has limitations and fails to capture the complexities of real-world business dynamics.

In the late 1930s and early 1940s, dissatisfaction with the neoclassical theory of firms emerged. Scholars raised concerns about its unrealistic assumptions. The publication of empirical studies provided evidence that firms' behaviour did not always align with neoclassical predictions. This empirical disconnect led to growing scepticism about the theory's validity in explaining real-world business practices. The critiques of the neoclassical theory of firms emphasise the need for more realistic and comprehensive models that consider the complexities of real-world business operations and market dynamics. Alternative economic theories, such as behavioural economics and evolutionary economics, attempt to address some of these critiques by incorporating more realistic assumptions and accounting for the dynamic nature of firms and markets.

- Neoclassical theory is based on unrealistic assumptions

Let us first look at the basic assumption of Neoclassical theory and then explain its limitations and concerns.

4.1.1.1 The Basic Assumptions of the Neoclassical Theory

Imagine you are the owner-entrepreneur of an ice cream stand in a busy market in India. Your primary goal is to maximise profits by making rational decisions. As the sole decision-maker, you have complete information about your ice cream business, allowing you to understand the cost of producing each flavour (marginal cost) and the revenue generated from selling each ice cream cone (marginal revenue). You continue to produce a specific flavour until the cost of making one more cone equals the revenue earned from selling that extra cone, adhering to the "MC = MR" principle. You possess perfect knowledge about your ice cream stand's performance, market conditions, and potential competition, enabling you to make informed decisions to optimise production and pricing. While there is competition from other ice cream stands, short-term entry by new firms is challenging, but long-term entry remains possible.

- Profit-maximising entrepreneur

The Neoclassical theory of the firm is an economic framework

that seeks to explain the behaviour and functioning of firms within a competitive market environment. This theory is grounded in the principles of neoclassical economics and emphasises rational decision-making by firms in their pursuit of profit maximisation. The theory is built upon several key assumptions that serve as the foundation for its analysis. Here are the basic assumptions of the neoclassical theory of the firm:

1. Single Owner - Entrepreneur

- Single entrepreneurial decision-maker

The traditional firm theory assumes a single owner-entrepreneur who makes all decisions, assuming unlimited information, time, and rationality for profit maximisation. This entrepreneur is responsible for making all business decisions, managing resources, and bearing the risks associated with the firm's operations. The theory simplifies the analysis by attributing all decision-making authority to a single individual, the owner-entrepreneur.

2. Profit Maximisation Goal

- Prioritising profit maximisation

The Neoclassical economists assert that companies prioritise profit maximisation. They argue that the increasing of economic activity and competition fuels growth. The attempt of the firm to maximise profit is considered a rational behaviour and is based on the marginalist principle.

3.The Marginalist Principle

- "MC = MR", guides profit-maximising

The goal of profit maximisation is achieved through the marginalist principle, i.e., MC = MR, where;

- Marginal Cost (MC): This refers to the additional cost incurred by producing one more unit of goods or service.
- Marginal Revenue (MR): This refers to the additional revenue earned by selling one more unit of goods or service.

The "MC = MR" principle suggests that a profit-maximising firm should produce at a level where the marginal cost equals the marginal revenue. In other words, the firm should continue producing additional units of output until the cost of producing the last unit equals the revenue generated by selling that last unit.

4. The Certainty of Knowledge

- Comprehensive understanding about the firm

The firm possesses perfect knowledge about its historical performance, current state, and forthcoming changes within its environment. The firm's knowledge extends to its own demand and cost functions with complete certainty. Learning from previous errors, the firm integrates its insights into an ongoing assessment of its demand and cost. The cost function follows a U-shape in both the short and long run, indicating a singular optimal output level.

5. The Entry of New Firms

- Entry regulation

The Neoclassical theory of the firm outlines entry regulation across different models. In Neoclassical firm theory, common entry rules include:

(a) Focusing on actual industry entrants, not potential ones.

(b) Short-term entry is near impossible. Only long-term entry is viable.

6. The Time Horizon

- Maximising profits in each period

The firm's time horizon is influenced by factors like technological progress, capital intensity, nature, and gestation period of the product, focusing on long-run profit maximisation. This is achieved by maximising profits in each independent period using the MC = MR rule for short and long terms.

4.1.1.2 Criticisms of the Neoclassical Theory of the Firm

- Real-world deviations from Neoclassical theory

The Neoclassical theory has provided a framework for understanding the behavior of firms in a competitive market environment. Empirical studies published during the late 1930s and early 1940s, provided evidence contrary to the Neoclassical predictions, indicating a disparity between theory and actual firm behaviour. In this real world, firms often deviate from the assumptions of the Neoclassical Theory of the Firm. They consider multiple goals, stakeholders, uncertainties, and diverse decision-making structures.

Consider the case of Reliance Industries, a prominent conglomerate in India. In the context of the Neoclassical Theory

of the Firm, this theory suggests that Reliance's primary goal should be profit maximisation. However, a closer look reveals a more complex reality. Reliance, like many real-world firms, is not solely focused on profit. Moreover, with the company's diverse interests in retail, energy, and technology, managerial utility also comes into play. The company's multifaceted goals, considerations of uncertainty, strategic actions to prevent entry, and the intertemporal interdependence of decisions, all highlight the need for a more adaptable and comprehensive economic framework that aligns with the complexities of modern-day business practices.

- Reliance exhibits multifaceted objectives

In the modern business world, firms are complex organisations where ownership and management are separate. This separation empowers managers to pursue goals beyond just maximising profits. Managers cannot make decisions with the rationality proposed by the traditional theories. This is because they have restricted information, limited time, and abilities to compare various strategies. These complexities of modern businesses should be considered while incorporating a theoretical framework.

- Complexities in modern firms

The traditional theory of the firm is often criticised for its assumption of a profit maximisation goal due to the lack of essential knowledge, information, and necessary capabilities of the firm to achieve the goal. The firms often lack a clear understanding of their demand and cost functions, making applying the marginalist principle of MC = MR challenging. Furthermore, some argue that even if firms could pursue maximum profit, they might choose not to. Instead, firms have various goals, with profit being one among many. While profit remains a crucial objective, other goals also play a significant role. For instance, Reliance Industries tries to expand its market share to establish dominance, especially in industries like petrochemicals and telecommunications.

- Multiple goals beyond profit

The alternative goals of the firms are as follows:

Maximising Managerial Utility: Some theories propose that managers, due to the separation of ownership and management, have the freedom to set goals that serve their interests. These goals could encompass salaries, prestige, job security, and market share. While different theorists hold varied views on maximising managers' utility, some suggest focusing on sales revenue growth or a balanced growth of both sales and capital

- Managerial goals and utility

assets to align managers' and shareholders' utility.

- Satisfactory outcomes in real-world complexities

Satisficing Behaviour: It is suggested that in a world of uncertainty, limited information, and time constraints, firms might not act with the global rationality presumed by traditional theories. Instead of aiming to maximise specific metrics like profits or growth, some firms adopt a "satisficing" approach, seeking satisfactory outcomes given real-world complexities. This behaviour acknowledges bounded rationality, with internal and external factors constraining firms' pursuit of their goals.

- Constant market share and long-term profitability

Goal of long-run survival and market share: Certain writers propose that firms primary objective is long-term survival. Alternatively, some firms prioritise maintaining a consistent market share. The relationship between market share and profit maximisation is complex, as firms may seek a constant market share without necessarily maximising long-term profits.

- Strategies to prevent new entrants

Prevention of new entrants and avoidance of risk: Recent theories suggest that some firms aim to prevent new entrants by employing strategies like limit pricing, which makes entering the market less appealing. The rationale for this can be multifaceted, including long-run profit maximisation, long-term survival, or mitigating uncertainty related to the reactions of new entrants.

- Profit maximisation *vs* survival

Empirical evidence suggests that owner-controlled firms yield higher profits than those where management is separate from ownership. Supporters of profit maximisation draw parallels to Darwin's theory of survival of the fittest. They argue that profit maximisers survive as they accumulate resources for faster growth, eliminating non-profit maximisers. Critics contend that the economic selection mechanism might not operate as smoothly in practice. If all firms deviate from profit maximisation, the concept of the 'fittest' loses meaning. In dynamic markets, firms can extend survival through differentiation and diversification, and even large firms with monopoly power can evade elimination due to competition dynamics.

The traditional theory of the firm initially assumed perfect knowledge of costs, revenues, and the business environment, disregarding uncertainty's impact on decision-making. Later, it acknowledged that firms operate in an uncertain environment.

- Challenges to traditional firm theory

Critics challenge this approach on multiple fronts. Firstly, it demands extensive knowledge and computational skills from entrepreneurs, which are often lacking. Secondly, the focus on expected profit does not fully mirror real-world firm behavior, ignoring entrepreneurs' attitudes toward risk. Risk-averse entrepreneurs might avoid high-risk projects, even if their expected profitability is high. Thirdly, the time horizon's determination is neglected in decision-making, though it significantly influences choices. Fourthly, estimating future costs and revenues for present value maximisation faces complications tied to discount rate selection and time horizon. Lastly, traditional theory treats entrepreneurs' expectations as external to the firm, neglecting internal factors that shape them, which are important in behavioural theories.

- Static nature of traditional theory

While the traditional theory of the firm acknowledges time in certain aspects, its treatment is static. Firstly, the division between the short and long run introduces time considerations, yet it does not define the duration of the long run in practical decision-making. Secondly, the theory assumes the firm operates with a certain time horizon for profit maximisation, involving discounting future costs and revenues. However, it does not adequately address the length of this time horizon and how it interacts with uncertainty and risk aversion. Thirdly, the timing of demand relative to production and considerations like investment gestation and final product completion involve time. Despite these, the traditional theory remains fundamentally static. It assumes that the firm's time horizon consists of identical and independent periods. This approach treats decisions as separate and unaffected by previous or future decisions, which is a significant limitation. In reality, decisions are intertwined over time: choices made in one period influence those in preceding and subsequent periods. This interconnectedness is disregarded by the traditional theory, which asserts that long-run profits are maximised by equating marginal cost to marginal revenue in each short-run period (MC = MR).

- Entry conditions

In the traditional theory, entry considerations vary depending on the market structure. In pure competition and the model of monopolistic competition, entry is free, but it is a long-run phenomenon. Monopoly, by definition, blocks entry. Traditional models of oligopoly do not explicitly address entry. Classic duopoly models are "closed" as they do not allow entry. These models can be expanded to more sellers, but the

number remains constant at market equilibrium. Cartel theory assumes entrants would join the cartel for stability, and similar assumptions apply to price-leadership models. However, traditional theory does not address potential entry and its impacts on decision-making, leaving a gap in understanding how possible entrants might influence market dynamics.

- Goal of profit maximisation

Some argue that although the firm's ultimate goal is long-run profit maximisation, equating short-run marginal cost (SRMC) with short-run marginal revenue (SRMR) may not always achieve this objective. Others challenge the notion of profit maximisation being the sole goal of a firm.

- Neoclassical theory criticised on various grounds

In conclusion, the Neoclassical Theory of the Firm has attracted significant criticism due to its oversimplified assumptions and limited scope in explaining the complexities of real-world business operations. The assumption of profit maximisation as the sole goal of firms has been challenged, as practical scenarios often involve multiple objectives, including managerial utility, long-term survival, market share, and risk aversion. The theory's static nature fails to consider the interdependence of decisions across periods, ignoring markets' dynamic and evolving nature. Furthermore, the traditional theory's treatment of uncertainty and entry considerations falls short of capturing the complex realities of decision-making under uncertain conditions and the potential influence of new entrants. Behavioural economics, managerial theories, and alternative economic frameworks attempt to address these shortcomings by acknowledging the complexities of firm behavior, the interplay of various goals, and the impact of changing market dynamics. Ultimately, the criticisms highlight the importance of evolving economic theories that better align with the intricacies of real-world business practices, enabling a more comprehensive understanding of firms' behaviours and strategies.

4.1.2 Hall and Hitch Report

- Challenged prevailing notions of monopolistic competition

The Hall and Hitch Report is a paper titled 'Price Theory and Business Behaviour,' authored by Sir John Hall and Edward Hitch in 1939. This report's findings provided ground-breaking insights into the decision-making processes of firms within various industries. The report challenged prevailing economic theories by examining a diverse sample of firms,

including the manufacturing, retail, and building sectors. It shed light on how firms approached profit maximisation, pricing strategies, and market structures. In 1939, Hall and Hitch published research from Oxford analysing business decisions in response to government actions. They studied 38 firms: 33 manufacturing (15 consumer goods, 4 intermediate products,7 capital goods, 7 textiles), 3 retail, and 2 building firms. The sample included firms belonging to well-managed enterprises and was not randomly selected. Results from the study by Hall and Hitch showed that firms did not aim to maximise profits, disregarded the MC = MR rule, and operated mainly in an oligopoly market structure. This challenged the prevailing notion of monopolistic or imperfect competition by Chamberlin and Joan Robinson.

Hall and Hitch's report can be summarised as follows:

- Competitive market dynamics

Contradicting monopolistic competition, firms do not operate independently; they remain acutely aware of their competitors' responses. This behavior, in stark contrast to monopolistic competition assumptions, indicated a broader prevalence of oligopoly than previously believed. Even the duopoly theory built on the premise of consistent competitor reactions proved insufficient to address the complexities of oligopolistic interplay and the resulting uncertainties about the demand for products within these firms.

Hall and Hitch discovered that firms prioritise long-term profit maximisation, not short-term, using MC = MR. They adopt average-cost pricing, setting prices to cover AVC, AFC, and a 'normal' profit margin (often 10%).

$$P = AVC + AFC + \text{profit margin}$$

P is the product price, AVC is the average variable cost, and AFC is the average full cost.

- Breakdown of marginalism

Hall and Hitch presented the following reasons for the marginalism's breakdown, (a) Firms lack knowledge of their demand curve and marginal costs, making the application of the marginalist rule (MC = MR) unfeasible. (b) Firms embraced the notion that the 'full-cost price' represented the 'right' price, ensuring a 'fair' profit and covering production costs.

Procter & Gamble (P&G), a leading consumer goods company exhibits characteristics similar to the Hall and Hitch Report findings. The industry's oligopolistic structure is mirrored by P&G's vigilant monitoring of competitors' actions, responding to pricing and product strategy changes. P&G's emphasis on long-term profit maximisation is evident through substantial research, development, and marketing investments to secure market dominance. In pricing strategies, P&G departs from the traditional "MC = MR" rule, employing dynamic pricing strategies influenced by competition and demand.

4.1.3 Full Cost or Average Cost Pricing

- Firms adopt average-cost pricing

Unlike traditional theory, Hall and Hitch found that firms prioritise price over output and follow average-cost pricing. However, if rivals charge lower prices, they might deviate from this rule to secure large orders or protect their position. Full cost is the full average cost, which includes average direct costs (AVC) plus average overhead costs (AFC) plus a normal margin for profit: Thus price, P = AVC + AFC + profit margin (usually 10%). The average variable costs or direct costs are the costs of labour, raw materials, etc. The average overhead costs include costs on fixed factors.

- Manufacturers displayed price stickiness

Finally, it was found that manufacturers' prices remained relatively sticky despite demand and cost changes, contrary to traditional theory's predictions of price-output adjustments. This "stickiness" was common in the real world. Hall and Hitch introduced Chamberlin's "kinked" demand curve to explain this price stickiness phenomenon. The kink implies the following pattern of expected reactions of competitors. Firms believed raising prices would lead to customer loss, but cutting prices would not yield significant sales growth as competitors would follow suit.

- Average-cost price is independently determined

The price set by firms matched the average cost with the kink. Firms independently reached this average-cost price without colluding with each other. They refrained from collusion, fearing new entrants jeopardising established firms' long-term position. The collusive price reduction did not seem profitable for the firms as they perceived market demand as price inelastic. Thus, firms maintained steady prices, except during general cost increases, leading to an overall increase in price. The 'kink' in the individual demand curve indicates

elasticity above a given price and inelasticity below it.

According to Hall and Hitch, the average cost, follows a U-shaped path. The product's price is determined at the point of tangency of the AC curve and kinked demand curve. This price includes all costs and tends to stay fixed as long as costs remain constant. It is shown through the figure given below.

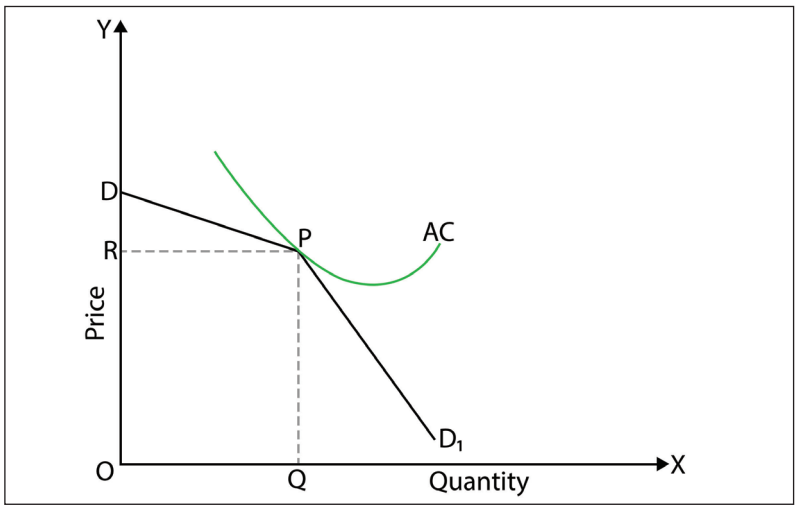

Fig. 4.1.1 Kinked Demand Curve

- Price determination at the point of tangency

In the above figure, DPD_1 is the kinked demand curve with a kink at point P. AC is the U-shaped average cost curve. The price $\frac{PQ}{OR}$ is determined at the point of tangency, P. The full cost of the average cost principle determines the average cost. Thus, PQ covers full or average cost, and it will remain rigid as long as there is no change in any of the factors affecting the cost.

- Kinked demand curve explains price "stickiness"

Any increase in the price above it will reduce the firm's sales, as its competitors will not follow it in raising their prices. This is because the PD portion of the kinked demand curve is elastic. On the other hand, if the firm reduces the price below QP, its competitors will also reduce their prices. Hall and Hitch's framework uses kinked demand to explain price "stickiness" but not price levels. Firms set their prices independently based on average cost, and these prices stay sticky due to anticipated competitor reactions creating a kink at the average cost price level.

Hall and Hitch did not formulate a definitive theory for pricing

in oligopoly markets. While they touched on significant factors like long-term profit motives, firm goodwill, competition dynamics, and average-cost pricing, they did not integrate them into a comprehensive oligopoly theory. Their findings posed a significant challenge to marginalism. Their study's outcomes indicated that short-term profit maximisation was not commonly the firms' goal. Many firms intended to achieve a reasonable profit and pursued other objectives, like fostering goodwill, maintaining fairness with competitors, and more.

- Firms sought reasonable profits and other objectives

Furthermore, the demand curve and its price elasticity, critical to marginalism, remain uncertain in practice due to unknown consumer preferences and competitors' responses. Oligopolistic firms operate within uncertain conditions regarding customers and competitors, making demand and marginal revenue schedules unknown to firms. In addition, marginal costs remain uncertain in multi-product firms, which is common in modern business. Even if MC and MR were known, pursuing short-term profit maximisation would necessitate frequent price adjustments due to fluctuations in costs and demand. However, such frequent price changes are impractical, as prices often show notable stickiness despite short-run cost and demand shifts.

- Price uncertainty in oligopoly

In conclusion, the Hall and Hitch Report provided ground-breaking insights into the behaviour of firms in response to government measures. Their findings challenged traditional economic theories by revealing that firms prioritise long-term profit maximisation over short-term gains. The report's exploration of the "kinked" demand curve further explained price "stickiness," offering a fresh perspective on how firms navigate pricing strategies in oligopolistic environments. Overall, the Hall and Hitch Report and the concept of average cost pricing shed light on the complex interplay between firms' goals, market dynamics, and pricing behaviour.

- Pricing strategies within oligopolies

Caterpillar Inc., a multinational corporation specialising in construction and mining equipment, operates aligned with the concept of full-cost or average-cost pricing. They employ a pricing strategy that factors in direct and overhead costs, including labour, materials, facilities, and more, along with a reasonable profit margin, usually around 10%. This approach ensures that the prices they set for their heavy machinery cover all production expenses and maintain profitability. Caterpillar is known for maintaining price stability over time,

providing consistency and predictability to their customers in the construction and mining industries. However, in the face of intense competition or strategic opportunities, Caterpillar may adjust its pricing strategy to secure large orders or defend market share. Nevertheless, Caterpillar's adherence to full-cost pricing principles represents how an MNC can navigate pricing complexities in a highly competitive industry while prioritising cost coverage and price stability.

4.1.4 Gorden's Attack on Marginalism

Imagine a scenario in the restaurant industry that illustrates the concept of full-cost or average-cost pricing. A restaurant chain, "Gourmet Delights," operates in a competitive market where consumer preferences and costs constantly change. "Gourmet Delights" adopts an average-cost pricing strategy to ensure price stability and cover production costs. They calculate the average cost of preparing a dish, which includes direct costs like ingredients and labor, as well as overhead costs such as rent and utilities and a reasonable profit margin is added to this cost. This comprehensive pricing approach allows "Gourmet Delights" to set consistent prices for their menu items, regardless of fluctuating demand or cost conditions. However, if a rival restaurant introduces a significant price cut or unique dining experience, "Gourmet Delights" might temporarily adjust its pricing to compete effectively. This scenario illustrates how a real-world business, like "Gourmet Delights," can apply the principles of average-cost pricing to maintain price stability while adapting to changing market dynamics and consumer preferences, aligning with the critiques outlined by Gordon in the marginalist debate.

In 1948 Gordon entered the marginalist debate, criticising the traditional theory of the firm's assumptions and postulates. Gordon's critique of marginalism focuses on its limitations and inadequacies. He questions the core assumptions of marginalist theory, highlighting issues such as imperfect knowledge of consumer preferences and uncertain market conditions. His critique can be summarised as follows.

The industrial environment is complicated, influenced by numerous variables shaping demand and costs and the policy choices available to firms (pricing, advertising, and diversification). The constantly changing determinants of

demand and costs make simultaneous marginal adjustments challenging for entrepreneurs. The complexity prevents firms from learning through experience due to the ever-changing economic landscape, making past estimations invalid—uncertainty further challenges marginalist behavior due to the inability to accurately predict future demand and cost conditions. Addressing uncertainty effectively within a dynamic context necessitates insights into how business expectations are formed, a knowledge gap. This leads firms to adopt extra goals besides profit maximisation to reduce uncertainty. The empirical evidence shows widespread use of average-cost pricing, especially for multiproduct firms where estimating changes in marginal costs for all products is nearly impossible. The studies reveal that firms pursue various goals beyond profit maximisation, such as maintaining stable employment and building goodwill.

- The pursuit of diverse goals by firms

Managers address specific issues within different sections of the firm without sticking to marginalist rules. Local solutions might not align with profit maximisation. Hence, based on a standard output level, the average cost rule is more practical. It emphasises maintaining production to meet demand rather than solely maximising profits. In the long run, accurately knowing or estimating demand is difficult due to ever-changing economic conditions. Here, adopting the average-cost rule is logical, as it results in a consistent price level across firms.

- Local solutions that may not align with profit maximisation

Gordon suggests that escaping this requires a dynamic multiperiod analysis. Here, cost and revenue functions are assumed for each period within the entrepreneur's horizon, followed by the maximisation of the present value of future net revenue (profit). However, this dynamic approach is impractical as it assumes entrepreneurs possess given expectations. Entrepreneurs must be presumed to possess the information and the ability to form accurate future expectations about the economic landscape. Yet, expectations are not addressed in marginalism, and assuming them as given avoids rather than solve the uncertainty issue.

- Gordon suggests dynamic multiperiod analysis

Summarised Overview

The Neoclassical theory of the firm is a foundational economic framework aimed at understanding how firms operate within competitive markets. Rooted in the principles of Neoclassical economics, it emphasises rational decision-making by firms with the goal of maximising profits. This theory is constructed upon several fundamental assumptions that lay the groundwork for its analysis. The Neoclassical theory of the firm provides a structured understanding of firm behaviour in competitive market settings, incorporating these assumptions to analyse decision-making processes and profit-driven strategies. The Neoclassical theory of the firm has faced criticism for oversimplified assumptions and its inability to address real-world complexities. It assumes profit maximisation as the sole goal of firms and perfect information, disregarding multiple objectives, uncertainty, and managerial discretion. The theory's static nature neglects intertemporal decision interdependence, while its treatment of entry and uncertainty falls short.

The Hall and Hitch Report, explained in detail the decision-making processes of firms in response to government actions. Contrary to monopolistic competition, the report highlighted that firms operated within an oligopoly market structure, considering competitors' responses. Their findings also showcased a focus on long-term profit maximisation rather than short-term goals, with firms adopting an average-cost pricing strategy to set prices covering AVC, AFC, and a 'normal' profit margin. This insight reshaped the understanding about firm behaviour and market dynamics. The "kinked" demand curve explains price "stickiness," where firms maintain prices despite changing demand and costs. This report challenged marginalism, showing that firms' goals extend beyond short-term profit, and complex interplays of competition, uncertainty, and market dynamics influence their decision-making.

Gordon's critique of marginalism exposed its limitations and emphasised its inadequacies in explaining firm behaviour. He challenged core assumptions, pointing to the complexity of the real industrial environment and the uncertainties it introduces. Gordon highlighted the practical challenges of simultaneous marginal adjustments due to the dynamic nature of demand, costs, and various policy variables. He argued that uncertainty further undermines marginalist behaviour, as future demand and costs cannot be accurately predicted. Gordon suggested that firms adopt additional goals beyond profit maximisation to navigate uncertainty. His critique also touched upon the widespread use of average-cost pricing and the importance of subjective interpretations of demand and costs.

Self Assessment

1. Explain the basic assumptions of the Neoclassical theory of the firm.
2. Discuss the limitations of the Neoclassical Theory of the Firm in addressing the complexities of modern business operations.
3. Describe marginalist principle in the Neoclassical theory of the firm. How does the equality of marginal cost (MC) and marginal revenue (MR) guide firms' production decisions?
4. What were the key findings of the Hall and Hitch Report? Explain the concept of average-cost pricing as introduced by Hall and Hitch. How does it differ from the marginalist approach in determining prices?
5. Critically analyse Gordon's attack on marginalism.

Assignments

1. Write a case study of a real-world company that deviates from the assumption of profit maximisation. Explain the company's alternative objectives and how they influence its decision-making.
2. Analyse the implications of assuming a rational, profit-maximising owner-entrepreneur on the neoclassical theory of the firm. Provide examples to illustrate how this assumption may not hold true in practice.
3. How did the Hall and Hitch Report's findings contribute to understanding firm behaviour?
4. Examine Robert Gordon's arguments against marginalism in the Neoclassical Theory of the Firm.

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 2
Pricing Models

Learning Outcomes

After completing this unit, the learner will be able to:

- understand the concept of average cost
- learn the rationale behind limit pricing as a strategy
- familiarise with the models of Sylos-Labini

Background

The behaviour of firms within competitive markets involves a web of decisions involving pricing, production, and market strategies. This includes a range of theories and models that attempt to capture the essence of firm behaviour and strategies. Oligopoly refers to a market characterised by a small number of interdependent firms, where each firm's actions significantly impact the behaviour and decisions of its rivals. In such a market, firms must carefully consider not only their pricing strategies but also anticipate and respond to the reactions of their competitors.

In an oligopoly, the actions of one firm can have a significant impact on its competitors, creating an environment of interdependence and strategic decision-making. In such scenarios, traditional models of price determination, fails to capture the complexities of the market. The Oligopoly Pricing Model emerges as a powerful tool. This model recognises that the pricing decisions of firms in oligopolistic markets are not made in isolation. Instead, firms must consider how their pricing choices will impact their competitors' behaviour and how their rivals might respond.

A real-world example of oligopoly behaviour can be observed in the global airline industry. Major international airlines like Delta Air Lines, American Airlines, and United Airlines operate highly interdependently. These airlines offer similar routes and services, and their

pricing decisions can significantly impact each other and the industry. In this scenario, if one airline, Delta, decides to increase its ticket prices on a popular international route, its competitors, like American Airlines and United Airlines, closely monitor this move. They must decide whether to match Delta's higher prices or maintain their pricing strategy. If they all choose to raise prices, it can lead to increased revenues but may also deter some customers. Therefore, each airline carefully considers the potential reactions of its competitors when making pricing decisions. To maintain a competitive edge, airlines also engage in non-price competition. They may focus on providing better in-flight services, more comfortable seating, loyalty programs, or frequent flyer perks to differentiate themselves and retain customer loyalty without engaging in aggressive price wars. This behaviour illustrates the complexities of oligopolistic markets, where firms must anticipate and respond to the actions of their competitors to maintain profitability and market share.

Keywords

Average Cost Pricing, Pricing Strategies, Market, Oligopoly, Competition

Discussion

4.2.1 Average Cost Models

- Alternative pricing approach

Average-cost pricing explores the pricing strategies of firms based on their cost structures. It presents an alternative perspective to the traditional profit-maximisation approach and offers insights into how firms determine their prices while considering various cost components. This approach aims to ensure that the price they charge covers all costs incurred in producing the product while allowing the firm to achieve a reasonable profit. Average Cost Pricing is often used in industries where accurately determining marginal costs for each unit is difficult or impractical. This strategy provides simplicity and stability in pricing decisions, allowing firms to maintain a consistent price level across different situations and market conditions.

- Representative model in pricing

A 'representative' model of average-cost pricing is a theoretical framework that simplifies the complexities of real-world business environments to understand how firms set prices to cover their costs and achieve certain profit margins. This representative model of average-cost pricing aims to capture the essence of firms' pricing decisions while acknowledging the complex cost structures and market dynamics. It serves as a simplified representation of the broader average-cost pricing concept, providing a foundational understanding of the principles at play.

- Average-cost pricing

Average-cost pricing models propose setting prices based on average total cost, incorporating a profit margin. The formula P = AVC + GPM = AC is used, where P is the price, AVC represents the average variable cost, and GPM is the gross profit margin. Various theories exist, differing in how average cost is determined for pricing. These theories share common characteristics and can be combined into a "representative model." This model's predictions are explored under dynamic changes, and a comparison with other firm theories is undertaken.

- Toyota's average cost-based pricing

One real-life example of a multinational corporation (MNC) that operates with an approach similar to the Average Cost Pricing Model is Toyota in the automotive industry. Toyota is known for its commitment to lean manufacturing and cost-efficiency. They employ a strategy focusing on achieving economies of scale and standardising their production processes. Toyota calculates its average production costs, including materials, labour, and overhead, and aims to set prices that cover these costs while maintaining a reasonable profit margin. This approach results in a reputation for producing reliable and affordable vehicles across their product range. Toyota's ability to provide consistent pricing and value for money has contributed to its success in global markets. This real-world example demonstrates how a multinational corporation can adopt an average cost-based pricing strategy to simplify pricing decisions and offer competitive and consistent prices to consumers.

4.2.1.1 Goals of the Firm

In average-cost pricing theories, the underlying assumption is that firms aim for long-term profit maximisation. However, this goal does not involve maximising profits in each period

within the firm's time horizon. It acknowledges that achieving profit maximisation in the long run, as traditionally theorised by equating marginal cost (MC) to marginal revenue (MR) in each period, is not as straightforward. This is because these individual periods are interconnected: decisions made in any one period are influenced by decisions made in the past, and they, in turn, will impact decisions in the future. Hence, the conventional rule of equating MC to MR in decision-making is not entirely suitable for describing how businessmen behave in the real world. Instead, long-term profit maximisation is achieved by setting the price equal to the firm's average production cost. This approach considers the cumulative effect of pricing decisions over time, aiming for sustained profitability rather than optimising profit in each isolated period.

- Long-term profit maximisation

4.2.1.2 Demand and Cost Schedules

When we try to understand how businesses behave in the long term, we need to know two things: how much people will want to buy from them over a long time (that's demand), and how much it will cost them to make all that stuff (those are costs). But here is the problem: predicting these things in the long run is hard. People's preferences change, and we cannot always guess how our competitors will act. The same uncertainty goes for costs. Technology is always advancing, and prices for inputs keep fluctuating. So, businesses make decisions based on what it costs to make things right now, and they assume there is space to handle changes and surprises in the future.

- Demand and costs uncertainty

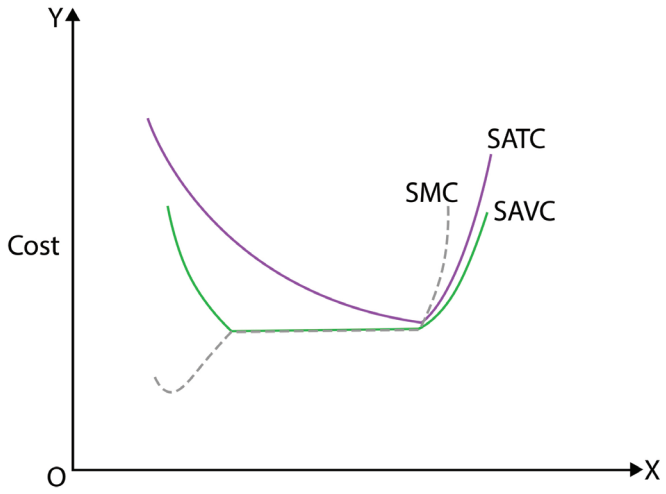

Fig. 4.2.1 Average variable cost

- Short-run cost curves and pricing

The short-run average variable cost (SAVC) curve has a saucer-like shape as shown in the figure above. The descending part shows decreasing cost due to improved use of fixed inputs up to plant capacity. During this falling SAVC range, the short-run marginal cost (SMC) is below it. The rising part of SAVC represents waste in raw materials, higher machinery repair expenses, and overtime labour costs. When SAVC is rising, SMC is above it. During the flat section of SAVC, SMC equals average variable cost, and pricing is based on this flat part. Firms have high costs below the normal capacity output but do not raise prices as they expect to eventually reach optimal production levels.

4.2.1.3 Price Determination: The 'Mark-Up' Rule

Price determination involves two stages. First, the firm sets a price (P) to cover its total costs when operating within its optimal capacity range and achieve a subjective profit level. Second, the firm compares this estimated price with the potential entry price and sets a price (P*) to discourage entry. Let us look into this.

1. Subjective Estimate of the Desired Price

The firm employs the "mark-up" rule:

P = AVC + GPM

Here,

-P represents the desired price.

-AVC stands for Average Variable Cost.

-GPM refers to the Gross Profit Margin, which is subjectively determined.

This two-stage process allows the firm to set a price that covers costs and provides a profit while also considering the competitive landscape to deter potential entry into the market. Businessmen consider short-run Average Cost (AC) a reasonable estimate of long-run average cost. This approach allows the firm to adapt to changing circumstances while aiming for long-term profitability.

The Gross Profit Margin (GPM) is designed to cover the

Average Fixed Cost (AFC) and generate a normal profit, and it is calculated as follows:

GPM = AFC + NPM

Here, NPM represents Net Profit Margin.

To determine the AFC, you can divide the Total Fixed Cost (TFC) by a "planned," "budgeted," or "normal" level of output denoted as X*:

$$\textbf{AFC} = \frac{\textbf{TFC}}{\textbf{X}^*}$$

In this context, X* represents the level of output that the firm expects to produce and sell while operating with normal utilisation of its plant capacity. This approach helps ensure that the gross profit margin covers the AFC, allowing the firm to achieve a normal profit. The net profit margin (NPM) is known to established firms through experience. It is set to provide a fair return on capital, ensuring a steady flow of investment in the industry in the long run and to cover any unique risks associated with the product. By adding Average Variable Cost (AVC), Average Fixed Cost (AFC), and NPM together, the firm arrives at an estimate of the "desired" price. This desired price is the price the firm would ideally charge to cover all its costs, including normal plant utilisation, and achieve what it thinks as a normal profit.

- Average cost-based pricing strategy

2. Actual Price Setting

The initially estimated "desired" or "standard" price (P) is not necessarily the price that will be charged in practice. The actual price (P*) depends mainly on the threat of potential entry or potential competition in the market. Competition among existing firms is typically managed through tacit collusion or price leadership. Tacit collusion often occurs within trade associations, which publish industry-wide average-cost information for specific product lines. To ensure that the industry operates smoothly, price leadership is sometimes employed. In this scenario, a leading firm, usually one of the largest with the lowest costs, determines the pricing strategy. Less efficient firms then follow suit and accept the leader's pricing.

- Market competition and pricing

The actual price (P*) set by the price leader depends on two key factors:

(a) The level of potential competition in the market.

(b) The prevailing economic conditions, whether the overall business environment is booming or depressed.

In this average-cost pricing model, the actual price (P*) is influenced by the presence or absence of barriers to entry in the market.

- Factors influencing actual price

Barriers to Entry: When barriers to entry exist, P* will be higher than the normal price (P), resulting in abnormal profits for the price leader and possibly less efficient firms. Barriers to entry essentially allow firms to charge more due to limited competition.

Threat of Potential Entry: If the threat of potential entry is strong, the quoted price (P*) will equal the leader's normal price (P), and the leader will earn normal profits. The threat of potential entrants competitively determines the effective gross profit margin (GPM). In other words, the market conditions and competition dictate the profit margin.

Adjustment of GPM: There's evidence that the gross profit margin is adjusted when an entrant charges a lower price or when market conditions deviate from the norm. In a sellers' market, firms often charge a higher GPM, while in periods of economic downturn, the GPM is lowered to remain competitive.

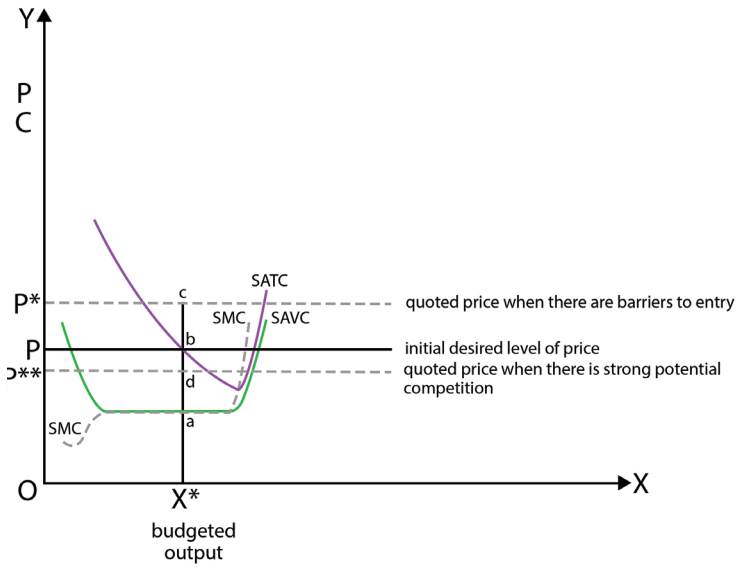

Fig. 4.2.2 The Determination of Price

The figure given above illustrates how prices are determined based on certain conditions. It is important to note that the horizontal lines in the figure represent the prices firms would charge under these conditions, not demand curves. In the above given figure, the SATC (short for Short-Run Total Cost) curve includes the net profit margin that firms consider normal for their specific product. The price leader, based on their cost structure, ideally wants to set a price, "P," that covers both their SAVC (Short-Run Average Variable Cost) and their "normal gross profit margin," represented as "ab." At this price, the leading firm is willing to sell as much as the market demands. Please note that the price "P" is calculated assuming a certain budgeted output, denoted as "X*."

- Pricing determined by competition and market conditions

If there are barriers to new firms entering the market (or in times of strong demand), the leader might opt to set a higher price, "P*," which results in making above-average profits when they produce at or above the budgeted output level. In this case, the actual gross profit margin at "P*" is larger than the normal margin "ab." However, if there is a significant threat of new competitors entering the market (or during economic downturns), the leader might choose to set a lower price, "P**," which leads to a smaller effective gross profit margin "ad," which is less than the desired margin "ab".

4.2.1.4 A Critical Analysis

- Average-cost pricing in practice

The adoption of average-cost pricing practices by numerous firms in various industries is supported by empirical studies. Average-cost pricing is a practical approach that firms use to simplify pricing decisions, coordinate with other market participants, and manage uncertainty. In practice, there is empirical evidence that firms pass at least part of their corporate taxes on to customers through price increases, aligning with the predictions of average-cost theories.

The discussion of average-cost pricing practices and their relation to the economic theories of the firm raises several important points:

1. **Compatibility with Various Firm Goals**: Average-cost pricing practices are found to be widely adopted by both small and large firms across various industries. However, adopting these practices does not necessarily establish average-cost pricing as a distinct theory of the firm. Instead, these practices are compatible with

various hypotheses explaining firm behaviour, such as sales maximisation, satisficing behaviour, short-run profit maximisation, and long-run profit maximisation.

2. **The Role of Goals in Pricing**: The desired mark-up margin in average-cost pricing can vary depending on the firm's goals. Without knowledge of the firm's specific goals, it is challenging to determine whether it seeks to maximise sales, achieve satisfactory profits, or pursue long-term profit maximisation. Average-cost pricing can be applied to achieve different goals, making it difficult to infer a firm's objective based solely on its pricing practices.

3. **Empirical Evidence**: Empirical studies reveal several key findings regarding average-cost pricing practices:

   - Prices are not adjusted immediately in response to changes in demand or costs.
   - Corporate taxes are often shifted to buyers through price increases.
   - Prices can be "sticky" over extended periods despite changing cost and demand conditions.

4. **Multiple Goals of Firms**: Empirical evidence suggests that firms often have multiple goals rather than a single-minded focus on profit maximisation. While this might appear to contradict average-cost pricing as a theory, proponents of average-cost pricing argue that other goals can still be achieved more effectively when firms maximise profits.

5. **Relationship with Marginalism**: In essence, average-cost pricing reduces to marginalism when the firm's goal is long-run profit maximisation, and the Average Variable Cost (AVC) is constant over the relevant range of output.

6. **Reasons for Adoption**: There are several reasons to justify the widespread adoption of average-cost pricing practices:

   - Simplicity: Average-cost pricing is easier to apply and it involves concepts familiar to businessmen and accountants.
   - Multiproduct Firms: It simplifies price-setting in

multiproduct firms where obtaining information on price elasticities for all products is challenging and costly.

- Trade Associations: Trade associations often provide cost information and standard cost accounting methods, leading to price coordination.
- Coordinating Markets: Average-cost rules can contribute to the orderly functioning of markets, as firms anticipate competitors' reactions and market conditions, reducing uncertainty.

In conclusion, while widely adopted by many firms in various industries, the average-cost pricing theory does not stand as a separate theory of the firm but serves as a practical pricing practice. This theory demonstrates its adaptability by being compatible with various hypotheses explaining firm behaviour, including sales maximisation, satisficing, short-run profit maximisation, and long-run profit maximisation. Empirical studies reveal that firms often apply average-cost pricing practices, showing resistance to immediate price adjustments in response to changes in demand or costs. These findings challenge the simplistic view of short-run marginalist behaviour and suggest that firms may have multiple goals beyond profit maximisation. The average-cost pricing theory aligns with marginalism when the goal is long-run profit maximisation and the Average Variable Cost (AVC) remains constant over the relevant range of output.

- Average-cost pricing - practical pricing practice

4.2.2 Bain's Limit Pricing

J. Bain, published his 'Limit Pricing theory' in the article "Oligopoly and Entry-Prevention" published in American Economic Review in the year 1949, much prior to his significant work, "Barriers to New Competition" published in 1956. His early article aimed to explain the rationale behind firms maintaining prices below the point of unitary demand elasticity over extended periods. Bain's conclusion stemmed from his belief that the traditional theory could not account for this empirical phenomenon due to its failure to consider a crucial determinant in pricing decisions: the potential threat of new market entrants. The traditional theory focused on actual entry, leading to the long-term equilibrium of individual firms and the industry (where Price equals Long-Run Average Cost

or P = LAC). However, Bain argued that in the long run, the price did not fall to the level of LAC due to barriers to entry. Simultaneously, the price was not established at the level congruent with profit maximisation, owing to the looming prospect of potential entry. He maintained that the price was strategically set above the LAC (representing the price in pure competition) yet below the monopoly price (where MC =MR and short-term profits are maximum). This behaviour can be comprehended by assuming the presence of barriers to entry, wherein established firms refrain from setting the monopoly price but rather adhere to the 'limit price.' This limit price signifies the highest price these established firms believe they can impose without incentivising new entries.

- Pricing below monopoly but above pure competition

Intel Corporation, a multinational semiconductor giant, is a real-world example of Bain's limit pricing theory within the semiconductor industry. Intel strategically calculates a limit price for its semiconductor products in this context. Intel understands that if it were to increase its semiconductor prices beyond the limit price substantially, it would create a lucrative opportunity for potential competitors to enter the market. This could lead to a loss of market share and a decline in long-term profitability. Therefore, Intel strategically sets its prices slightly above the limit price to deter new entrants while ensuring a consistent flow of profits over time. Intel's approach aligns with the fundamental objective of limit pricing: to balance short-term profit maximisation and safeguard its dominant position in the semiconductor industry.

- Intel's strategic limit pricing

4.2.2.1 Assumptions of the Theory

Bain's limit pricing model is based on the following assumptions

1. The industry's long-term demand curve is fixed.
2. The Marginal Revenue (MR) curve is also fixed.
3. Collusion exists among the established firms within the oligopoly.
4. The established companies can calculate a limit price, which acts as a barrier against potential entrants.
5. New firms can enter if the price goes above the limit. This makes sales uncertain for existing firms.

6. The established firms aim to maximise their long-term profits.

4.2.2.2 Models of Limit Pricing

This theory deals with two scenarios:

- No Collusion with New Entrants: This is when there is no cooperation with new entrants.
- Collusion with New Entrants: This is when there is cooperation with new entrants.

(A) No Collusion with New Entrants

- No collusion, assured profits

When there is no collusion with potential entrants, two scenarios are examined in the figure below. In the figure, output is represented on the horizontal axis, while price is shown on the vertical axis. DD_1 represents the market demand curve, and MR represents the corresponding marginal revenue curve. LAC_1 signifies the long-run average cost curve for the established non-colluding oligopolist firm. As LAC_1 is a horizontal line, the marginal cost curve MC_1 aligns with it. Monopoly output is labelled as OQ, where MR equals MC_1. The monopoly price, marked as P_1, produces monopoly profits for the established firm. Given this price, uncertainty arises regarding the entry of new firms. The range of uncertain demand is DA, leading to uncertain profits. Let us consider P_L as the limit price capable of preventing entry. With this price, output becomes OQ_1, yielding profits of $P_LAN_1M_1$. This represents assured profits for the established firms. The absence of an incentive for new firms to enter stems from the possibility that the limit price (P_L) may align with the average cost of potential entrants. Despite the established firms not achieving the maximum price, they are shielded from the entry threat.

If the long-run average cost curve becomes LAC_2, the price set is P_2, and output becomes OQ_2. This price lies below the limit price. In this situation, the ceiling imposed by P_L is non operative. There is no risk of potential competitors entering the market, while the established firm secures maximum profits denoted as $P_2BN_2M_2$.

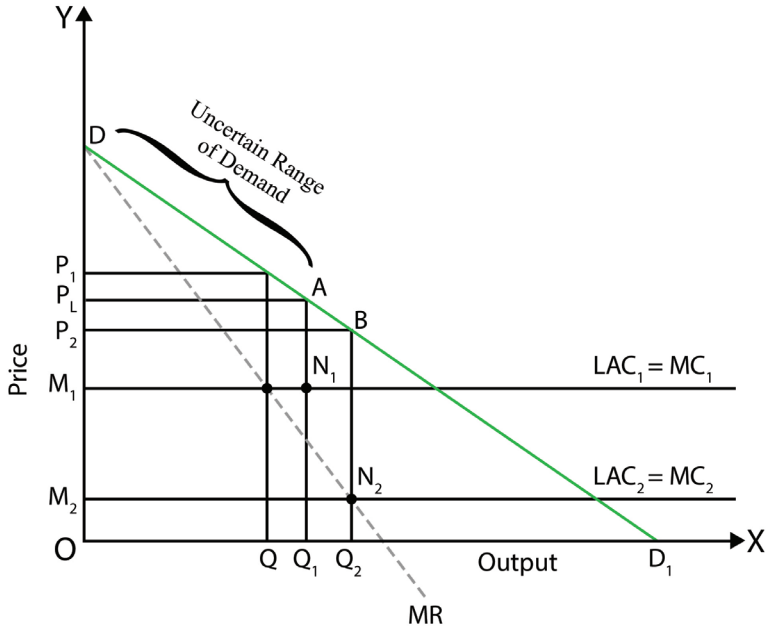

Fig. 4.2.3 No Collusion with New Entrants

Hence, with the entry-preventing limit price PL in place, the established firms have three possible choices:

- **Price Above P_L**: Set a price higher than P_L, exposing themselves to the risk and uncertainty of potential entry and navigating an unclear situation after the entry occurs.
- **Price at P_L**: Charge a price equal to the limit price P_L. While this prevents new firms from entering, it results in profits lower than the maximum achievable.
- **Price Below P_L**: Opt for a price lower than P_L, such as P_2, effectively preventing the threat of entry and securing the highest possible profits.

- Price choices: above, at, below limit price

(B) Collusion with New Entrants

Bain presents an alternate scenario where the established firms engage in collusion with new entrants. Instead of aiming to prevent entry through a limit price, the established firms allow new entrants into the market and cooperate with them. This situation is explained through the figure given below.

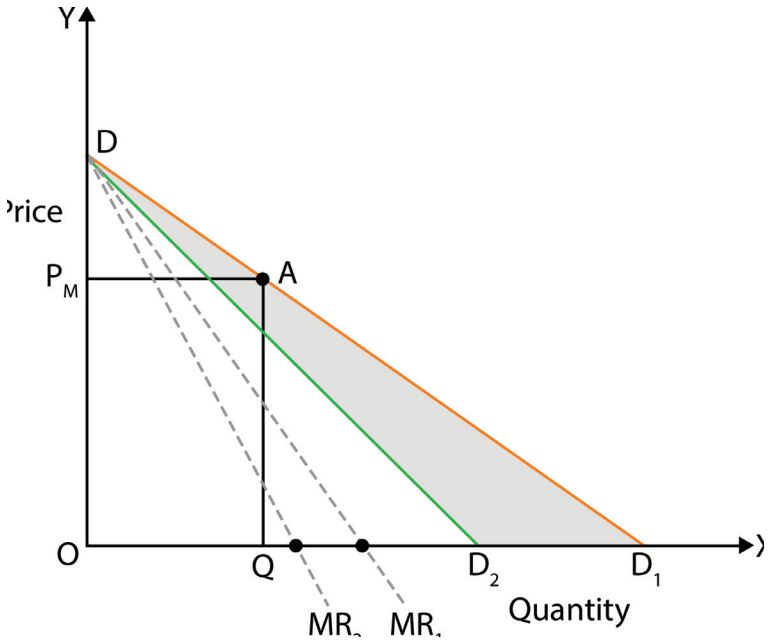

Fig. 4.2.4 Collusion with New Entrants

- Collusion leads to shared market

In the figure, DD_1 signifies the original market demand curve, while MR_1 represents the corresponding marginal revenue curve. P_M indicates the price that maximises profits in a monopoly scenario, and this price might attract new entrants. In this case, the established firms might not adopt a limit price to prevent potential entrants. Collusion occurs between the established firms and the new entrants, leading the established firms to accept the entry of new firms and share the market with them. Consequently, the demand curve shifts leftward to the new position, represented by DD_2. The shaded area DD_1D_2 illustrates the portion of the market demand that the new entrants capture. All firms, both established and new, charge the same price P_M, which is set to maximise profits.

4.2.2.3 Bain's Condition of Entry

Bain's theory highlights that the risk of entry can be prevented by implementing a limit price. Whether the entry barrier is strong or not can be assessed using what Bain labelled as the "condition of entry." This refers to how established firms can consistently raise their price above the competitive level without inducing new firms to enter. The condition of entry (E) can be described as:

$$E = \frac{P_L - P_C}{P_C}$$

Where, P_L is the limit price and P_C is the competitive price, the price under pure competition in the long run (which is equal to Long-Run Average Cost or LAC)

By solving this equation, we can determine P_L as given below

$$E = \frac{P_L - P_C}{P_C}$$

$E * P_C = P_L - P_C$ …… (Cross multiplication)

$P_L = E * P_C + P_C$ …… (Interchanging sides)

$P_L = P_C(E + 1)$ …… (Taking common factor)

So, $P_L = P_C(E + 1)$

From the equation, when P_L=P_C, then E=0. This suggests that there is no barrier preventing the entry of firms. However, when P_L>P_C, E>0, indicates the presence of a barrier to entry. In this situation, firms can achieve significant excess profits.

4.2.2.4 Barriers to Entry of Firms in Oligopoly

Bain's theory explains the barriers that prevent the entry of new firms into the oligopoly market. These barriers are:

1. **Product Differentiation**: Product differentiation, gives firms some control over product pricing. This often involves advertising and other promotional efforts, impacting demand and costs. As consumers are loyal to specific brands, this is a major hurdle for new entrants. New firms must significantly lower their prices or invest heavily in advertising to overcome this. These actions can escalate costs, potentially leading to losses against established competitors.

2. **Absolute Cost Advantage**: Established firms in oligopolies often possess an undeniable cost advantage due to factors like skilled management, patents, superior production techniques, control over key materials, favourable borrowing terms, internal financing, and vertical integration. This relative advantage restricts new entrants, acting as a significant barrier.

- Barriers to entry in oligopoly

3. **Heavy Initial Capital Requirement**: A substantial barrier emerges from the need for significant initial capital. New firms often struggle to secure financing from banks or capital markets. They face higher borrowing costs compared to established competitors. This difficulty in raising capital impedes their entry and operations.

4. **Economies of Scale**: Established firms enjoy real (technical, managerial, and labour) and pecuniary (bulk buying, lower transport and selling costs) economies of scale. New entrants lack access to these efficiencies, forming a potent barrier to market entry.

4.2.2.5 Criticism

While J.S. Bain's contribution to firm theory and pricing strategies for preventing market entry is significant, certain aspects of his analysis have raised objections. They are:

- Objections to Bain's theory

1. **Collusive Pricing Basis**: Bain's pricing theory is fundamentally collusive. The firm with the lowest cost determines the price, while less efficient firms follow suit. In contrast to the traditional price leadership theory, where the leader aims to maximise short-term profits, in Bain's model, the leader's goal is to prevent new entries.

2. **Product Differentiation and Economies of Scale**: Bain identified product differentiation and economies of scale as significant entry barriers. However, he overlooked the fact that these factors might increase the likelihood of entry under specific conditions. Thus, his stance on their impact on entry is debatable.

3. **Complexity of Potential Entry Threat**: Bain's explanation of potential entry threat can be complex, making it challenging to understand and apply.

4. **Empirical Limitations**: Bain's empirical findings regarding entry issues possess significant limitations. He did not include crucial situations like cross-entry, takeovers, vertical integration, and capacity expansion by existing firms, all of which have a substantial impact on firms' pricing behaviour. These situations were not adequately addressed in his analysis.

In conclusion, Bain's limit pricing theory is important for

understanding market dynamics and strategic pricing. His work explains the complex relationship between established firms and potential new entrants, offering insights into the barriers that shape market competition. Bain's emphasis on limit pricing, where established firms set prices strategically to prevent new entrants, has provided a valuable framework for understanding competitive strategies within oligopolistic markets. However, while Bain's theory has significantly enriched our understanding, it is not without its critics. Despite these challenges, Bain's theory is important in offering valuable insights into the complex interplay between market structure, pricing strategies, and the dynamics of firm competition.

- Provides a valuable framework

4.2.3 The Model of Sylos – Labini

P. Sylos-Labini made significant contributions to the limit pricing theory, building upon the foundations laid by J.S. Bain. His modification of the theory introduced a more detailed analysis of the impact of economies of scale as a barrier to entry in oligopolistic markets. This refinement allowed for a clear understanding of the dynamics at play. One of the standout features of Sylos-Labini's contribution was his development of behavioural patterns of both established firms and potential entrants. This postulate, known as "Sylos's Postulate," formed a fundamental aspect of his model. It detailed the mutual expectations of established firms and potential entrants regarding post-entry market conditions, particularly prices and output levels, and the strategic interactions between existing players and newcomers. His model extended beyond price determination and explained the complex interplay between market structure, cost factors, and strategic behavior. This paved the way for a more accurate analysis of the conditions that governed firms' entry and pricing strategies within oligopolistic industries.

- Sylos-Labini's contribution to limit pricing

4.2.3.1 Assumptions of the Model

Sylos-Labini's limit pricing model is built upon a set of key assumptions. These assumptions serve as the framework through which he explores the dynamics of firm behaviour and market equilibrium. Let us examine each of these assumptions to gain a clearer understanding:

1. **Given Demand with Unitary Elasticity**: The model assumes that the market demand for the product is

predetermined and exhibits unitary price elasticity. This implies that changes in price result in proportionate changes in quantity demanded.

2. **Homogeneous Product**: The product being offered is uniform and lacks differentiation. This characteristic leads to a unique equilibrium price in the market.

3. **Plant Size and Economies of Scale**: The industry comprises three distinct plant sizes: small, medium, and large. Economies of scale are present as plant size increases, leading to lower production costs. However, the technology is considered rigid, making constructing a continuous Long-Run Average Cost (LAC) curve impossible. Instead, three distinct cost lines correspond to the different plant sizes.

4. **Price Leadership**: The largest firm with the lowest cost acts as the price leader in the industry. The price leader sets the price strategically, aiming to prevent the entry of new firms. Smaller firms are price-takers and cannot individually influence the price, but collectively, they can exert pressure on the price leader.

5. **Normal Rate of Profit**: It is assumed that each industry's profit rate is normal, meaning that firms earn an average profit.

6. **Leader's Knowledge**: The price leader possesses complete information about market demand and the cost structure of all plant sizes, enabling them to make informed pricing decisions.

7. **New Entrant's Plant Size**: When a new firm enters the market, it does so with the smallest available plant size.

8. **Sylos's Postulate**: Established firms expect new entrants to not enter if they anticipate their post-entry price falling below their Long-Run Average Cost (LAC). On the other hand, entrants expect established firms to continue producing the same quantity post-entry as before entry.

In this model, after the entry of a new firm, the product's market price decreases, leading to an increase in demand, which benefits the new entrant. Sylos-Labini's model thus provides a structured approach to understanding the effects of economies of scale, price leadership, and behavioural

expectations in shaping firms' entry and pricing strategies in oligopolistic markets.

4.2.3.2 Price Determination

In Sylos-Labini's model, the biggest and most efficient firm takes the lead in deciding the price. This leader understands the costs of different plant sizes and knows the industry's normal profit rate. With this insight, the leader sets a price that even the smallest and least efficient firms can accept. Moreover, this chosen price is designed to discourage potential new entrants to the market. This benefits the most efficient firms because they can maintain their dominance in the market. Since firms have varying costs, there are different minimum acceptable prices for each plant size. The key principle is that these prices should cover all costs and allow for a normal profit.

For each plant, the minimum acceptable price is given by:

$$\mathbf{P_i = TAC_i\ (1 + r)}$$

where P_i is the minimum acceptable price for the i^{th} plant size.

TAC_i is the total average cost for the i^{th} plant size and r is the normal profit rate of the industry.

- Strategic pricing approach

The carefully chosen price prevent the threat of new firms entering the market. If, however, an entrant decides to join the market despite the conditions, the market price, based on the limit price, will fall below the entrant's minimum acceptable price. This minimum acceptable price is equivalent to the minimum price for the smallest firm or the least efficient plant size. The mechanics of Sylos-Labini's limit pricing model can be understood through the figure given below.

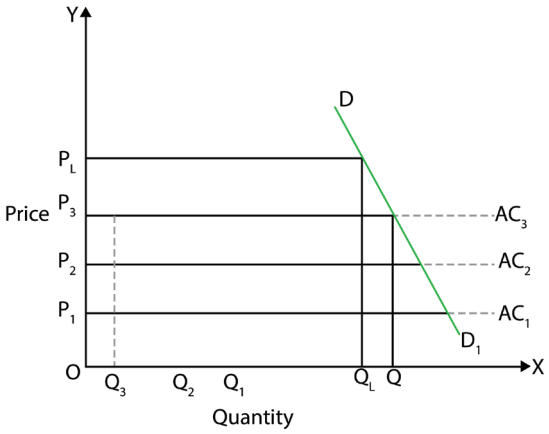

Fig. 4.2.5 Price Determination

This diagram's horizontal axis represents quantity, while the vertical axis represents price. DD_1 represents the market demand curve, while AC_1, AC_2, and AC_3 denote the average cost curves for large, medium, and small-sized plants. At the price denoted as P_3, which is the minimum acceptable price for the smallest, least efficient firm, the corresponding market demand is represented by OQ. Given the minimum average cost (AC_3), the output from the small-sized plant is OQ_3. It is important to note that since the price set by the most efficient firm must also be acceptable to the least efficient one, it must be positioned above P_3. Let us consider that the limit price is defined as P_L, where $P_L > P_3$. This limit price correlates with an OQL = OQ - OQ_3 output level—notably, the limit price PL safeguards against the threat of entry. If any firm entered the market at this price, the total supply would exceed OQ, causing the price to dip below the average cost (AC_3) of the smallest or least efficient firm. Assuming that a new entrant's average cost aligns with that of the small-sized plant (AC_3), this entrant would experience losses and consequently be discouraged from entering the industry. A crucial observation is that all firms achieve excess profits at the limit price P_L. This limit price functions as the upper limit that effectively prevents the entry of new firms. However, this price must not fall below P_3, as that would be unacceptable to the small-sized, least efficient firms. Regarding output, any level exceeding OQ_L effectively serves as a barrier against entry. Conversely, any output smaller than OQ_L fails to prevent the entry of new firms into the industry.

- Limit price: safeguard against entry

The Sylos-Labini model highlights several key determinants that influence the entry-preventing price, shedding light on the strategic pricing dynamics of oligopolistic markets. They are:

1. **Absolute Size of the Market**: According to Sylos-Labini, there is an inverse relationship between the size of the market and the entry-preventing price. In simpler terms, as the market expands and becomes larger, the limit price (or the price set by the leader to prevent new entrants) tends to decrease. This phenomenon occurs because a larger market provides room for increased competition, prompting the leader to adjust the price strategically to prevent new entrants from entering the market.

2. **Price Elasticity of Demand**: There is a negative relationship exists between the limit price and the price

elasticity of demand. When the demand for a product is highly elastic (meaning that consumers are highly responsive to changes in price), the leader must set a lower price to discourage potential entrants. In other words, a product with elastic demand requires a lower limit price to prevent the threat of new firms entering the market.

- Entry-preventing price determinants

3. **Technology of the Industry**: The technology employed within the industry substantially influences the entry-preventing price. This is largely because technology dictates the available plant sizes and the associated average costs. The larger the minimum plant sizes results in higher average costs, which, in turn, necessitate a higher price to prevent new entrants to the market.

4. **Prices of Productive Factors**: The prices of the factors of production (such as labour, raw materials, and capital) determine the entry-preventing price in the industry. Changes in factor prices impact all firms within the industry uniformly. In cases where factor prices increase, the average costs of firms also rise, leading to an increase in the entry-preventing price across the industry. Conversely, a decrease in factor prices will reduce the entry-preventing price.

4.2.3.3. Criticism

The Sylos-Labini model, while offering valuable insights into entry-preventing pricing strategies in oligopolistic markets, has faced substantial criticism on various fronts. They are:

1. **Unrealistic Assumptions**: The model's foundation is built upon several assumptions. These assumptions include the unitary elastic demand, rigid technology with strong discontinuities, and the naive methodological approach. These unrealistic assumptions weaken the model's applicability to real-world scenarios.

2. **Validity of Sylos's Postulate**: Critics argue that maintaining pre-entry quantities may not always be the most effective approach for established firms to counter potential entrants. Alternative strategies, such as retaliation or mixed strategies, might be more realistic and strategic.

3. **Weakness in Relaxed Assumptions**: The model's validity remains questionable even when some assumptions are relaxed. This highlights a fundamental weakness in the model's structure and its ability to capture the complex dynamics of entry prevention.

4. **Irrelevance for Established Entrants**: If the entering firm is already established in the same industry or another, the significance of scale barriers diminishes. The model's focus on scale barriers becomes less relevant in such cases.

5. **High Limit Prices and Scale Economies**: Setting the limit price too high can lead to increased entry possibilities due to the potential benefits of scale economies. This contradicts the model's primary statement about preventing entry through limit pricing.

6. **New Firm Strategies**: The model fails to consider scenarios where new entrants could overcome scale barriers by leveraging advanced production methods, better plant locations, or other innovative strategies. This weakens the model's practical applicability.

7. **Static Nature**: The model's static nature limits its ability to explore the long-term consequences and implications of implementing an entry-prevention strategy. It lacks insight into the dynamic changes that might occur over time.

8. **Lack of Justification**: The model does not provide a strong justification for adopting an entry-preventing policy. This absence of rationale weakens the theoretical underpinning of the model.

9. **Detailed Information Assumption**: The assumption that the price leader possesses detailed and accurate information about cost structures, market demand, and acceptable profit limits may not align with the reality of imperfect information and uncertainty that firms often face.

- Oligopoly analysis with limitations

The Sylos-Labini model of limit pricing offers a valuable framework for analysing the strategic behavior of firms in oligopolistic markets. By focusing on the concept of entry prevention through price setting, the model sheds light on the dynamics of competition and barriers to entry. However, the

model is not without its limitations and criticisms. Despite these limitations, the model provides a foundational understanding of how price leadership and entry prevention can shape the behavior of firms in concentrated markets.

While finding a real-life example that perfectly mirrors the Sylos-Labini limit pricing model due to its simplified assumptions is challenging, we can draw an illustration for it. Imagine a scenario similar to the global soft drink industry, with major players like Coca-Cola (representing the price leader), PepsiCo, and Dr. Pepper Snapple Group. In this, the soft drink market exhibits unitary price elasticity, meaning consumers are highly responsive to price changes. The technology for soft drink production has economies of scale, with larger production facilities benefiting from lower costs. Still, there are distinct cost structures for small, medium, and large-scale production plants. As the dominant player with the most efficient production facilities, Coca-Cola takes on the price leader role. Coca-Cola strategically sets its prices at a level that accommodates even the smallest competitor, like Dr. Pepper Snapple Group. The prices set by Coca-Cola are carefully calculated to ensure that they are above what would make it unattractive for Dr. Pepper Snapple Group to enter the market and compete profitably. This strategy protects Coca-Cola's market dominance. The limit price, as determined by Coca-Cola, serves as a barrier to entry for potential competitors. New entrants considering entering the soft drink market face the daunting challenge of competing against established giants like Coca-Cola, knowing that the market price is strategically set to discourage new competition. In this way, Sylos-Labini's limit pricing model can be related to the soft drink industry. While this analogy helps convey the essence of the Sylos-Labini model in a real-world context, it is important to note that a multitude of factors beyond the simplified assumptions of the model influences the actual pricing dynamics in the soft drink industry.

- Soft drink industry analogy

Summarised Overview

The concept of average-cost pricing in economics is a significant approach that offers insights into how firms determine their prices based on their cost structures. It presents an alternative perspective to traditional profit-maximisation and aims to cover all production costs while ensuring a reasonable profit. A 'representative' model simplifies the complexities of real-world business environments to understand how firms set prices, providing a foundational understanding of pricing principles. This model proposes setting prices based on average total cost, incorporating a profit margin. Empirical evidence shows that prices often do not immediately adjust to changes in costs or demand, indicating that firms may have multiple goals beyond profit maximisation.

Bain's limit pricing theory, addresses the intriguing phenomenon of firms maintaining prices below the point of unitary demand elasticity over extended periods. This behaviour deviates from conventional profit-maximising pricing models and is driven by the strategic consideration of potential new market entrants. Bain argued that traditional economic theory failed to account for this because it focused solely on actual entry, overlooking the role of barriers to entry in shaping pricing decisions. He proposed the concept of the "limit price," strategically set above competitive pricing but below monopoly pricing, to deter new entrants while ensuring steady profits. The theory explores scenarios of collusion and non-collusion with new entrants, highlighting the importance of entry barriers, product differentiation, economies of scale, and initial capital requirements in pricing strategies within oligopolistic markets. While Bain's theory has significantly contributed to understanding market dynamics and strategic pricing, it has also faced criticism, particularly regarding its collusive pricing basis and treatment of certain entry barriers.

Sylos-Labini's limit pricing model builds upon J.S. Bain's theory, offering a refined analysis of entry barriers in oligopolistic markets. Central to Sylos-Labini's model is the "Sylos's Postulate," which illuminates the mutual expectations of established firms and potential entrants regarding post-entry market conditions. This model assumes unitary price elasticity of demand, a homogeneous product, and varying plant sizes with economies of scale. It designates the largest and most efficient firm as the price leader, strategically setting a price to deter new entrants while ensuring profits for all firms. The model's key determinants of the entry-preventing price include market size, price elasticity of demand, technology, and factor prices. Despite its insights, the model has been criticised for its unrealistic assumptions, the validity of Sylos's Postulate, and its static nature.

Self Assessment

1. Explain the concept of the average cost in the context of an industrial organisation.
2. Discuss Bain's limit pricing strategy.
3. Explain how a firm can use this strategy to deter potential entry by competitors.
4. Outline the main features of the Sylos-Labini model of pricing.
5. Compare and contrast Bain's limit pricing strategy with the Sylos-Labini pricing model.

Assignments

1. Choose a specific industry or company and analyse how they apply average-cost pricing strategies. Discuss the factors that influence their pricing decisions and how this approach impacts their competitiveness and profitability
2. Choose a multinational corporation operating in India and analyse its pricing strategy. Research and present a case study of a firm that has successfully achieved long-term profit maximisation through average-cost pricing.
3. Write an essay that explores the differences between the models of limit pricing proposed by Bain.
4. Write a comprehensive essay that evaluates Bain's limit pricing theory. Discuss its contributions to the understanding of pricing strategies in oligopolistic markets, as well as its limitations. Use examples and empirical evidence to support your analysis and conclusions.

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Suggested Readings

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 3
Managerial Decision-Making and Organisational Behaviour

After completing this unit, the learner will be able to:

- familiarise with the concept of Baumol's Sales maximisation theory
- gain insights into the Marris model of managerial enterprise
- learn Williamson's concept of managerial discretion
- familiarise the Behavioural Model of Cyert and March

Background

Managerial theories of the firm provide valuable insights into the complicated dynamics that shape how businesses operate and make decisions. This foundation of managerial theories of the firm, comprehend the multifaceted dynamics of modern businesses. Managerial theories view a firm as a 'coalition' of individuals with different goals, such as managers, workers, stockholders, etc. To ensure the firm's survival, conflicts among these groups need resolution, often by top management. Key decisions and information access are in the hands of top management, who hold the most influence. In managerial business model, ownership is separate from management. Shareholders appoint the board of directors, who then select top management. Top management, often on the board, influences appointments through proxy voting. This can lead to self-perpetuating management if profits are acceptable, firm growth is reasonable, and dividends maintain shareholder contentment and share prices. This prevents takeover attempts. When ownership is separate from management, top management can pursue goals beyond profit. In all managerial theories, managers prioritise their utility within this profit-constraint framework for job security.

Apple is a multinational technology company known for its innovative products like the iPhone, iPad, and MacBook. The ownership of Apple is widespread, with a diverse base

of shareholders, including institutional investors like mutual funds and individual retail investors. In Apple's case, the top management, including the CEO and the board of directors, holds significant power and decision-making authority. Shareholder meetings often see limited participation from individual shareholders, and board elections are typically conducted using proxies. This gives top management substantial influence over director appointments. Apple's managers, including the CEO, prioritise their interests, often tied to substantial compensation packages, stock options, and bonuses linked to short-term performance metrics. They aim to maximise their utility and job security while operating within the company's financial obligations and shareholder expectations. Apple's operation explains how managerial theories of the firm play out in practice. It highlights the complex dynamics where top management balances self-interest with the need to meet financial goals and ensure the company's long-term success in a context where ownership is distinct from management, and various stakeholders' interests must be carefully managed to maintain the firm's growth.

Keywords

Sales Maximisation, Growth Maximisation, Principal-Agent Relationship, Managerial Discretion, Bounded Rationality

Discussion

4.3.1 Baumol's Sales Maximisation

- Sales revenue maximisation theory

Professor William J. Baumol, in his prominent work titled "Business Behavior, Value, and Growth" published in 1967, introduced the managerial theory based on sales maximising. According to this model, the company's goal is to maximise the amount of money it makes from sales, while still ensuring a certain profit level. This minimum profit requirement is set based on what the shareholders expect. The reason for wanting to maximise sales is because managers of big companies can benefit more from this approach than just trying to maximise profits. When a company focuses on increasing sales, it grows bigger. This can make managers more important and improve their chances of getting promoted. Simply put, aiming for higher sales can be better for managers than only trying to

make the most profit.

- Amazon's growth-oriented strategy

Amazon, followed a strategy similar to Baumol's sales revenue maximisation model. Starting by Jeff Bezos in the US, Amazon cared more about selling a lot and growing instead of making big profits immediately. At the beginning, Amazon focused on getting lots of customers by offering many products at good prices and improving how they helped customers. Amazon focused on growing and getting more customers. It used the money it made to improve how it worked and to sell more things. As Amazon got bigger, the people in charge became more important. They were the ones making sure Amazon grew and worked well. This made them more valuable in the company. Even though Amazon later started making more profit, it first focused on growing and selling a lot.

- Managers prioritise maximising sales

According to Baumol, firms aim to maximise sales for a few reasons. In many modern companies, managers make decisions separate from owners. Baumol thinks managers often choose to maximise sales because it makes sense to them. Managers there often cared more about selling a lot than just making profit. There are a few reasons why managers might think this way. Managers prioritise maximising sales due to several reasons:

Pay and Recognition: Managers' earnings and bonuses tend to relate more to sales than to profits.

Financial Support: Banks and financial institutions prefer funding firms with strong, growing sales.

Employee Satisfaction: Growing sales lead to better wages and work conditions for employees, while declining sales can lead to salary cuts and job losses, causing unhappiness.

Manager Prestige: Managers gain recognition from large and growing sales, while profits benefit shareholders.

Stability: Managers prefer steady performance with decent profits over risky strategies focusing only on maximising profits.

Competition: Strong, increasing sales give companies a competitive edge while losing market share weakens their position against rivals.

- Baumol's theory focuses on sales revenue maximisation

Managers maximise sales for the sake of their earnings, financial backing, employee happiness, status, stability, and competitiveness. Managers, especially top ones, tend to avoid significant risks, which might slow economic growth. Generally, big companies have research teams that develop new ideas for products or ways to make things. They introduce these changes gradually to avoid big ups and downs in the company's performance. Baumol'sales revenue maximisation theory presents a different perspective on how firms operate by focusing on maximising sales revenue, rather than the traditional objective of profit maximisation. This theory suggests that firms balance revenue generation and cost management to ensure long-term viability and growth.

4.3.1.1 Baumol's Models

The theory is explained through static and dynamic models, each shedding light on different aspects of a firm's behavior. In the static model of Baumol's theory, the firm operates in a fixed time frame, making decisions to maximise sales revenue subject to cost constraints. The key premise is that managerial compensation is linked to sales revenue, motivating managers to pursue higher revenue levels. Firms determine an optimal output level that maximises the difference between total revenue and total cost, while considering resource limitations. This model highlights the trade-off between higher sales and the associated production and operation costs. It also emphasises that firms can deviate from pure profit maximisation due to managerial objectives.

The basic assumptions of the static models are:

- Static model: revenue *vs* cost

- The firm thinks only about what happens in one period.
- In that period, the firm wants to make the most sales money while still having some profit.
- There is a minimum profit the firm needs to make. This is set by what shareholders, banks, and other financial places expect. If profits go below this minimum, managers might lose their jobs, and the company's stock price might drop.
- The models use regular ideas for costs and earnings. Like, costs go down, then up again, and when the company charges more for something, people buy less of it.

The dynamic model extends the analysis over time, considering how firms adapt their strategies to changing circumstances. Baumol's dynamic theory introduces the concept of the "sales revenue growth rate" as a key performance indicator. Firms strive to balance maintaining current sales levels and investing in activities that foster future growth. The theory suggests that firms allocate resources to innovation, advertising, and research to sustain competitive advantage and revenue growth. This model acknowledges that investment decisions have implications for both current and future sales revenue.

We will examine four static models suggested by Baumol:

1. A single-product model without advertising.
2. A single-product model with advertising.
3. A multiproduct model without advertising.
4. A multiproduct model with selling activities.

Model I: A Single-Product Model Without Advertising

In this model, firms aim to determine the optimal level of sales or output for a single period while facing fixed costs. The goal is to balance maximising revenue and minimising costs, considering the constraints posed by fixed costs and production capacity. The total cost curve and total revenue curve according to the above discussed assumptions is shown in the figure given below.

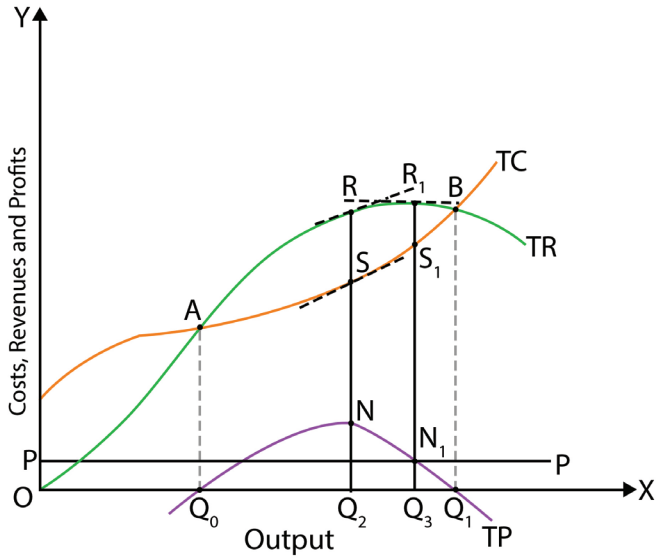

Fig 4.3.1 Single-Product Model, without Advertising

- Profit *vs* Sales balance

In the figure given above, you will find output shown from left to right and costs, revenues, and profits shown from bottom to top. Two points, A and B, represent where the company covers its costs without making extra profit. At OQ_0 and OQ_1, the company just breaks even without any extra profit. However, at OQ_2, the company makes the most profit and marginal revenue is exactly the marginal cost. There is a line, TP, that tracks the total profit. This line touches Q_0 and Q_1, indicating no profit, but it reaches its highest point at Q_2, where profit is maximised. The horizontal line, PP, signifies the company's desired profit level. If the actual profit falls below this line, the company is unsatisfied. Regarding sales, the peak is at point R_1 or output level OQ_3. Drawing a line tangent to the total revenue line at R_1 (where MR = 0) shows where sales are at their highest. The company aims to balance making a profit with selling as much as possible.

Here are the simplified conclusions drawn from the single-product model without advertising:

- Maximising sales *vs* profits

- The company focused on maximising sales produces more output (OQ1) than the profit-maximising approach (OQ_2).
- When aiming to maximise sales, the price set for the product is lower than what is set for profit maximisation.
- Profits achieved by the sales-maximising approach are lower than those achieved by the profit-maximising strategy. In the figure the profits of the sales-maximising approach (N_1Q_3) are less than those of the profit-maximising approach (NQ_2).
- The sales-focused company avoids producing at an output level where the price elasticity of demand (E_p) is below 1, meaning customers are not responsive to price changes. They prefer output levels where customers respond more to price changes ($E_p > 1$).

Model II: A Single Product Model with Advertising

Baumol recognised that in an oligopolistic market structure, prices and output are influenced by non-price competition, where advertising plays a major role.

Here are the key assumptions in his single-product model with advertising:

- Model with advertising

- The firm's primary objective is to maximise sales while ensuring a minimum profit.
- The price of the product is assumed to remain consistent. However, it is worth noting that this is a simplification for modelling purposes.
- Increased advertising spending leads to higher sales revenues. This means that advertising causes the demand curve to shift to the right, resulting in increased quantity sold and greater sales revenues.
- The total costs the model considers include production and advertising expenses.
- The production costs are not influenced by the advertising expenses. In other words, the costs of making the product are not affected by how much is spent on advertising.

Model with advertising

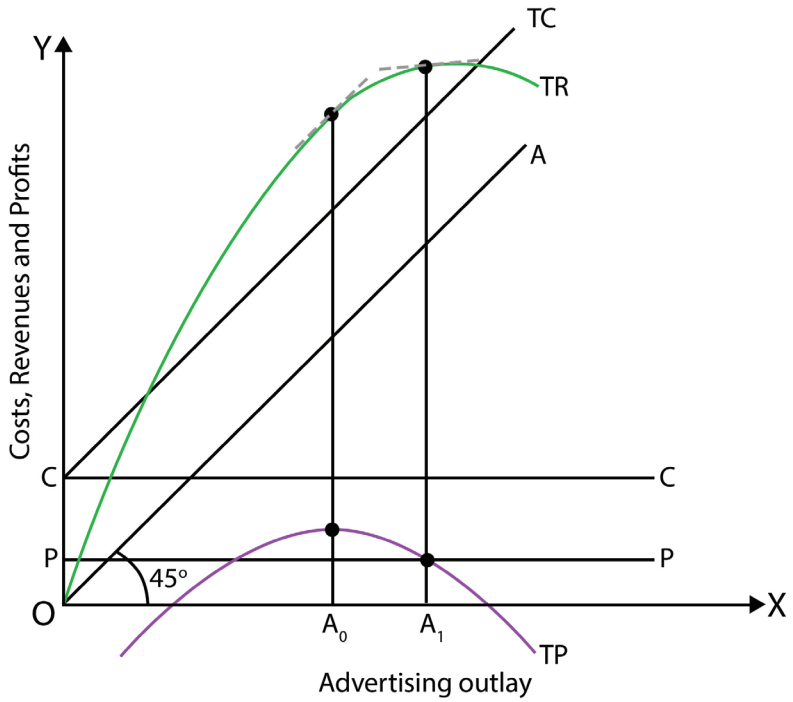

Fig 4.3.2 Single Product Model with Advertising

In the above figure, the amount spent on advertising is shown on the horizontal axis, while revenues, costs, and profits are measured on the vertical axis. The curve labelled CC

represents the production cost, assumed to be unaffected by advertising. The line OA represents the advertising function and is set at a 45-degree angle. The combined vertical representation of CC and OA gives us the total cost curve TC, which becomes a direct function of advertising expenditure. The line PP signifies the minimum profit requirement. Profits reach their maximum point at advertising outlay A_0. Similarly, the highest total revenues or sales correspond to advertising outlay A_1, given the minimum profit constraint. The curve TP represents the total profit. The advertising outlay OA_1 for the sales-maximiser is greater than the advertising outlay OA_0 for the profit-maximiser. A key assumption in Baumol's model is that production costs remain unaffected by advertising. This implies that advertising does not change the production costs. Consequently, the total output remains constant despite advertising. This can result in an increase in sales revenue due to a rise in price. This suggests that advertising does not impact price. However, in reality, the increase in revenue is a result of increased output. Baumol's single product model with advertising does not explicitly reveal the price implications of increased advertising expenditure.

- Baumol's advertising model

Model III: Multi-product Model without Advertising

In the oligopolistic market structure, firms produce multiple products and utilise various resources. Baumol's model addresses the equilibrium of a firm that deals with multiple products.

The model is based on several assumptions:

- The primary objective of the firm is to maximise sales.
- The firm produces two goods labelled as X and Y.
- A predetermined quantity of resources or inputs is available to the firm.
- The firm allocates these resources to produce both goods that maximises sales revenue.
- There is no allocation for advertising expenditure in this model.

- Multi-product model

The equilibrium of the sales-maximising multiproduct firm is

explained through the figure given below.

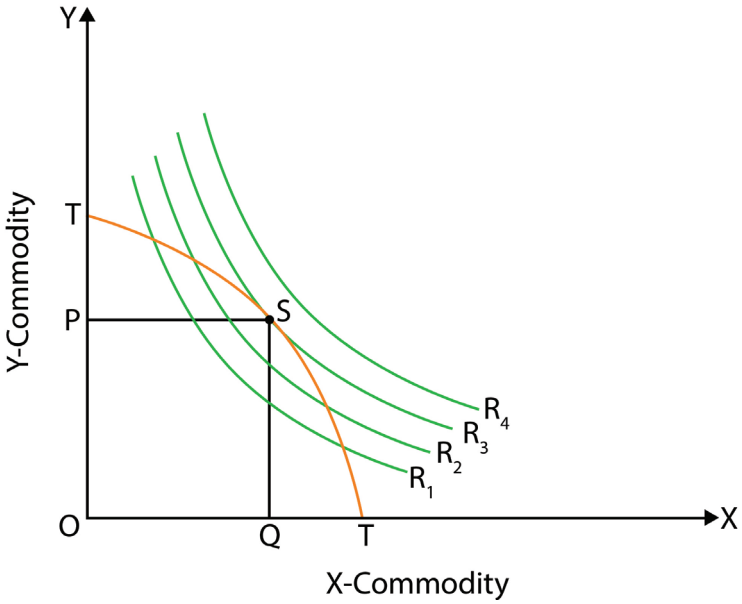

Fig 4.3.3 Multi-Product Model without Advertising

In the figure above, the horizontal axis represents the quantity of the X-commodity, while the vertical axis represents the quantity of the Y-commodity. The curve labelled TT is the product transformation curve, curving downwards and concave towards the origin. This curve illustrates the relationship between producing the two commodities. The slope is represented by the marginal rate of product transformation (MRT_{YX}), which is determined by the ratio of the marginal costs associated with producing the two commodities.

$$MRT_{Y.X} = \frac{-MC_X}{MC_Y} = \frac{-\frac{\partial C}{\partial X}}{\frac{\partial C}{\partial Y}}$$

The lines labelled R_1, R_2, R_3, and R_4 in the graph represent iso-revenue curves. An iso-revenue curve illustrates various combinations of the two commodities that yield the same total revenue for the firm. When an iso-revenue curve is situated farther from the origin, it signifies a greater total revenue the firm achieves. The slope of an iso-revenue curve is determined by the ratio of the marginal revenues associated with the two commodities.

The slope of the iso-revenue curve $= \frac{\frac{\partial R}{\partial X}}{\frac{\partial R}{\partial Y}} = \frac{MR_X}{MR_Y}$

- Product transformation curve and iso-revenue curves determine equilibrium

The firm's equilibrium is established at point S, where the product transformation curve coincides with the iso-revenue curve R_3. At this balanced point, the sales-maximising firm produces an amount of X-commodity represented by quantity OQ and an amount of Y-commodity denoted by quantity OP. Notably, this equilibrium outcome aligns with the equilibrium of a profit-maximising firm. In scenarios where the costs and resources are not identical between the two types of firms, the equilibrium solution for a multi-product sales-maximiser would differ from that of a multi-product profit-maximiser.

Model IV: Multi-product Model with Advertising

In this model, the multi-product firm engages in advertising expenditures. The primary objective of the firm is to optimise its sales revenue while adhering to a minimum profit requirement. The approach to arriving at a solution within this model is as follows:

Maximise $\mathbf{R = f (X_i, X_j, A)}$,

where R is the sales revenue, Xi and Xj are the output levels of i^{th} and j^{th} products, and A is the advertising expenditure on two products.

Subject to constraint, $\mathbf{M = R - C - A}$

where, M is the profit and C is the total production cost.

The equilibrium condition is,

$$\frac{\frac{\partial R}{\partial a_i}}{\frac{\partial R}{\partial a_j}} = 1$$

or

$$\frac{\partial R}{\partial a_i} = \frac{\partial R}{\partial a_j}$$

The condition mentioned above indicates that the marginal

- Marginal revenue equality

revenue from advertising one product must be equal to the marginal revenue from advertising another product. If this condition is not met, the firm can enhance its total revenue (R) by reallocating its overall advertising expenditure (A) among its various products. The firm would allocate more advertising budget to those products for which the marginal revenue is higher and reduce it for products where the marginal revenue is lower. Furthermore, this concept can be extended to account for simultaneous adjustments in both advertising and production levels, especially when the firm can achieve surplus profits through such actions.

4.3.1.2 Criticisms

Baumol's sales maximisation theory, has faced criticism on several fronts such as:

Assumption of Price and Expansion Control: Critics argue that Baumol's theory assumes that firms have control over their pricing and expansion policies. This assumption overlooks the interdependence and competition between firms in oligopolistic markets, where actions by one firm can trigger reactions from others.

Neglect of Actual and Potential Competition: It does not consider that encroaching on the market shares of other firms, either in the same industry or in other industries, can lead to reactions that limit a firm's ability to increase sales.

Long-Term Profit Maximisation: Critics like M.H. Peston argue that sales maximisation is not necessarily incompatible with long-term profit maximisation. A firm might be willing to maintain high sales levels even if they are unprofitable in the short run, with the hope that the product will become profitable once it establishes a market presence.

Data Availability and Disclosure: Testing the sales maximisation hypothesis against other behavioural hypotheses can be challenging due to the need for detailed demand and cost function data, which firms may not disclose or even possess.

Equivalence of Sales and Profit Maximisation: Baumol assumes that in the long run, sales maximisation and profit maximisation will yield the same outcomes. However, this

generalisation lacks sufficient empirical support and may not hold in all cases.

Equilibrium in an All Sales-Maximising Industry: Baumol's model does not explain how an industry consisting entirely of sales-maximising firms would reach equilibrium.

Steep Kink in Demand Curve: Some critics, like Shephard, argue that a steep kink in the demand curve could make both profit maximisation and sales maximisation compatible. However, others, like Hawkins, disagree and suggest that a steep kink could improve the precision of Baumol's model.

Welfare Implications: Baumol claimed that his model would increase societal welfare by promoting larger output compared to profit maximisation. Critics dispute this claim, asserting that it may not necessarily lead to improved resource allocation and societal welfare.

Empirical Evidence: While empirical studies related to various aspects of Baumol's theory have been conducted, conclusive evidence either in support of or against the sales maximisation hypothesis remains limited.

Baumol's theory of sales maximisation provides a valuable perspective on the objectives and behavior of firms, particularly in oligopolistic markets. It highlights the idea that firms may prioritise sales growth over profit maximisation, driven by a desire to maintain market share, prestige, or other non-monetary goals. However, this theory has faced criticism for its simplifying assumptions and limitations in explaining real-world complexities. Baumol's theory serves as a reminder that the objectives of firms can be diverse and dynamic, and the pursuit of sales maximisation can be a rational strategy under specific circumstances. However, its practical application and relevance in modern, complex markets require careful consideration of its assumptions and limitations, as well as a broader understanding of the factors shaping firm behavior.

- Sales maximisation theory criticism

Reliance Industries Limited has historically prioritised aggressive sales growth and market expansion across various sectors, including petrochemicals, telecommunications, retail, and more. For instance, in the telecommunications sector, Reliance Jio, a subsidiary of Reliance Industries, entered the market with a focus on rapidly acquiring customers by

offering affordable data and voice services. While initially incurring substantial capital expenditure and minimal profits, Reliance Jio aimed to maximise its subscriber base and market presence. This strategy disrupted the Indian telecom industry and led to significant sales growth for the company. Similarly, in the retail sector, Reliance Retail has pursued an expansion strategy by opening a wide network of stores and acquiring other retail chains. The goal is to increase sales volume and market penetration, even if it means operating with lower short-term profit margins. Reliance Industries' approach aligns with the concept of sales maximisation, emphasising rapid growth and market dominance over immediate profit maximisation. This strategy has allowed the company to establish itself as a major player in various industries in India and showcases how an MNC can operate in line with Baumol's sales maximisation theory.

- Reliance industry's sales maximisation strategy

4.3.2 Marris Model of Managerial Enterprise

Robin Marris in his book "The Economic Theory of Managerial Capitalism" (1964) has developed a balanced growth maximising model of the firm. He focuses on the idea that large modern firms are managed by managers, while shareholders are the owners who decide how the firm is run. Managers want the firm to grow fast, and shareholders want to get high dividends and see the value of their shares increase. To connect this growth rate with the firm's share prices, Marris comes up with a balanced growth model. In this model, the manager picks a steady growth rate. This rate affects how the firm's sales, profits, and assets all grow over time. If the manager decides on a higher growth rate, they will need to spend more on advertising and research to create more demand and new products. This means they will keep more of the profits to make the company bigger. But this also means they will have less money to give shareholders as dividends. Managers might also worry about someone taking over the firm. Since managers care a lot about their job security and the firms' growth, they will choose a growth rate that makes the share prices high, gives shareholders decent dividends, and stops the firm from being taken over. Owners (shareholders) also want the firm to grow steadily so that they get good returns on their investment. So, both managers and owners aim for a balanced growth of the firm that suits them both.

- Balanced growth model

Infosys, one of India's largest IT services companies, follows the principles of the Marris model. The company's managers

- Infosys's balanced growth model

focus on steady growth in demand for their IT services, achieved through continuous innovation, global expansion, and diversification into new technology domains. This growth strategy is evident in Infosys's consistent efforts to create cutting-edge solutions, expand its client base, and explore emerging technologies like artificial intelligence and cloud computing. At the same time, Infosys maintains a strong financial position, characterised by a healthy balance sheet and a conservative approach to debt. This financial stability ensures job security for its managers, as financial stability is a key component of their utility function. Infosys consistently provides dividends to shareholders, showing its commitment to balancing growth with profitability. The company's share price has also seen steady increases over the years, aligning with the objectives of its shareholders.

4.3.2.1 Goals of the Firm

In Marris's model, the firm's main aim is to make sure its growth is steady and balanced. This means the firm wants to grow its products' demand and its capital supply. That is explained as follows:

Maximise, $\mathbf{g = g_D = g_c}$

where g = balanced growth rate,

g_D = growth of demand for the firm's products

g_c = growth of the capital supply

- Growth limitations

In aiming for this balanced growth, the firm faces two limitations. Firstly, it depends on the skills and abilities of its managerial team. Secondly, there is a financial constraint tied to managers' wish for strong job security. These constraints are examined in another part. The reason behind this goal is that when both demand and capital growth are maximised, the managers not only boost their own well-being but also benefit the owners (shareholders). Managers think about things like their salary, status, power, and job security, while owners focus on profits, company size, capital, market share, and public image. So, managers aim to maximise their own well-being.

$\mathbf{U_M = (salaries, power, status, job\ security)}$

while the owners seek their own utility maximisation

U_0 = f* (profits, capital, output, market share, public esteem).

Marris argues that managers and owners have somewhat similar goals, despite what other managerial theories suggest. Marris's model focuses on situations where the company grows at a steady rate over time. In this scenario, aiming to maximise the growth rate of one measure is pretty much like aiming to maximise the growth rate of others too. Size and growth rate do not always mean the same thing for managers' satisfaction. If they were the same, managers could easily move from one company to another without much preference, as long as the earnings and status were the same. Studies show that managers prefer getting promoted within the same growing company rather than going to a bigger one. Marris says that since growth is usually good for shareholders too, it makes sense to aim for a high growth rate. There is no need to separate the growth rate of demand (which managers like) from the growth rate of capital supply (which shareholders like) because they end up being the same in balance.

- Owners and managers goals

The utility function of owners can be written as follows:

U_{owners} = f*(gc)

where gc = rate of growth of capital.

Marris suggests that growth and profits do not always go together. Moreover, Marris seems to assume that managers' salaries, status, and power are closely linked to how fast the company's product demand grows. Faster growth usually means higher salaries and more prestige for managers. Managerial utility function may be written as follows

$U_M = f(g_D, s)$, where g_D = rate of growth of demand for the products of the firm and

s = a measure of job security.

Marris, inspired by Penrose, says that a constraint on the growth rate (g_D) of a company is set by the decision-making ability of its managers. He also suggests that 's', representing job security, can be figured out using three key ratios: liquidity, debt, and profit retention. These ratios show how the firm

handles its finances. Thus, the managerial utility function becomes

$$U_M = f(g_D)s$$

where s is the security constraint.

4.3.2.2 Constraints in the Model

In the initial model, there are two constraints: one from the management team's capacity and another from job security. These show up in a financial constraint. Let us look closely at these constraints.

The Managerial Constraint:

- Managerial constraints on growth

The constraint is set by the management team's capacity at any given time. The company's growth is restricted by how much growth the management team can handle effectively. This teamwork needs experience, and new managers need time to become part of this efficient team. So, the "managerial ceiling" slowly moves, but it cannot be sped up. This the company's 'research and development' (R&D) department comes up with new ideas and products that affect product demand. R&D work is teamwork, and just hiring more people does not make it efficient quickly. New scientists and designers need time to contribute effectively to the R&D department. So, both the management constraint and the R&D capacity limit how fast the company's demand growth (g_D) and capital supply growth (g_c) can be.

The Job Security Constraint:

- Job security and financial stability

Managers want job security and do not like the idea of being dismissed. They do not want risky policies that could make them lose their position. To feel secure, they prefer things like service contracts and good pension plans. Marris thinks that being safe in your job is possible by being careful with finances. Managers can get dismissed if their decisions make the company fail financially (go bankrupt) or make it an attractive target for takeovers. In the first case, shareholders might bring in new managers to turn things around. In the second case, if a takeover happens, the new owners might replace the old managers.

Managers avoid borrowing too much because if the firm

- Balanced liquidity ensures security

cannot pay back loans and interest, even if it is doing well, it could end up insolvent and declared bankrupt. Having the right liquidity policy is important for every firm. If the liquidity ratio is too low, there is more risk of going bankrupt. But if it is too high, the company might become a target for takeovers. The raiders could use excess cash to boost their own businesses. So, managers need to find a balance in the liquidity ratio – not too high or too low. In Marris's model, he assumes that more liquidity means more security, which might not always be true, but it is how he works with the idea.

- Profits sustain capital growth

In Marris's view, the most important source of funding for capital growth is retained profits. However, the firm cannot keep all profits because it needs to pay shareholders enough to keep them happy and maintain share prices. If profits are low and share prices drop, the firm might be vulnerable to takeovers, putting managers' positions at risk. Managers blend the three financial ratios (debt, liquidity, retention) into one measure called the 'financial security constraint' (a). They do this in a way they feel is right, considering their risk attitude. Marris does not explain exactly how they decide on 'a,' but it's like a weighted average of the ratios, with the weights based on managers' choices.

4.3.2.3 The Model

Managers strive to maximise their own utility, which depends on the growth of demand for the firm's products, considering the security constraint.

$$U_{managers} = f(g_D)$$

The owners or shareholders aim to maximise their own utility, which Marris suggests is influenced by the rate of growth of the firm's capital supply (not just profits, as traditional theory assumed).

$$U_{owners} = f(g_C)$$

The firm reaches equilibrium when it achieves the maximum balanced-growth rate. In other words, equilibrium is reached when the following condition is met:

$$g_D = g_C — g^* \text{ maximum}$$

The initial step in solving the model involves deriving the 'demand' and 'supply' functions, which means identifying the factors that influence the growth rates g_D and g_C.

Marris shows that these growth rates, g_D and g_c, can be defined in relation to two variables: the diversification rate (d) and the average profit margin (m).

The Instrumental Variables:

The firm's process begins by deciding on its financial strategy, represented by the value of the financial constraint a. Subsequently, it selects the diversification rate (d) and the profit margin (m) that result in maximising the balanced-growth rate g*.

The policy variables in the Marris model are the following:

- Financial Policy (a): The firm has the freedom to choose its financial strategy, affecting growth through adjustments in security ratios (leverage, liquidity, dividends).
- Diversification Rate (d): The firm can modify its product range or expand it to influence the diversification rate.
- Price Determination: In Marris's model, price is influenced by the oligopolistic industry structure. The equilibrium price is achieved through tacit collusion or competitive strategies like advertising and product variation.
- Advertising (A) and Research & Development (R&D): The firm can control the level of advertising and R&D spending. Higher spending lowers the average profit margin, while lower spending increases it. This aligns with the average-cost pricing rule in the model.

- Policy variables in Marris model: 'a,' 'd,' price, 'A,' and 'R&D.'

The rate of growth of the demand: gD

The model assumes that the firm's growth is achieved through diversification, excluding growth via mergers or takeovers.

The rate of growth of demand for the firm's products is influenced by two factors: the rate of diversification (d) and the success rate of new products (k).

- Growth via diversification factors

- Marketing and diversification impact demand

Marris follows the idea that clever marketing can sell almost anything, linking value and price. The success of new products hinges on advertising (A), R&D spending, and diversification (d). Higher A and R&D boost success, but a lower average profit margin (m) decreases it. Excessive diversification leads to more failures. Although demand growth (g_D) rises with diversification (d), it slows down as introducing too many products strains development and marketing capacity. Optimal 'new idea' flow from R&D avoids rushed development, prevents overworked management, and reduces failed products.

The rate of growth of capital supply: g_c

- Growth funded by profits

Shareholder-owners aim to maximise the growth rate of corporate capital, representing the firm's size, including fixed assets, inventories, short-term assets, and cash reserves. The preference for growth over profits in uncertain periods is not explicitly explained. Growth is funded internally from profits and externally via new bonds or bank loans. The ideal mix of internal and external financing is debated. Marris argues profits are the primary growth funding source due to limited new share issuance and managers' security concerns. Managers seek financial security by defining limits on debt/assets (leverage) and liquidity ratios. However, managers cannot retain all desired profits. The "retention ratio" has an upper limit to ensure satisfactory dividends, satisfying shareholders and avoiding share price drops that could attract takeovers. Managers subjectively set the three security ratios through the parameter "a," impacting retained profits and hence capital growth rate.

4.3.2.4 Equilibrium of the Firm

- Equilibrium conditions in Marris Model

In the Marris Model of Managerial Enterprise, solving for equilibrium requires specific conditions. The model cannot be resolved (is under identified) unless managers subjectively determine either variable m or d. Once managers define a and one of the other policy variables, the equilibrium growth rate can be calculated. The equilibrium of the firm is represented in the figure given below:

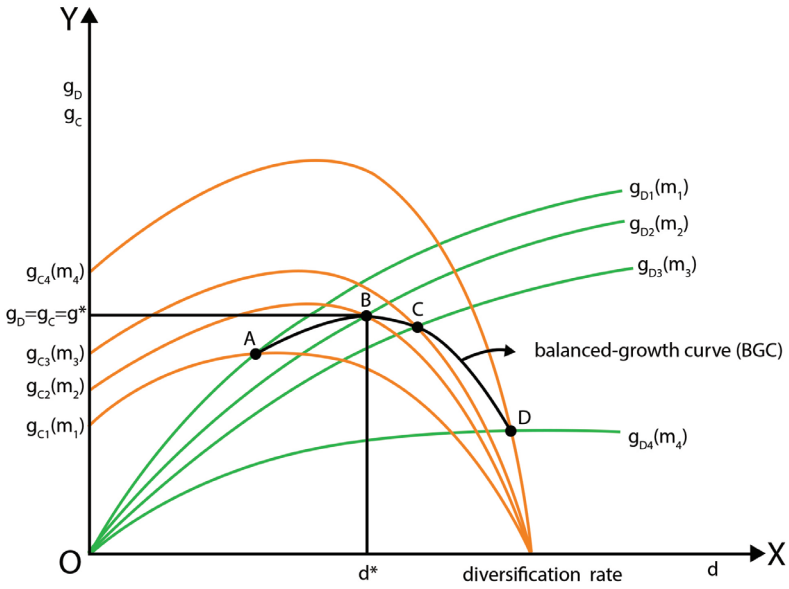

Fig. 4.3.4 Equilibrium of the firm

The $g_{D1,}$ $g_{D2,}$ g_{D3} and g_{D4} are the curves of growth rate of demand for products corresponding to m_1, m_2, m_3 and m_4 average profits respectively. As m increases, the growth rate of demand falls and the curve shifts downwards. The $g_{c1,}$ $g_{c2,}$ g_{c3} and g_{c4} are the curves of growth rate of supply of capital. With rise of average profits, the growth rate of supply of capital increase and curve shifts up. The g_D and gc curves linked to a particular profit rate intersect at certain points. For instance, the g_D and g_c curves related to m intersect at point A, those of m_2 at point B, and so on. All points of intersection of g_D and g_c curves for the same m level form the balanced-growth curve 'ABCD.' In the Marris Model, a firm reaches equilibrium at the peak of the balanced-growth curve.

In conclusion, Robin Marris's model of the managerial enterprise provides a comprehensive framework for understanding the complicated dynamics between managers and shareholders in large modern firms. Through a careful analysis of managerial decision-making and the interplay of financial, strategic, and operational considerations, the model sheds light on the complex balance that firms strive to achieve between growth and profitability. Marris's emphasis on the pursuit of balanced growth, where both the growth of demand for products and the growth of the capital supply are maximised, reflects the objectives of managers and owners. The model highlights the significance of managerial capacity, financial security, and the

delicate equilibrium between these factors. Managers' pursuit of their own utility, influenced by factors like job security, is intertwined with the interests of shareholders seeking capital growth and steady returns. Marris's model underscores the idea that firms are complex systems driven by a delicate interplay of factors. It challenges traditional assumptions about the dichotomy between managers and shareholders by highlighting areas of convergence and shared objectives. The model's insights into the complex relationships between growth, profits, managerial choices, and shareholder interests provide a valuable lens to analyse the behavior of modern corporations.

- Marris model insights on firms' dynamics

4.3.3 Williamson's Managerial Discretion

The concept of managerial discretion is proposed by Oliver E. Williamson in his article 'Managerial Discretion and Business Behaviour,' published in the American Economic Review in 1963. Williamson suggests that managers often prioritise their own utility over aiming for maximum profits. However, profits are still important because they set a baseline that managers must meet to maintain their job security and satisfy shareholders. This shows how managers balance their personal interests with the financial needs of the company. The manager's utility function includes factors like salary, security, power, status, prestige, and professional excellence.

- Managerial discretion and utility

One multinational corporation that operates in a manner reflecting Williamson's managerial discretion is Google, a subsidiary of Alphabet Inc. Google's CEO, Sundar Pichai, is known for making decisions that extend beyond strict profit maximisation. For instance, Google has undertaken ambitious projects like Google X, which focuses on innovations like self-driving cars and renewable energy solutions. These projects, while potentially profitable in the long term, often require substantial investments and may not yield immediate returns. Pichai's decisions to pursue such ventures highlight the balance between profitability and his vision of technological advancement, innovation, and Google's long-term global influence. This approach aligns with Williamson's concept of managers prioritising their utility functions, which includes factors such as professional excellence, innovation, and corporate prestige, alongside financial considerations, in guiding their strategic decisions.

- Google's managerial discretion

- Managers' compensation and utility

Managers' prestige, power, and status are often seen through the emoluments (benefits) they receive, such as expense accounts, luxurious offices, and company cars. Emoluments are like economic rents that managers get, but they do not actually increase productivity or make managers more likely to leave the company. These are possible due to managers' strategic roles in the business. Emoluments might be less appealing than regular salary payments because they come with spending restrictions. Managers' status and power are linked to their ability to make investments beyond the normal operations of the firm. The minimum investments required for normal operations are part of the minimum profit constraint, along with the profits needed for dividends. Discretionary investment spending brings satisfaction to managers as it lets them pursue their personal projects. This aspect offers managers and top executives a way to achieve their personal goals and aspirations. Staff expenditures, emoluments, and discretionary investment expenses can be measured in monetary terms and serve as proxies for non-operational concepts like power, status, prestige, and professional excellence in the managerial utility function.

This allows the utility function of managers to be expressed as follows:

$$\mathbf{U = f_1 (S, M, I_D)}$$

where S = staff expenditure, including managerial salaries (administrative and selling expenditure)

M = managerial emoluments

I_D = discretionary investment

The demand function of the firm

The firm's demand is defined by a downward-sloping curve, represented by the equation:

$$\mathbf{X = f^*(P, S, \mathcal{E})}$$

or

$$\mathbf{P = f_2 (X, S, \mathcal{E})}$$

where X = output

P = Price

S = Staff Expenditure

Ɛ = the condition of the environment, (parameter indicating autonomous shifts in demand)

The demand is assumed to have a negative relationship with price but a positive relationship with staff expenditure and the shift factor ε. Thus,

$$\frac{\partial P}{\partial X} < 0; \frac{\partial P}{\partial S} > 0; \frac{\partial P}{\partial \varepsilon} > 0$$

An increase in staff expenditure is expected to shift the demand curve upwards, enabling the firm to charge higher prices. The same applies to any other environmental change (e.g., an increase in income) that shifts the firm's demand curve upwards.

The Production Cost:

The total production cost (C) is assumed to be an increasing function of output i.e.;

$$\mathbf{C = f_3(X)}$$

$$\frac{\partial C}{\partial X} > 0$$

Actual profit Π:

The actual profit is calculated by subtracting production costs (C) and staff expenditure (S) from the revenue generated from sales (R).

$$\mathbf{\Pi = R - C - S}$$

Reported profit Π_R:

This profit is reported to the tax authorities and is the actual profit minus the managerial emoluments (M), which are tax deductible.

$$\mathbf{\Pi_R = \Pi - M = R - C - S - M}$$

Minimum profit Π_0:

This represents the profits (after tax) necessary to maintain a satisfactory dividend policy for shareholders. If shareholders receive insufficient profit, they might sell shares or advocate management changes, jeopardising managers' job security. To prevent this, managers aim for a minimum profit Π_0 that satisfies shareholders. For this, reported profits must exceed the required minimum profit plus the tax obligation to the government.

$$\Pi_R \geq \Pi_0 + T, \text{ where } T = \text{tax}$$

The tax function is

$$\mathbf{T = \overline{T} + t.\ \Pi_R}$$

where t = marginal tax rate or unit tax rate

$\overline{T}$ = a lump sum tax

Discretionary Investment = I_D

Discretionary investment refers to the remaining portion of reported profit after deducting the required minimum profit(Π_0) and tax expenses(T).

$$\mathbf{I_D = \Pi_R - _{\Pi 0} - T}$$

Discretionary Profit = Π_D

This represents the profit remaining after deducting the necessary minimum profit and tax from the actual profit.

$$\mathbf{\Pi_D = \Pi - \Pi_0 - T}$$

4.3.3.1 The Model

We will present the model in two stages to simplify the explanation. In the first stage, we assume that there are no managerial emoluments (M = 0), meaning that the actual profit is the same as the reported profit for tax purposes.

The simplified model may be stated as follows

Maximise U = f (S, I_D)

subject to $\Pi \geq \Pi_0 + T$

Since there are no emoluments, discretionary investment absorbs all the discretionary profit. As a result, we can express the managerial utility function as follows:

$U = f [S, (\Pi - \Pi_0 - T)]$

For simplicity, let us assume there is no lump-sum tax, making T equal to $t\Pi$. Consequently, the managerial utility function simplifies to:

$U = f [S, (1 - t) \Pi - \Pi_0]$

where, $(1 - t) \Pi - \Pi_0 = \Pi_D$ is the discretionary profit.

In Williamson's model, illustrating the firm's equilibrium graphically involves creating an indifference curves map for managers and a curve depicting the relationship between the two variables found in the utility function, S and Π_D.

- Managers' preference

Managers' indifference curves are represented on the figure given below with staff expenditure (S) on one axis and discretionary profit (Π_D) on the other. Each curve shows combinations of S and Π_D that provide managers with the same level of satisfaction. The curves typically slope downward from left to right, illustrating diminishing marginal substitution between staff expenditure and discretionary profit shown in the figure given below. It is assumed that these curves do not intersect the axes, indicating that managers choose positive levels of both staff expenditures and discretionary profits. This means that the firm aims for values of Π_D and S that lead to positive utility across all components of its utility function.

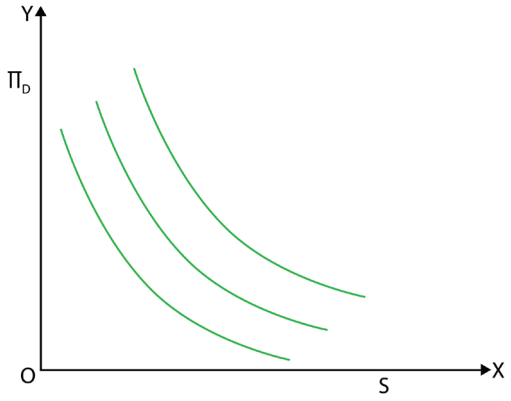

Fig 4.3.5 Indifference Curves of Managers

This means that the model in this version excludes corner solutions, such as points a, b, c, etc., (in figure above), where Π_D would be zero in the final equilibrium of the firm.

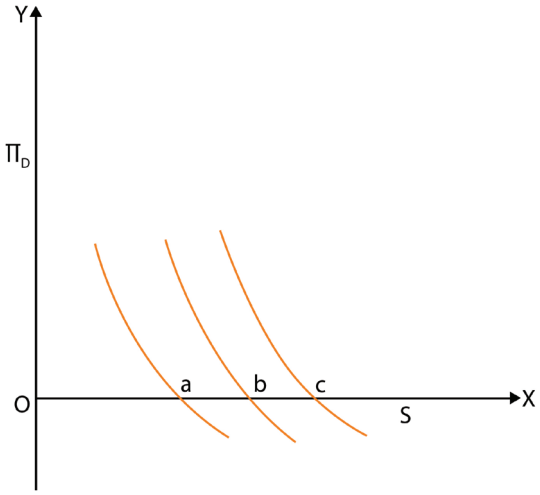

Fig 4.3.6 Indifference Curves of Managers

The relation between staff expenditure (S) and discretionary profit (Π_D) is established through the profit function.

$\Pi = f(X) = f(P, S, \mathcal{E})$

Given the external factors t and Π_0, determined by tax regulations and shareholder dividend preferences, and assuming optimal output choice based on marginal cost (MC) and marginal revenue (MR) equality, along with a fixed market environment ($\mathcal{E}$), the connection between Π_D and S is illustrated in figure given below.

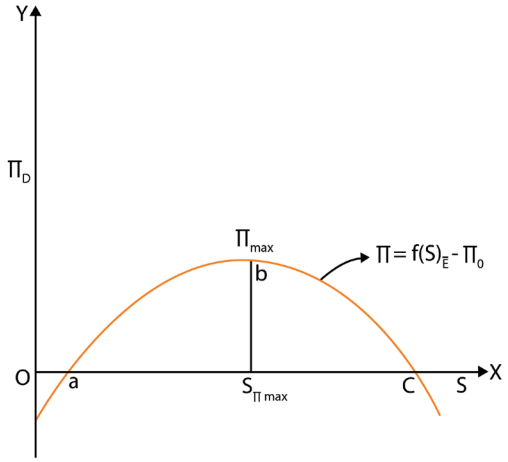

Fig 4.3.7 Relationship between Π_D & S

Initially, as production progresses and up to the point where profits peak (point b in figure above), both discretionary profits and staff expenditures increase. However, if production exceeds this point, profits start decreasing while staff expenditures continue to rise. If these expenditures go beyond point c, the minimum profit requirement is no longer met. Thus, solutions to the right of c (and to the left of a) are non-feasible. It is important to note that the illustrated profit curve does not include the minimum profit threshold Π_0. Another way to depict the minimum acceptable profit is by graphing the profit function as $\Pi = f(S)_{P\,\varepsilon}$ and indicating Π_0, similar to Baumol's model, using a straight line parallel to the S-axis. Subtracting Π_0 from each level of actual profit (Π) offers the advantage of simplifying the constrained maximisation problem into an unconstrained one. The firm's equilibrium is established at the point where the profit-staff curve touches the highest point in managerial indifference curve, known as point 'e' in the figure given below.

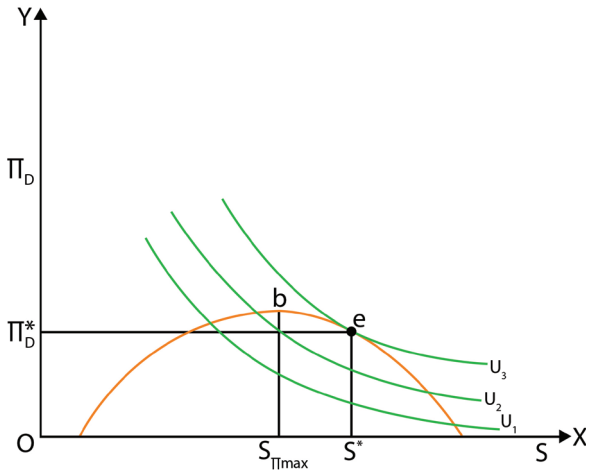

Fig 4.3.8 Equilibrium of the Firm

Since the indifference curves have a negative slope, the equilibrium point will always lie on the falling portion of the profit-staff curve. This highlights managers' inclination towards staff expenditure. In Williamson's framework, the staff expenditure (S*) will exceed that of a profit maximiser ($S_{\Pi max}$). Moreover, the model suggests greater output, reduced price, and diminished profit compared to the profit-maximisation model.

4.3.3.2 Evaluation of the model

Williamson used multiple case studies to substatiate that his rational management behavior model better explained several real-world scenarios. These scenarios included:

Cyclic Staff Expenditure: Firms increasing staff expenditure and managerial emoluments during economic booms and reducing them during recessions.

Tax Reaction: Business firms adjusting their behavior in response to changes in taxes.

Impact of Fixed Costs: Changes in output, staff expenditure, and emoluments based on shifts in the firm's fixed costs.

New Managerial Cuts: Newly appointed managers making substantial cuts in staff expenditure without harming firm productivity.

Multi-Plant Efficiency: Multi-plant firms redistributing fixed overheads to different plants and activities to identify and eliminate inefficient ones.

Williamson argued that these phenomena are more effectively explained by his model, as they are inconsistent with the profit-maximising behavior assumed in traditional models. However, it is important to note that the existing evidence is not entirely conclusive in confirming the validity of Williamson's model. In dynamic and changing conditions, the assumption of "ceteris paribus" (all other things being equal) is often unrealistic. Williamson's model also falls short in adequately addressing the challenges posed by oligopolistic interdependence and intense rivalry among oligopolistic firms. In scenarios where strong rivalry is prominent, the profit-maximising model might provide a more fitting explanation. In conclusion, Williamson's managerial discretion model offers valuable insights into the decision-making processes within firms, emphasising that managers often prioritise their own utility over strict profit maximisation. While the model explores various real-world phenomena, it also faces limitations in capturing the complexities of dynamic and competitive markets, particularly in cases of strong oligopolistic rivalry. While Williamson's model provides a useful alternative perspective, its application and validity depend on the specific

- Managerial discretion model

context and dynamics of the business environment. Further research and empirical validation are essential to assess its effectiveness in explaining managerial behavior across diverse economic scenarios.

4.3.4 Basic Ideas of Behavioural Model of Cyert and March

- Realistic firm behavioural model

The Behavioural Theory provides a realistic perspective on business analysis, focusing on actual firm behavior and decision-making. Unlike traditional profit-maximisation goals, firms in this approach aims in achieving satisfactory performance in areas like profit, market share, and sales. Cyert and March introduced this theory in their 1963 work titled 'A Behavioural Theory of Firm.' They systematically examine how large corporations behave in imperfect markets characterised by uncertainty.

- General Electric and behavioural theory

One real-life example of a multinational corporation (MNC) that operates in a manner aligned with the principles of Cyert and March's behavioural model is General Electric (GE). GE is a conglomerate with diverse business segments, including aviation, healthcare, renewable energy, and more. Within each segment, there are distinct groups with varying goals and priorities. For instance, GE's aviation division focuses on innovation and product development to maintain a competitive edge in the aerospace industry. Simultaneously, shareholders expect consistent profitability and dividends. GE's management faces the challenge of balancing these conflicting demands. They allocate resources to research and development to meet the engineers' demands for innovation, ensuring the development of advanced aircraft engines. However, they also implement cost-saving measures and divest non-core businesses to satisfy shareholders' profit objectives. GE's decision-making process is dynamic and adaptive, with constant negotiation and prioritisation among different groups. They aim for satisfactory outcomes by addressing the diverse goals of engineers, shareholders, and other stakeholders while managing limited resources. This real-world example demonstrates how a large MNC like GE applies the behavioural model's principles to navigate complex internal dynamics and achieve stability and success in a competitive global market.

The Cyert and March behavioural model presents a nuanced understanding of the dynamics within a firm, highlighting several key elements such as

1. **Coalition of Groups**: The firm is viewed as a complex coalition of various groups and individuals, such as managers, workers, customers, shareholders, suppliers, and more. Each group plays a role in the firm's activities and decision-making.

2. **Conflicting Goals**: Cyert and March emphasise that the different groups within the firm do not share a unified goal. Instead, each group has its own distinct set of goals and demands, which often conflict with those of other groups. For example, workers might seek higher wages and better working conditions, while managers aim for greater salaries and power.

3. **Formation of Demand Goals**: With multiple groups having conflicting demands, the firm faces the challenge of allocating limited resources to satisfy these demands. Groups prioritise and present their most important demands to the management, withholding others for later negotiation. The decision of which demands to present is influenced by factors like past achievements, expectations, and available information.

4. **Dynamic Nature**: The model recognises that demand aspirations are dynamic and subject to change based on the firm's performance and external environment. The relationship between past achievements and current demands is contingent on these changing factors, making the model adaptable to evolving situations.

5. **Bargaining and Reconciliation**: As conflicting demands arise; the firm engages in a continuous process of bargaining and negotiation among the different groups. The management must try to reconcile these conflicting interests and find ways to address the needs of various groups while managing limited resources.

6. **Multiple Goals:** In contrast to traditional profit-focused views, behaviourists like Cyert and March highlight that modern firms pursue a range of goals. These goals include production, inventory, sales, market share, and profit

objectives.

7. **Conflict Resolution in the Behavioural Model of Firms**: In the Cyert and March behavioural model, the inevitable conflicts arising from diverse goals within a firm are managed and resolved through various strategies. Despite these conflicts, firms exhibit stability due to limited time for bargaining, initial goal agreements, penalties for exceeding budgets, and constraints on discretionary actions. Key conflict resolution mechanisms include:

   - **Money Payments**: Unlike traditional theories that rely solely on market-priced payments to achieve goals, behavioural models emphasise alternative means. Money payments to factor owners are not sufficient to address competing demands.

   - **Side-Payments**: Additional payments, known as side-payments, are made to retain specialised individuals. For example, scientists may receive funds for research projects. Such commitments prevent the loss of skilled personnel to other firms.

   - **Slack Payments**: Slack payments involve providing groups within the firm more than necessary for efficient operations. Managers, workers, customers, and shareholders may receive slack. These payments stabilise firm performance by acting as a buffer against external and internal changes.

   - **Priority-based Demand Satisfaction**: Conflicting demands can be resolved by prioritising urgent requests. Higher priority is assigned to more pressing needs. For instance, production renewal might receive priority during the production process, while a competitor's sales campaign could prioritise funding for the sales department.

   - **Decentralised Decision-Making**: Properly decentralised decision-making, with clear authority and responsibilities assigned to different departments, can reduce conflict areas. While some decisions might require collaboration, decentralisation minimises clashes by defining decision areas.

The behavioural model acknowledges that conflicts are a natural outcome of diverse goals within firms. Effective conflict resolution strategies contribute to firm stability, ensuring smooth operations despite the competing demands of various groups within the organisation.

8. **The process of Decision-Making:** Decision-making in the Cyert and March behavioural model occurs both at the top management level and lower administrative levels. The process can be outlined as follows:

    - **Top Management Decision-Making:** Top management determines resource allocation to different departments based on the firm's goals and available resources. This allocation is carried out through the budgeting process. The share of each department in the budget is influenced by factors like past performance, coordination, and historical resource utilisation. Department heads present their demands and negotiate for budget shares, with the top management retaining discretionary funds for unforeseen needs. Project evaluation relies on simplified criteria like financial and improvement aspects, rather than detailed cost-benefit analyses.

    - **Lower Administrative Decision-Making:** Once budget allocations are made, department and section heads have flexibility in spending their allocated funds. Routine decisions are based on organisational blueprints, which are simple rules or directives. For instance, pricing decisions might follow a rule like setting the price at the average direct cost plus a profit margin, though final price determination remains with top management. These decisions are converted into practical rules-of-thumb for lower levels. Staff at lower levels learn from past experiences, avoiding previous mistakes and replicating successful measures.

In this model, decision-making is a dynamic process involving negotiation, budget allocation, and decentralised discretion. The top management determines major allocations while lower administrative levels implement decisions guided by established rules and lessons from past outcomes.

9. **Dealing with Uncertainty:** Cyert and March's behavioural

model addresses two types of uncertainty faced by firms—market uncertainty and uncertainty about rivals' reactions. Here is how they handle these uncertainties:

- **Market Uncertainty:** Market uncertainty involves potential changes in consumer preferences or production techniques. This type of uncertainty is inherent in any market environment. The model acknowledges that firms can partially reduce market uncertainty through activities like information-gathering and research. However, completely avoiding market uncertainty is not feasible. As a result, firms often operate with a short-term focus and tend to avoid extensive long-term planning due to the unpredictability of market shifts.

- **Uncertainty of Rivals' Reactions:** The behavioural model simplifies the uncertainty associated with rival firms' actions and reactions, particularly in oligopolistic markets. It assumes a form of tacit collusion among existing firms, implying that these firms may indirectly coordinate their actions to avoid disruptive competition. This assumption helps in simplifying the complex interactions in oligopolistic markets, allowing for a more manageable representation of strategic decision-making.

Overall, the behavioural model recognises and acknowledges the challenges posed by uncertainty in market dynamics and rivals' actions. It emphasises short-term operational flexibility due to market uncertainty and simplifies the treatment of uncertainty in oligopolistic environments for analytical purposes.

10. **Simplified Behavioural Model for Decision-Making:** Cyert and March's simple behavioural model outlines the decision-making process within large modern corporations operating in a duopoly producing identical products. Here are the steps involved in this model:

    - The firm forecasts reactions from various groups based on their past behaviours.

    - The firm estimates its demand function by extrapolating past sales data to predict future demand.

- Current-period costs are estimated to be the same as the previous period. If profits met goals in the past two periods, costs might include an allowance for slack payments.
- Profit is the primary goal, and the aspiration level for profits is an average of profits from the preceding two periods.
- Using the above information, the firm estimates output, price, cost, and profits. If these match the target profits, the firm adopts this solution.
- The firm re-evaluates costs, potentially cutting slack and unnecessary expenses under its control.
- If target profits are not achieved, the firm revises costs downward and adopts this solution if it meets the goals.
- If goals remain unmet, the firm revisits demand estimates, considering changes in sales strategy like increased advertising, more salespeople, etc.
- If the new solution meets profit targets, it is adopted; otherwise, the process continues.
- If goals are still unmet, the firm considers lowering its aspiration levels.

- Realistic insights, group conflicts, complex decisions

While this model focuses on a single goal (profit), real firms have multiple goals. In such cases, firms prioritise alternative goals based on their importance and viability within the given constraints. Cyert and March's model has paved the way for a more comprehensive understanding of decision-making in the business world, acknowledging the inherent complexity and adaptive nature of firms in their pursuit of achieving satisfactory outcomes within the constraints they face.

Summarised Overview

Baumol's Sales Revenue Maximisation Theory presents a unique perspective on managerial decision-making within firms, particularly in oligopolistic markets. This theory challenges the conventional profit-maximisation goal by emphasising that some firms prioritise maximising sales revenue while maintaining a minimum profit level. Managers may favor this approach because it can lead to personal benefits such as higher pay, improved job security, and career advancement. Additionally, it can be advantageous for the firm's growth and competitiveness. Baumol's theory is divided into static and dynamic models, each offering insights into how firms balance revenue generation and cost management. While this theory provides valuable insights into the diverse motivations driving managerial decisions, it has faced criticism for its simplifying assumptions and may not fully capture the complexities of real-world competition and market dynamics.

Marris's model of the managerial enterprise tries to explain the complex dynamics governing large modern firms. In this model, Marris emphasises the central role of managers in making decisions that impact a firm's growth and profitability. The key insight is that both managers and shareholders have intertwined but nuanced objectives, with managers seeking job security and rapid growth while shareholders aim for dividends and share value appreciation. The model introduces the concept of balanced growth, where a firm's success hinges on optimising the growth of both product demand and capital supply. Marris identifies constraints, including managerial capacity and financial security, that influence a firm's ability to achieve this balance. By highlighting the interconnectedness of managerial choices, financial strategies, and shareholder interests, Marris's model provides a robust framework for understanding the complexities of modern corporate management and governance.

Williamson's concept of managerial discretion highlights how managers balance personal interests with a company's financial needs. Managers prioritise their utility, including factors like salary, security, power, and prestige, alongside profits. The model illustrates how staff expenditure and discretionary profit play key roles in manager satisfaction and firm equilibrium. Managers tend to favor higher staff expenditure compared to profit-maximising models, resulting in greater output, lower prices, and reduced profits. While Williamson's model explains real-world phenomena, it faces challenges in dynamic and competitive markets and may not fully account for strong oligopolistic rivalry. Its application and validity depend on specific business contexts and require further empirical validation.

The Cyert and March's Behavioural Model of the firm revolutionises traditional economic perspectives by emphasising the complexities of real-world business behavior. Instead of solely pursuing profit maximisation, this model recognises that firms are coalitions

of diverse groups with conflicting goals. Decision-making involves the formation of demand goals, negotiation, and resource allocation among these groups, guided by priorities such as production, inventory, sales, market share, and profit. Conflict resolution mechanisms, including side-payments and slack payments, maintain firm stability. The model addresses market and rival uncertainty, advocating short-term flexibility and tacit collusion in oligopolistic markets. A simplified decision-making process highlights iterative and adaptive strategies for achieving goals. While focusing on profit, real firms often juggle multiple objectives, but Cyert and March's model provides valuable insights into the multifaceted nature of business dynamics, group interactions, and adaptive decision-making within organisations.

Self Assessment

1. Critically evaluate Baumol's Sales Maximisation theory
2. Discuss the factors that influence the growth rate of demand (g_D) and the growth rate of capital supply (gc) in the Marris model.
3. Explain the key concepts and assumptions of Robin Marris's model of managerial enterprise. Discuss how this model challenges traditional views of the firm's objectives and the role of managers and shareholders.
4. Discuss the concept of managerial discretion as proposed by Oliver E. Williamson. Explain how managers balance their personal interests with the financial needs of the company. Provide real-world examples to illustrate this concept.
5. Explain the key principles of Cyert and March's Behavioural Theory of the firm.

Assignments

1. Discuss the four static models of Baumol's theory, including the single-product and multi-product models with and without advertising. Compare and contrast these models, highlighting their key assumptions and implications for firms' production and pricing strategies
2. Write a case study that assesses the applicability of the Marris model in analysing the behavior of large corporations in the 21st century.

3. Conduct a case study of a multinational corporation and evaluate how its top management has exercised managerial discretion.
4. Interview employees from various departments within a company and analyse how they communicate their demand goals to the management.

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Suggested Readings

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 4
Case Studies of Full Cost Pricing and CEO Payments

After completing this unit, the learner will be able to:

- know about the application of economic theories and principles to real-world scenarios
- think critically about complex economic problems
- gain insights on real world economic analysis

Background

Case studies are powerful educational tools that provide learners with a unique opportunity to explore real-world scenarios, analyse complex situations, and develop critical thinking skills. These in-depth examinations of specific instances or events serve as invaluable teaching aids across various fields, including economics. In this discussion, we will explain the significance of case studies and how they enhance the learning experience. One of the primary benefits of case studies is their ability to bridge the gap between theory and practice. In economics, learners are often introduced to abstract concepts and principles. Case studies, however, offer a real connection to these theoretical ideas by presenting actual economic situations. By analysing such scenarios, learners can better grasp the real-world implications of economic theories. Case studies are essentially problem-solving exercises. They challenge learners to apply their knowledge and analytical skills to address complex issues, much like economists do in their daily work. By examining the facts, considering various perspectives, and proposing solutions, learners enhance their ability to think critically and make informed decisions. For instance, in the context of international trade, a case study could involve evaluating the economic consequences of a trade war between two major economies and proposing strategies for businesses to navigate this unstable environment.

Economics is deeply influenced by context, be it historical, geographical, or socio-political. Case studies provide learners with the context needed to appreciate the multifaceted nature of economic phenomena. Take, for example, a case study that examines the post war economic development of a nation. Learners can explore the historical circumstances, policy decisions, and external factors that contributed to the nation's economic growth, gaining a richer understanding of the interplay between context and economic outcomes. Case studies offer a form of experiential learning, allowing learners to step into the shoes of decision-makers and experience the complexities of real-world economic challenges. This hands-on approach fosters a deeper connection with the subject matter and encourages active engagement. Consider a case study on monetary policy, where learners take on the role of central bank officials tasked with managing inflation and stabilising the economy. Such experiences can leave a lasting impression and enhance comprehension.

Keywords

Case Study, Cost Pricing, CEO Payments, Full Cost Pricing

Discussion

4.4.1 Case Study – Full Cost Pricing

Full cost pricing is a pricing strategy used in economics and business that involves setting the price of a product or service based on the full, comprehensive cost of producing or providing that product or service. This pricing approach considers all the costs associated with the production or delivery of a particular item, including both direct and indirect costs, and often includes a margin for profit.

Here is a breakdown of the key components and principles of full cost pricing:

Direct Costs: These are the costs that can be directly attributed to the production of a specific product or service. Examples include raw materials, labor costs, and manufacturing expenses. Direct costs are variable and tend to increase as production levels rise.

Indirect Costs: Also known as overhead costs, indirect costs are expenses that cannot be directly linked to a particular product or service but are necessary for the overall operation of the business. They include items like rent or lease of facilities, utilities, administrative salaries, and equipment depreciation. Indirect costs are often fixed or semi-variable, meaning they do not necessarily increase with each unit produced.

Fixed Costs: These are expenses that remain constant regardless of the level of production. Fixed costs include items like rent for the manufacturing facility, salaries of permanent staff, and insurance premiums. They do not change in the short term based on production volume.

- Pricing based on costs

Variable Costs: Variable costs fluctuate with changes in production levels. These costs are directly tied to the number of units produced or services rendered. For example, raw materials and labor costs that increase as production volume goes up are considered variable costs.

Profit Margin: In full cost pricing, a profit margin is typically added to the total cost. This margin represents the desired profit that a business aims to achieve for each unit sold. Profit margins can vary depending on the company's goals and industry standards but are usually expressed as a percentage of the total cost.

- Cost coverage and competition

Full cost pricing ensures that the price set for a product or service covers not only the variable costs directly associated with production but also the fixed costs and overhead expenses necessary to keep the business running. This approach helps businesses avoid operating at a loss and provides a safety net for unexpected changes in costs or fluctuations in demand. However, it is important to note that full cost pricing may not always be the most competitive pricing strategy, as it does not consider market conditions, customer preferences, or competitors' pricing strategies. Therefore, businesses often need to strike a balance between covering their costs and remaining competitive in the market.

4.4.1.1 Case Study: Caterpillar Inc. - Navigating Pricing Strategies in the Heavy Machinery Industry

Caterpillar Inc., a multinational corporation headquartered

- Caterpillar's full-cost pricing

in the United States, specialises in the manufacturing of construction and mining equipment. The company operates in a highly competitive industry where pricing strategies play a critical role in determining market success. Caterpillar's approach to pricing reflects the principles of full-cost or average-cost pricing, as outlined by economists Hall and Hitch. Caterpillar faces intense competition from global players in the heavy machinery sector. To remain competitive and maintain profitability, the company must carefully consider its pricing strategies. Caterpillar calculates the full cost of manufacturing its heavy machinery, considering both direct and indirect costs. Direct costs include materials, labor, and production expenses. Indirect costs encompass facilities, utilities, administrative overhead, and more. The company adds a reasonable profit margin to the full cost, typically around 10%. This profit margin ensures that Caterpillar covers all production expenses and generates a profit. Caterpillar is known for its commitment to price stability. The company maintains consistent pricing for its heavy machinery over extended periods. In 2022, Caterpillar faced a challenging market environment due to increased competition and fluctuating demand in the construction and mining industries. The company's leadership needed to make critical pricing decisions to navigate these challenges while adhering to their full-cost pricing principles. Caterpillar conducted an extensive analysis of its direct and indirect costs associated with manufacturing heavy machinery. This included raw material costs, labor expenses, facility maintenance, administrative overhead, and more. The company calculated the full cost of manufacturing its heavy machinery by summing up all direct and indirect costs. This calculation served as the foundation for their pricing strategy. Caterpillar added a profit margin of 10% to the full cost, as per their standard pricing practice.

Despite market pressures and competition, Caterpillar decided to maintain price stability for its existing product lines. This decision aimed to provide consistency and predictability to its loyal customer base. While Caterpillar maintained price stability for its standard product offerings, the company introduced flexibility for large orders. When clients placed bulk orders, Caterpillar was open to negotiating prices to secure these deals. Caterpillar's adherence to full-cost pricing principles allowed the company to overcome market challenges while ensuring cost coverage and profitability. By maintaining price stability for their core product lines, Caterpillar provided

- Caterpillar's price stability strategy

reliability to its customers, who valued consistent pricing for their long-term equipment needs. The flexibility to negotiate prices for large orders enabled Caterpillar to secure significant contracts without compromising its overall pricing strategy. Caterpillar Inc.'s case study serves as a real-world example of how a multinational corporation successfully applies the principles of full-cost pricing in a competitive industry. Their commitment to considering all production costs and adding a reasonable profit margin has allowed them to maintain profitability and customer loyalty.

4.4.2 Case Study – CEO Payments

CEO (Chief Executive Officer) payments, also commonly referred to as CEO compensation or CEO pay, refer to the financial remuneration and benefits provided to the top executive of a company, typically the CEO. CEO compensation is a complex and often controversial topic, as it involves a combination of salary, bonuses, stock options, and other forms of incentives. Here is a detailed explanation of CEO payments:

Components of CEO Payments: A significant portion of CEO compensation comes in the form of a base salary, which provides financial stability. Bonuses are performance-based and reward CEOs for achieving specific targets, such as financial goals or strategic milestones. Stock options give CEOs the right to buy company shares at a predetermined price, aligning their interests with shareholders. Additionally, pension and retirement benefits ensure financial security for CEOs post-tenure, and perks may include benefits like a company car, executive health plans, or club memberships.

- **Base Salary**: This is the fixed amount of money that a CEO receives regularly, typically on an annual or monthly basis. It forms the foundation of CEO compensation and is designed to provide financial stability.

- **Bonuses**: Bonuses are performance-based payments that CEOs receive in addition to their base salary. These bonuses can be tied to various metrics, such as financial performance, revenue growth, profitability, or achieving specific strategic goals. Bonuses incentivise CEOs to meet or exceed company targets.

- **Stock Options**: CEOs often receive stock options, which

grant them the right to purchase company shares at a predetermined price in the future. These options align the CEO's interests with those of shareholders since an increase in the company's stock price benefits both parties.

- **Restricted Stock Units (RSUs):** RSUs are another form of equity compensation where CEOs are granted shares of the company's stock that vest over time. This means that the CEO gains ownership of the shares after a specific period, which encourages a long-term commitment to the company's success.

- **Long-Term Incentive Plans (LTIPs):** LTIPs are performance-based incentives designed to reward CEOs for achieving long-term strategic objectives. These can include metrics related to shareholder returns, market share growth, or sustained profitability over several years.

- **Pension and Retirement Benefits**: CEOs may receive contributions to their retirement plans, such as a 401(k) or a pension plan. These benefits ensure financial security for CEOs after their tenure.

- **Perquisites (Perks):** Perquisites are additional benefits provided to CEOs, which can include items like a company car, executive health benefits, club memberships, and even personal use of the company's resources. While perks may not make up a significant portion of CEO compensation, they can be valuable.

Factors Influencing CEO Payments: The level of CEO compensation is influenced by several factors. Company size and financial performance play a significant role, with larger and more profitable companies offering higher pay packages. Industry norms also matter, as different sectors may have varying compensation standards. CEO tenure, market competition for top talent, and shareholder approval or feedback can further impact pay levels.

- **Company Size and Performance**: The size and financial performance of the company often play a significant role in determining CEO compensation. Larger, more profitable companies tend to offer higher CEO pay.

- **Industry**: Different industries have varying norms for

CEO compensation. High-risk or highly competitive industries may offer more significant pay packages to attract top talent.

- **CEO Tenure**: Longer-serving CEOs often command higher compensation as they gain experience and demonstrate their ability to lead the company successfully.
- **Market Competition**: The demand for experienced CEOs can influence pay levels. Companies may offer competitive packages to attract or retain CEOs with proven track records.
- **Shareholder Approval**: CEO compensation packages are often subject to shareholder votes. Negative feedback from shareholders may lead to changes in compensation structures.

- Controversy and criticism

CEO compensation has often faced scrutiny and criticism. Critics argue that excessively high CEO pay, especially when not tied to performance, can lead to moral hazards and a misalignment of interests between executives and shareholders. In response, many companies advocate for transparency in disclosing CEO compensation, linking pay to performance metrics, and implementing clawback provisions that allow the recovery of excessive compensation under certain conditions. These efforts aim to strike a balance between attracting talent and ensuring that CEO pay is in line with company performance.

4.4.2.1 Case Study: CEO Compensation at Microsoft Corporation

Microsoft Corporation is a multinational technology company that specialises in computer software, consumer electronics, personal computers, and cloud services. The company is one of the world's largest and most valuable companies, and its CEO, Satya Nadella, is one of the most highly compensated executives in the world.

CEO Compensation Components:

Satya Nadella's CEO compensation package at Microsoft Corporation includes the following components:

- **Base Salary:** Nadella received a base salary of $1 million in 2022. This salary provides him with financial stability while leading the company.
- **Performance-Based Bonuses:** In addition to his base salary, Nadella is eligible for performance-based bonuses. These bonuses are tied to the achievement of specific key performance indicators (KPIs) such as revenue growth, profit margins, and customer satisfaction. His potential bonus ranged from 60% to 120% of his base salary, depending on performance.
- **Stock Options:** Microsoft granted Nadella stock options, allowing him to purchase company shares at a fixed price. These options vest over a period of years, promoting a long-term commitment to the company's success.
- **LTIPs:** Nadella participated in Microsoft's Long-Term Incentive Plans (LTIPs), which rewarded him for achieving long-term strategic goals, such as maintaining market leadership in cloud computing and expanding the company's presence in emerging markets. LTIPs were structured to encourage Nadella's focus on the company's long-term sustainability.

Factors Influencing CEO Compensation:

Several factors influenced Satya Nadella's CEO compensation at Microsoft Corporation:

- **Industry Norms:** In the highly competitive technology industry, attracting and retaining top talent is crucial. Nadella's compensation was benchmarked against industry standards to ensure it remained competitive.
- **Performance Metrics:** Microsoft's board of directors closely monitored performance metrics, ensuring that Nadella's pay was directly tied to the company's financial health and growth. Under Nadella's leadership, Microsoft's stock price has more than doubled, and the company has become a leader in cloud computing.
- **Market Competition:** The demand for experienced technology CEOs influenced Nadella's pay. Competing tech giants, such as Amazon and Alphabet, sought similar talent, driving up compensation packages.

- **Transparency and Accountability:** Microsoft Corporation is committed to transparency in CEO compensation. The company discloses Nadella's compensation in its annual reports and engages with shareholders to address concerns. The CEO's pay is subject to shareholder votes, and the company seeks to align executive pay with long-term shareholder interests.

Satya Nadella's CEO compensation package reflects the complex nature of executive pay in the technology industry. His compensation is designed to attract and retain top talent, incentivise performance, and align his interests with those of shareholders. Microsoft's commitment to transparency and accountability helps to ensure that Nadella's pay is fair and equitable.

Summarised Overview

Full cost pricing is a comprehensive strategy used in economics and business to determine the price of a product or service by considering all associated costs, including direct and indirect expenses, while also incorporating a profit margin. This approach ensures that the price covers not only variable production costs but also fixed expenses and overheads, providing a safety net against unexpected cost fluctuations. However, it may not always be the most competitive pricing strategy as it does not account for market conditions or customer preferences. A case study example featuring Caterpillar Inc., a global leader in heavy machinery manufacturing, illustrates the successful application of full-cost pricing principles. Caterpillar maintains pricing stability for its core product lines by calculating the full cost of production, adding a profit margin, and remaining open to negotiations for bulk orders. This real-world case showcases how a multinational corporation effectively balances cost coverage and profitability while prioritising customer loyalty and consistency in a competitive industry.

CEO compensation is a multifaceted and often contentious subject, encompassing various components such as base salary, bonuses, stock options, RSUs, LTIPs, pension benefits, and perks. This comprehensive package is provided to a company's top executive, typically the CEO. It reflects a complex interplay of factors, including company size, financial performance, industry norms, CEO tenure, market competition, and shareholder input. While CEO pay has faced criticism for perceived excesses, efforts are made to enhance transparency, tie compensation to performance metrics, and introduce clawback provisions to align executive pay with company results. A case study of Microsoft's CEO

compensation illustrates the nature of executive remuneration in the corporate world, emphasising the importance of balancing competitiveness and accountability while attracting and retaining top talent in competitive industries like technology.

Self-Assessment

1. Discuss the concept of full-cost pricing in economics and business. Provide direct and indirect costs examples and explain how companies calculate their full costs when setting prices.
2. Using Caterpillar Inc. as a case study, analyse how a multinational corporation successfully applies the principles of full-cost pricing in a competitive industry. What strategies did Caterpillar employ to maintain price stability and profitability?
3. Explain the various components of CEO payments, including base salary, bonuses, stock options, and perks. How do these components align with the interests of shareholders?
4. Examine the factors that influence CEO compensation levels. How do these factors interact to determine CEO pay?
5. How did Microsoft structure Satya Nadella compensation package to attract and retain top talent in the technology sector?

Assignments

1. Compare and contrast full cost pricing with other pricing strategies commonly used in economics and business.
2. Research recent trends in CEO compensation, considering factors such as company size, industry, and shareholder influence.
3. Select a tech company of your choice and analyse its CEO's compensation package, considering elements like stock options and performance-based bonuses.
4. Analyse a real-world case study of a business implementing full cost pricing. Discuss how direct and indirect costs are considered, and assess the impact of this pricing strategy on the company's profitability and competitiveness.

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Suggested Readings

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

സർവ്വകലാശാലാഗീതം

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ഗ്രഹപ്രസാദമായ് വിളങ്ങണം
ഗുരുപ്രകാശമേ നയിക്കണേ

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നീതിവൈജയന്തി പാറണം

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