University of Algiers 3

Faculty of Economics, Commercial Sciences and Management

Handout in Microeconomics 1

LECTURES AND EXERCISES

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2023 -2024

Introduction:

Welcome to Microeconomics1 handout! Within these pages, you'll find a rich tapestry of knowledge tailored to enrich your exploration of microeconomic principles. This meticulously crafted resource is designed not only to accompany your educational journey but also to serve as a beacon of clarity amidst the complexities of economic theory. Whether you're a student embarking on the quest to decipher the intricacies of individual economic behavior or an esteemed professor seeking additional pedagogical aids, this handout endeavors to cater to your needs with utmost efficacy.

Objectives:

At its core, this handout is imbued with a dual purpose: to illuminate the nuances of microeconomic theory and to furnish you with practical tools for real-world application. Through a judicious blend of theoretical exposition and hands-on exercises, our aim is to instill within you a deep-seated comprehension of microeconomic principles while honing your analytical prowess. By delving into the realm of microeconomics, we endeavor to equip you with the intellectual acumen necessary to navigate the intricacies of economic decision-making at the individual level.

Syllabus Distribution:

Over the span of 15 weeks, our journey through microeconomics will be meticulously charted, with each week building upon the foundations laid in the preceding ones. From the rudimentary concepts of supply and demand to consumer analysis, our syllabus will traverse the breadth of microeconomic theory, offering a panoramic view of economic phenomena. Each topic, carefully selected and sequenced, will serve as a stepping stone towards a more profound understanding of the intricate interplay between individual agents and the broader economic landscape.

Support for Students and Professors:

In our collective pursuit of knowledge, this handout aspires to be more than just a repository of information—it seeks to be a trusted companion in your academic endeavors. For students, it offers a roadmap to navigate the labyrinth of microeconomic theory, with clear signposts and ample opportunities for exploration along the way. For professors, it stands as a testament to our commitment to pedagogical excellence, providing a wealth of resources to enrich your teaching repertoire and foster an environment conducive to intellectual growth.

Microeconomics Syllabus

1 - Course Description and Overall Objectives:

This course provides students with the foundation theories of basic microeconomics including an introduction into the study of economics and analyses of economic agents' behaviors, particularly that of the individual and the firm. The course begins with a description of the subject area, and continues to introduce the basic concepts and theories that are used as the foundation of microeconomic theory and analysis. This includes discussions and applications of the market operations, theory of the consumer; theory of producer; and market structures.

Prerequisite(s): The student must know the basic processes and rules that were only covered at the stage of middle and secondary education.

Course Objectives:

A. Introduce tools and methods of economic analysis that will serve as the basis forother courses in economics such as Macroeconomics, Economic Analysis, Managerial Economics, and Economic Resources.

B. Provide non-specialists economics student with a good introduction to the fundamental principles of microeconomics.

C. Familiarize students to use the concepts to which they are introduced to facilitateanalysis of the functioning of the micro economy.

2 - Intended Learning Outcomes of the Course:

(A) Through **knowledge and understanding**, students will be able to:

(1) Define the nature of microeconomics.

(2) Describe the functioning of a market economy through demand and supply.

(B) Through **intellectual skills**, students will be able to:

(1) Apply the concepts of demand and supply to explain the price and quantity equilibrium of a market.

(C) Through **professional and practical skills**, students will be able to:

(1) Apply microeconomic tools in real economic context.

(2) Analyze the behavior of markets and agents.

(3) Asses and justify the behavior of markets.

3 - Teaching and Learning Methods:

The course comprises a combination of lectures, direct reading, case studies & Problems.
Required facilities: Overhead Projector and Data Show.

Course Meeting Times:

Lecture: 2 sessions per week, 1.5 Per session, total 3 hours.
Tutorials: 1 session per week, 1.5 Per session

4– Student Assessment Methods, Schedule and Grad in :

Assessment No.	Type	Lecture	Tutorial
1	Attendance	-	2
2	Participation/discipline	-	3
3	Test/ Homework	-	5
4	Final Examination	-	10
Total		20	20

- Attendance is expected and will be taken each class. Students are allowed to miss **1** class during the semester without penalty. Any further absences will result in point and/or grade deductions.
- Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials.

5 – Course Outline:

Week	Content
Week 1	**General Presentation about Microeconomics Syllabus and course organization**
Week 2	**Chapter 1: Introduction to Microeconomics** What Is Economics? How Economists use scientific approach (Theories and Models) to Understand Economic Issues Microeconomics and Macroeconomics
Week 3	**Chapter 2: Demand and Supply and Market equilibrium** Demand for Goods and Service
Week 4	**Chapter 2: Demand and Supply and Market equilibrium** Supply of Goods and Services
Week 5	**Chapter 2: Demand and Supply and Market equilibrium** Market equilibrium
Week 6	**Chapter 3: Elasticity** Elasticity Analysis
Week 7	**Chapter 3: Elasticity** Continue: Elasticity Analysis
Week 8	**Chapter 4: Applications on Supply and Demand : Government Intervention** Introduction to Government Policy Price Controls
Week 9	**Chapter 4: Applications of Supply and Demand : Government Intervention** Taxes and Subsidies
Week 10	**Chapter 5: Consumer Behavior Theories** Introduction to Consumer Choices Cardinal Utility Approach: Marginal utility theory
Week 11	**Chapter 5: Consumer Behavior Theories** Continue : Cardinal Utility Approach
Week 12	**Chapter 5: Consumer Behavior Theories** Ordinal Utility Approach: The Indifference Curves
Week 13	**Chapter 5: Consumer Behavior Theories** Continue : Ordinal Utility Approach
Week 14	**General Revision**
Week 15	**Final Examination**

6 - List of References:

(a) Course Notes:

Student are required to write their lessons and notes will be distributed to the students throughout the semester.

(b) Essential Books (Text Books):

- Michael PARKIN, Microeconomics, Pearson education, 13th edition, 2019
- Case, K., Fair, R. and Oster, S., Principles of Economics, Pearson Education, 10th Edition, 2014.

(c) Recommended Books:

- Kolstad, C.D., Microeconomics, Oxford University Press, 2nd Edition, 2010.
- Lipsey, R. and Chrystal, A., Economics, Oxford University Press, 12th Edition,2011.
- Christopher T.S. Ragan, Ragan Microeconomics, Pearson, Canada,2019.
- Martin Kolmar; Magnus Hoffmann, Workbook for Principles of Microeconomics,2018.
- R Frank and E Cartwright, Microeconomics and Behaviour (2nd ed), McGraw-Hill, Springer Texts in Business and Economics,2016.

Table of Contents

Chapter 1 :Introduction to Microeconomics

CHAPTER OBJECTIVES

In this chapter, you will learn about :

- What Is Economics?
- How Economists use a scientific approach (Theories and Models) to Understand Economic Issues
- Microeconomics and Macroeconomics

By the end of this section, you will be able to:

- Discuss the importance of studying economics
- Evaluate the significance of scarcity

1.1 What Is Economy, and What is difference between the word economy and the word Economics?

The word economy in English is derived from the Medieval Latin's **oeconomia**. The Latin word has its origin at the Ancient Greek's **oikonomos**. The world's first part **oikos** means "**house**", and the second part **nomos** means "**rules or to manage**".

The word **economy** refers to the complex of **activities** related to the **production**, **distribution**, as well as **consumption** of **goods** and **services**. In general, it is defined as a **social domain** that emphasize the **behaviors, practices**, **systems**, and **knowledge** associated with the production, use, and management of **scarce resources**.

Scarcity and the Fundamental Economic Questions (The economic problem)

The economic problem is the fundamental challenge facing all societies, which is how to satisfy unlimited wants and needs with limited resources. The choices we confront as a result of scarcity raise three sets of issues. Every economy must answer the following questions:

1. **What should be produced?** Every society must decide what it will produce with its scarce resources.
2. **How should goods and services be produced?** There are all sorts of choices to be made in determining how goods and services should be produced.
3. **For whom should goods and services be produced?** If a good or service is produced, a decision must be made about who will get it.

The definition of Economics

The word **Economics** refers to the economic science, which is a **social science**. It is social because it involves people and their behavior. It is a science because it uses, as much as possible, **a scientific approach** in its investigation of choices.

Economics is **the science studies human behavior and how people choose to use limited or scarce resources in attempting to satisfy their unlimited needs and wants**.

1.2 How Economists use a scientific approach (Theories and Models) to Understand Economic Issues ?

Economics relies primarily on deductive logic to create theory. **Deductive logic involves formulating and testing hypotheses.** In other words, the theory is created,and then data is applied in a statistical test to see if the theory can be rejected.

Inductive logic creates principles from observation. In other words, the scientist will observe evidence and attempt to create a principle or a theory based onany consistencies that may be observed in the evidence.

How Economics studies Human behavior?

Economics is the study of how humans make decisions in the face of **scarcity**. These can be individual decisions, family decisions, business decisions or societal decisions. If you look around carefully, you will see that scarcity is a fact of life. **Scarcity** means that human **wants** and **desires** for goods, services are **unlimited** and exceed available resources **(limited resources**).

Resources, such as labor, tools, land, and raw materials are necessary to produce the goods and services we want but they exist in **limited supply**. Of course, the ultimate scarce resource is time- everyone, rich or poor, has just 24 expendable hours in the day to earn income to acquire goods and services, for leisure time, or for sleep. At any point in time, there is only a finite amount of resources available.

Think about all the things you consume: food, shelter, clothing, transportation, healthcare, and entertainment. How do you acquire those items? You do not produce them yourself. You buy them. How do you afford the things you buy? You work for pay. If you do not, someone else does on your behalf. Yet most of us never have enough income to buy all the things we want. This is because of scarcity. So how do we solve it?

1.3 Microeconomics and Macroeconomics

It should be clear by now that economics covers considerable ground. We can divide that ground into two parts:

Microeconomics which refers to the branch of economics **that studies the economy on an individual and business level**, like households, workers, and businesses.It operates on concepts of consumer theory and utility, producer theory, and market structures, examining how resources and goods are produced and used by businesses and consumers. Using the principles of microeconomics, professionals can gain insight into the economic welfare of individuals and communities, which can be applied to everything from addressing income inequality in underinvested communities to pricing of products.

Macroeconomics looks at the economy as a whole. It **is concerned with the aggregate performance of the entire economic system** such as growth of production, the number of unemployed people, the inflationary increase in prices, government deficits, and levels of exports and imports. Microeconomics and macroeconomics are not separate subjects, but rather complementary perspectives on the overall subject of the economy.

Chapter 2: Demand and Supply and Market Equilibrium

CHAPTER OBJECTIVES

In this chapter, you will learn about :

- Demand & supply: determinants of demand & supply, demand & supply curves, the "laws" of demand and supply, movements along versus shifts of demand and supply curves.
- Normal & inferior goods, complements & substitutes, individual demand and supply v market demand and supply
- Equilibrium prices and quantities, price as a mechanism for equilibration.

By the end of this section, you will be able to:

- Explain demand, quantity demanded, and the law of demand
- Identify a demand curve
- Understand the difference between demand and quantity demanded
- Know the four main determinants of demand
- Explain demand shifts from both horizontal and vertical perspectives
- Create an aggregate demand curve given individual curves
- Explain supply, quantity supplied, and the law of supply
- Understand the difference between supply and quantity supplied
- Know the four main determinants of supply
- Explain supply shifts from both horizontal and vertical perspectives
- Explain equilibrium, equilibrium price, and equilibrium quantity
- Understand how supply and demand bring markets back to equilibrium
- Analyze the effect of supply and demand shocks to market price and quantity
- Calculate market surplus given supply and demand curves

Introduction to Demand and Supply

This chapter introduces the economic model of demand and supply—one of the most powerful models in all of economics. The discussion here begins by examining how demand and supply determine the price and the quantity sold in markets for goods and services, and how changes in demand and supply lead to changes in prices and quantities.

First let's first focus on what economists mean by demand, what they mean by supply, and then how demand and supply interact in a market.

2 .1 Demand for Goods and Services

Economists use the term **demand** to refer to the amount of some good or service consumers are **willing** and **able** to purchase at each price. Demand is fundamentally based on needs and wants—if you have no need or want for something, you won't buy it. Demand is also based on ability to pay. If you cannot pay for it, you have no effective demand. By this definition, a person who does not have a drivers license has no effective demand for a car.

What a buyer pays for a unit of the specific good or service is called **price**. The total number of units that consumers would purchase at that price is called the **quantity demanded**.

A rise in price of a good or service almost always decreases the quantity demanded of that good or service. Conversely, a fall in price will increase the quantity demanded.

Economists call this inverse relationship between price and quantity demanded the **law of demand**. The law of demand assumes that all other variables that affect demand (which we explain in the next module) are held constant.

Economists call a table that shows the quantity demanded at each price a **demand schedule.**

Price of Oranges	Quantity Demanded
100	5
120	4
150	3
180	2
200	1

The demand equation is the mathematical expression of the relationship between the quantity of a good demanded and those factors that affect the willingness and ability of a consumer to buy the good.

In its standard form a linear demand equation is ***Q = a - bP***. That is, quantity demanded is a function of price.

- Q = quantity demanded
- a = all factors affecting QD other than price (e.g. income, fashion)
- b = slope of the demand curve
- P = Price of the good.

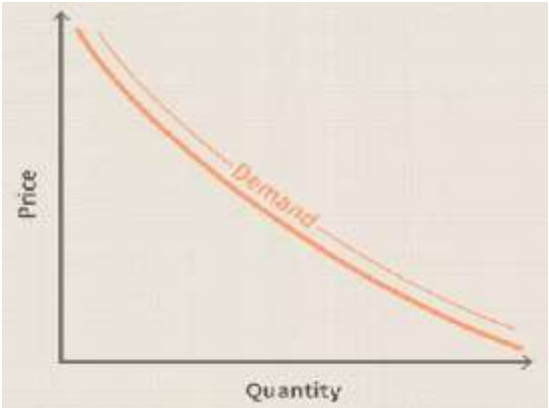
The inverse demand equation can also be written as

- P = a -b(Q)
- a = intercept where price is 0
- b = slope of demand curve

To graph the demand curve we directly use the demand schedule or the demand equation.

A **demand curve** shows the relationship between price and quantity demanded on a graph, with quantity on the horizontal axis and the price on the vertical axis.

Note that this is an exception to the normal rule in mathematics that the independent variable (x) goes on the horizontal axis and the dependent variable (y) goes on the vertical axis. Economics is not math.



Demand can be used either for the price-quantity relationship for an individual consumer (an **individual demand**), or for all consumers in a particular market (a **market demand**).

2.1.1 Individual demand

Individual demand implies, the quantity of good or service demanded by an individual or a household, at a given price and at a given period of time. *For example*, the quantity of detergent purchased by an individual or a household, in a month, is termed as individual demand.

Individual Demand Schedule

An individual demand schedule is a **tabular representation** of the list of quantities of a commodity demanded by an individual at different price levels, during a certain period of time.

Example 1 : Given are the price per kg of oranges and the quantity demanded by a consumer.

Price of Oranges	Quantity Demanded
100	5
120	4
150	3
180	2
200	1

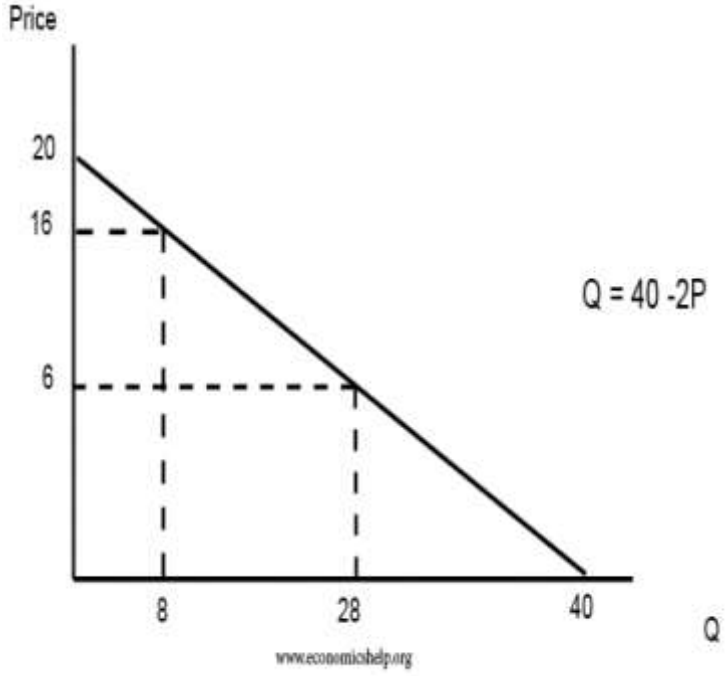
Individual Demand Curve

An individual demand curve represents the quantity demanded by the individual household at various prices. We can also say that it is the **graphical representation of the individual demand schedule**. It can be constructed by observing consumer behaviour when there is a change in price.

Considering the above example, the curve will be drawn as follows:

Example2 : linear demand curve Qd = 40 – 2P

Q	P
40	0
38	1
36	2
34	3
32	4
30	5
28	6
26	7
0	20



Example 3: Let's use the gasoline demand function above. And we only use price and quantity as variables. So, the equation we use is:

- Qd = 9.3 – 0.7P

First, we must obtain the inverse demand function to graph the function. The trick is moving P from the equal sign's right to the left. On the other hand, we move Qd from the left of the equal sign to the right. So, we get:

- 0.7P = 9.3 – Qd
- P = (9.3/0.7) – (1/0.7) ×Qd
- P = 13.3 – 1.4Qd

1.4 represents the slope of the demand curve. Meanwhile, the negative sign indicates a downward sloping curve. To illustrate the above equation, we have to get the gasoline price data, then calculate the quantity using the above equation. Say the result is as follows:

2.1.2 Market Demand

Market Demand refers to the sum total of the individual demands of all the consumers for a commodity in a market over a period of time, at given prices, other factors being constant.

Market Demand Schedule

A market demand schedule is a **tabular representation** indicating how much quantity of a commodity the consumers are willing and able to buy in a market at different prices, during a specified period of time. Basically, it is a sum of the individual demand schedules, indicating the preference scale of different consumers taken together, at different price levels.

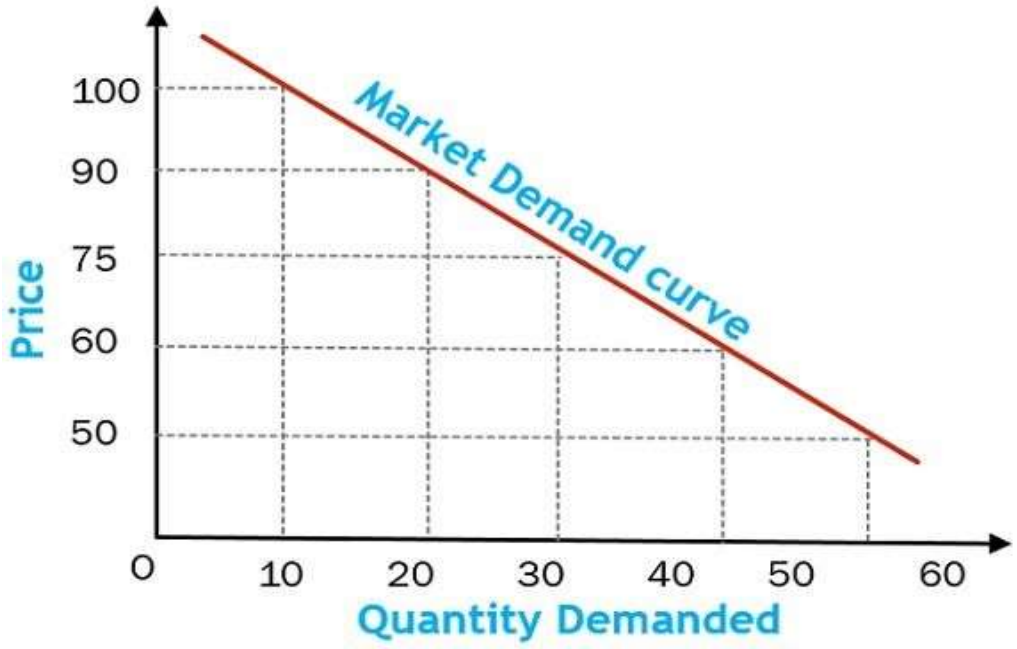
For Example : Given are the price per kg of sugar and the quantity demanded by all four consumers in the market : A, B, C and D.

Price per kg of Sugar	Demand by Consumers (in kg)				Market Demand (in kg)
	A	B	C	D	
50	10	10	15	20	55
60	08	07	12	17	44
75	06	06	08	12	32
90	04	04	05	09	22
100	02	02	01	04	10

Market Demand Curve

The market demand curve **graphically** indicates the horizontal sum of the individual demand curves. With the help of market demand, the firm can understand the entire market and not just individual customers.

For Example : Considering the above example, the curve will be plotted as under:



The market demand function

focuses on everyone who buys the product. Suppose each individual has an identical demand function. In that case, we multiply the total consumers in the market by the individual demand function to obtain it. For example, there are 100 buyers in the gasoline market with the following individual demand functions:

- Qd = 9.3 – 0.7P

The market demand function for the above case is :

- Qd = 100 (9.3 – 0.7P) = 930 – 70P

Thus, if the gasoline price increases by $1, the demand for gasoline in the market will decrease by 860 liters (930 – 70). On the other hand, every $1 decrease in the gasoline price will increase the demand for 860 liters.

However, if the demand function varies between individuals, we cannot apply the above calculation. Instead, we have to add each demand function.

For example, there are three consumers in the market: A, B, and C. The three demand functions for a product are as follows:

- Qda = 70 – 10 P
- Qdb = 80 – 4 P
- Qdc = 30 – P

From this information, we can derive the market demand function by adding up all the individual functions. Thus, the market demand function is :

- Qdm = (70 – 10 P) + (80 – 4 P) + (30 – P) = 180 – 15P

Is the formula above correct ? Assume the price (P) is $1. That will yield a total quantity of :

- Qda = 70 – (10 x 1) = 60
- Qdb = 80 – (4 x 1) = 76
- Qdc = 30 – 1 = 29

So, Qdm = 60 + 76 + 29 = 165. Using the market demand formula above, we get 180 – (15 x 1) = 165.

2.1.3 Other Determinants of Demand

In section 2.2, we explored how the price affected quantity demanded, but what about other factors that affect our choices ?

As we will see in this section, there are many determinants of demand. The four we will explore in detail are :

1. Income
2. Prices of Related Goods
3. Tastes and Preferences
4. Expectations

Income

The first determinant of demand we will explore is income. If you were to land a job with a top salary tomorrow, how would that affect your demand for different items ? Perhaps you would exchange your old Honda Accord for a Porsche, or go on a shopping spree at a high-end clothing store. Though having more money means you can buy more goods, there are some goods that you may actually buy less of. In introductory microeconomics, we classify goods into two types : **inferior goods** and **normal goods**. For inferior goods, as your income *rises* your demand *falls*. For normal goods, as income *rises* your demand *rises.*

	Normal Good	Inferior Good
Increase in Income	Increased Demand	Decreased Demand
Decrease in Income	Decreased Demand	Increased Demand

Price of Related Goods

So far, we have only looked at one good in isolation. In reality, there are many goods in the marketplace that interact with each other in unique ways. Some goods seem to pair nicely, whereas others compete. These interactions have specific classifications in economics. With reference to the good we are analyzing in our demand curve:

Complement goods are goods that a consumer likes to consume **with** a given good. For example, coffee and sugar. Demand for complements is positively correlated with the other goods price. If jelly increases in price, we will purchase less peanut butter.

Substitute goods are goods that a consumer could consume **instead of** a given good. For example, meat and chicken. Demand for substitutes is negatively correlated with the other goods price. If meat increases in price, we will purchase more chicken.

Like income, the impact of market price fluctuations on our demand curve depends on whether the two goods are substitutes or complements. The following table summarizes how our demand for a given good can be impacted by price fluctuations of other goods.

	Complement	Substitute
Increase in Price	Decreased Demand	Increased Demand
Decrease in Price	Increased Demand	Decreased Demand

Tastes and Preferences

Our tastes and preferences change over time. In gasoline example, assume you start dating someone who drives an electric car and constantly reminds you of the impact your gasoline consumption has on the environment. You will likely begin to follow some of their habits and purchase less gasoline. Marketing departments constantly try to influence your preferences, and sometimes even create them. That's because the more you prefer a product, the more you will demand it!

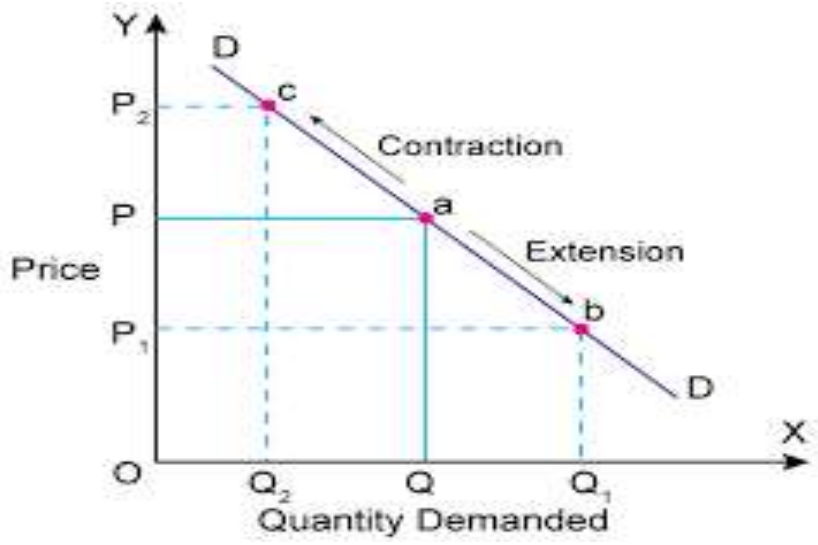
Expectations

changes in expectations can have a considerable impact on current demand. For example, an expectation that there may be a fuel (petrol/gasoline) shortage is likely to increase demand for fuel in the short run as motorists look to reduce the risk of not being able to use their vehicle. This can, of course, trigger further increases in demand and create the very shortage motorists feared.

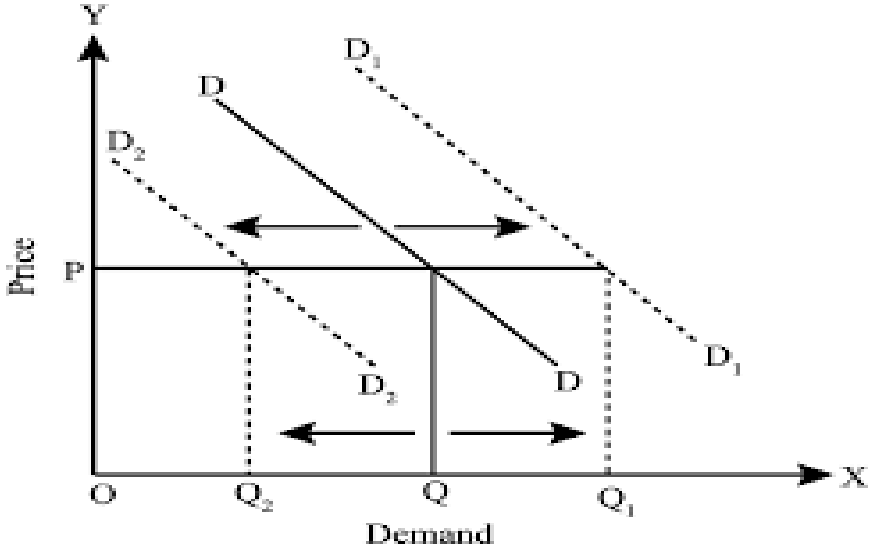
2.1.4 Change in Quantity Demanded vs. Change in Demand

A change in quantity demanded refers to a movement along a fixed demand curve -- that's caused by a change in price. A change in demand refers to a shift in the demand curve -- that's caused by one of the shifters: income, preferences, changes in the price of related goods and so on.

A change in price will lead to a change in the **quantity demanded**, assuming other determinants remain constant. Graphically, an increase in price leads to a **contraction** back and upwards along the existing demand curve, and a decrease in price leads to an **extension** down and forward along the existing curve, as shown.



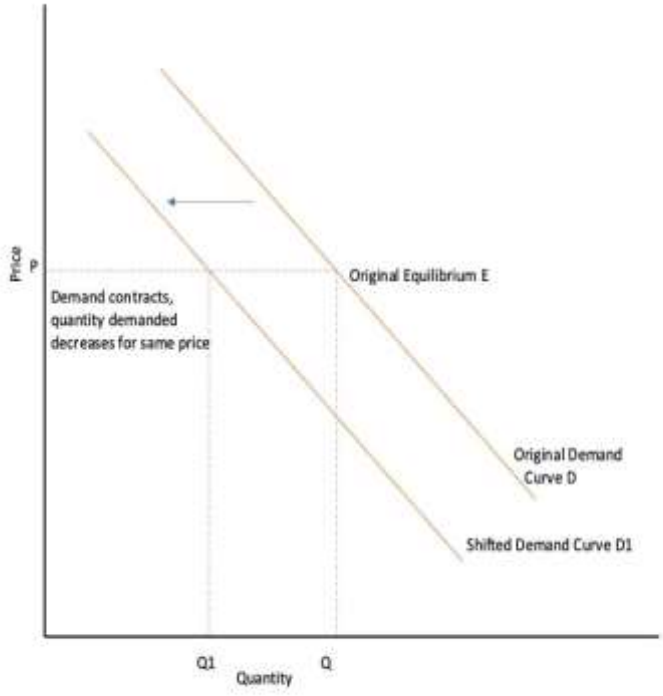
A change in **demand** refers to a shift in the entire demand curve, which is caused by a variety of factors (preferences, income, prices of substitutes and complements, expectations, population, etc.). In this case, the entire demand curve moves left or right.



Demand Curve Shifts Left

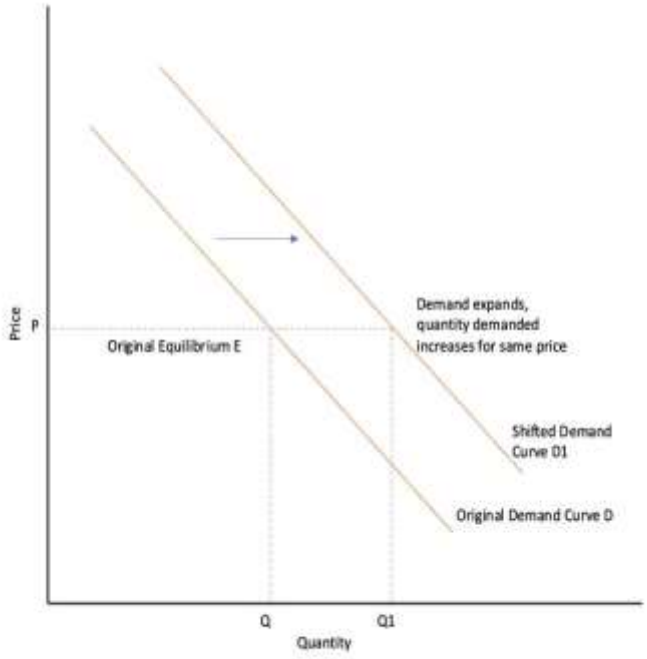
The demand curve shifts to the left if the determinant causes demand to drop. That means less of the good or service is demanded. That happens during a recession when buyers' incomes drop. They will buy less of everything, even though the price is the same.

For example, consider the following demand and supply chart for a product. If originally at price P, quantity Q was demanded, once the demand curve shifts to the left at the same price P, lower quantity Q1 will be demanded.



Demand Curve Shifts Right

The curve shifts to the right if the determinant causes demand to increase. This means more of the good or service are demanded even though there's no change in price. When the economy is booming, buyers' incomes will rise. They'll buy more of everything, even though the price hasn't changed.



For example, consider the following demand and supply chart for a product. If originally at price P, quantity Q was demanded, once the demand curve shifts to the right at the same price P, more quantity (Q1) will be demanded.

2 .2 Supply of Goods and Services

When economists talk about **supply**, they mean the amount of some good or service a producer is willing and able to supply or to sell at each price. Price is what the producer receives for selling one unit of a good or service. A rise in price almost always leads to an increase in the **quantity supplied** of that good or service, while a fall in price will decrease the quantity supplied.

Economists call this positive relationship between price and quantity supplied—that a higher price leads to a higher quantity supplied and a lower price leads to a lower quantity supplied—the **law of supply**. The law of supply assumes that all other variables that affect supply (to be explained in the next module) are held constant.

Like demand, we can illustrate supply using a table or a graph.

A **supply schedule** is a table, that shows the quantity supplied at a range of different prices. Again, we measure price in dollars per gallon of gasoline and we measure quantity supplied in millions of gallons.

Supply equation Usually, economists use several variables to explain how they affect supply. They assume other factors do not change or ceteris paribus. The supply function equation is ***QS = a + bP***

- Where Qs is quantity supplied
- a = the level of supply independent of price
- P = the market price of the product
- b = slope of the Supply curve
- P = Price of the good.

Example: Supply for Product X = 10 + 2(P)

If the market price is £10, then Qs= 10 + 20 = 30 units
The inverse supply equation can also be written as

P= a + bQS

a = plots the starting point of the supply curve on the Y-axis intercept.
b = slope of the supply curve.

To graph the supply curve we directly use the supply schedule or the supply equation.

A **supply curve** is a graphic illustration of the relationship between price, shown on the vertical axis, and quantity, shown on the horizontal axis.
The supply schedule and the supply curve are just two different ways of showing the same information. Notice that the horizontal and vertical axes on the graph for the supply curve are the same as for the demand curve.
Supply can be used either for the price-quantity relationship for an individual Producer (an **individual Supply**), or for all Producers in a particular market (a **market Supply**).

2.2.1 Individual Supply

Individual Supply is the amount of a commodity that a certain producer is willing and able to sell at a specific price during a specific period.

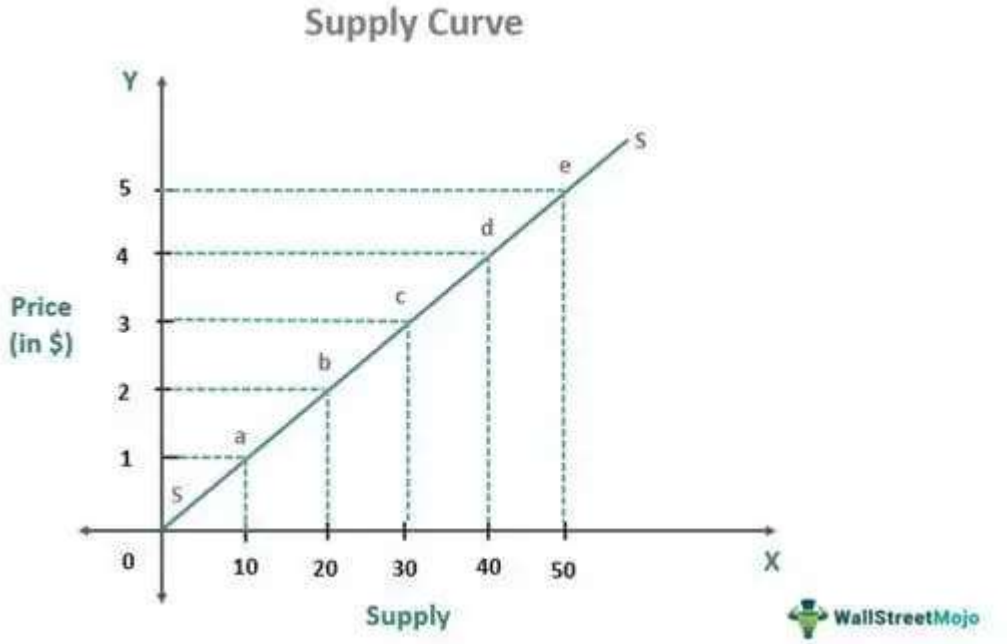
Individual Supply Schedule

Individual supply schedule is a tabular statement of the various quantities of product that is supplied by a particular single seller or producer at various price levels over a period of time, with all other factors being constant. The schedule of supply is a table that represents it. For instance :

Schedule of Individual Supply	
Price ($)	Quantity (Kgs)
1	10
2	20
3	30
4	40
5	50

Individual supply Curve

The supply curve often represents the above schedule. In the law of supply, the supply curve moves upward from left to right, describing a positive or direct relationship between the prices of the commodities and supply.



When the quantity supplied is expressed only as a function of the price of the product, other factors remaining constant, it is called a supply function.

Example : The following is a simple supply function :

$QS = – 10 + 1/2\ P$

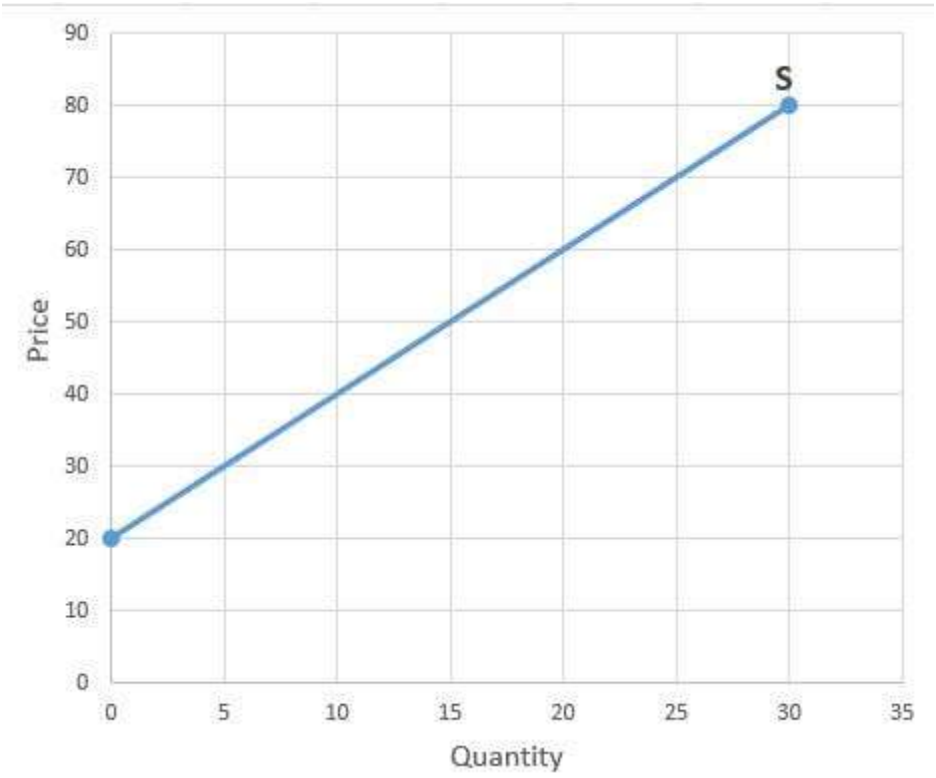
Since we want to graph price on the vertical axis, we need to rewrite the equation in terms of price:

$QS = – 10 + 1/2\ P$

$½\ P = Qs + 10$

$P = 20 + 2QS$

The slope of this supply curve is **2** and the vertical intercept is 20. To graph it, begin by marking the vertical intercept (20) and then plug in a larger value for Q (such as 30). Sketch a line connecting these points.



2.2.2 Market Supply

Market supply is the total amount of an item producers are willing and able to sell at different prices, over a given period of time e.g. one month. Industry, a market supply curve is the horizontal summation of all each individual firm's supply curves.

Market Supply Schedule

Market supply schedule is a tabular statement of the various quantities of the product that all the suppliers in the market are willing to supply at various price levels during a specific time period.

A market will be full of suppliers who will be supplying a particular commodity and all of these suppliers will be having their individual supply schedules. Therefore, the market supply schedule is a sum total of all the individual supply schedules of the suppliers of the market.

Market Supply Schedule can be represented as

$S_m = S_A + S_B + \ldots\ldots\ldots\ldots$

Where S_m = Market Supply Schedule

S_A = Individual Supplier A

S_B = Individual Supplier B

This option is also called the aggregate supply schedule. Below is an example of a market supply schedule.

Price per unit of product X (Px)	Quantity supplied by Company A (Qa)	Quantity supplied by Company B (Qb)	Market Supply (Qa + Qb)
100	1,000	3,000	4,000
200	2,000	4,000	6,000
300	3,000	5,000	8,000
400	4,000	6,000	10,000
500	5,000	7,000	12,000

Likewise, to determine its function, we add up the own supply function of each producer. If there are ten producers in the market, and each produces 100 units of output, then the total supply in the market is equal to 1000 units.

Just like calculating the market demand function, we calculate the market supply function of a product by aggregating the quantities supplied by each company. Say, the quantity function supplied by individual producers is **Qs = -100 + 200P**, and there are ten companies in the market. Then the market demand function in this case is **Qs = 10 (-100 + 200P) = -1000 + 2000P.**

2.2.3 Other Factors that Affect Supply

In section 2.2.1 we looked at the impact of price on the supply curve, but there are many other factors that affect a company's decision to produce. For example, new innovations are always coming out to make cake decorating and baking easier, whether it is machines like the one shown above, or faster and better mixers. These inventions save time and energy at different levels of production. External forces like these impact our supply curve. The four supply shocks we will examine in detail include:

1. Input Prices
2. Technology
3. Expectations
4. Number of Producers

Input Prices

Perhaps the most obvious shock to the supply curve is the cost of inputs. Also known as 'Factors of Production', these are the combination of labor, materials, and machinery used to produce goods and services. A rise in input prices increases the cost of production, disincentivizing producers to produce.

Technology

As mentioned at the beginning of the section, changes in technology will also shift the supply curve. Why is that the case? Technology changes have a direct impact on the cost of production. If suddenly a new innovation allows you to cut your work time in half, you will cut down your costs of labor. If technology allows you to conserve wasted resources, then your input prices will decrease, These changes will increase supply, shifting the curve to the right. **Technological Decay** is a less common

case where technological progress is reversed. What if the city banned the use of a certain cupcake icing machine because the noise was bothering other residents? This would cause you to go back to the less efficient practice of icing by hand, thereby increasing your costs. In summary:

- **Improvements** in technology will lower costs of production and **increase supply**
- **Decay** in technology will increase costs of production and **decrease supply**

Expectations

Like demand, expectations of the supply price affect production decisions. Production decisions are a lot like playing the stock market; if we are producing cupcakes and cookies to sell to the store tomorrow, we have to produce based on the current, incomplete knowledge we have about those prices. Normally, you will be confident that these prices will stay relatively stable, but if you have reason to believe the prices of cupcakes will drastically rise in the morning, you may devote more of your attention to producing them. Expectations are usually based on some form of evidence or signal and can cause supply shifts quite suddenly. In summary:

- If the firm expects **prices to rise,** supply will **increase**
- If the firm expects **prices to fall,** supply will **decrease**

Number of Producers

The final determinant of supply is the number of producers. So far, we have examined just one firm. Recall in section 3.3 we showed that the competitive market is characterized by many potential buyers, and added up individual demand curves to produce aggregate demand. Likewise, the market is made up of many other producers. By adding all the suppliers together, we get **aggregate supply.**

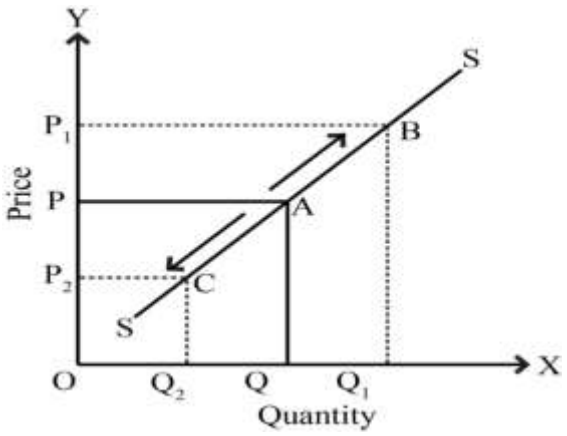
- When more **firms enter** the market, **supply will increase**
- When **firms leave** the market, **supply will decrease**

2.2.4 Change in Quantity Supplied vs. Change in supply

A change in supply shouldn't be confused with a change in the quantity supplied. The former causes a shift in the entire supply curve, while the latter results in movement along the existing supply curve.

Movement along the supply curve or change in quanity supplied

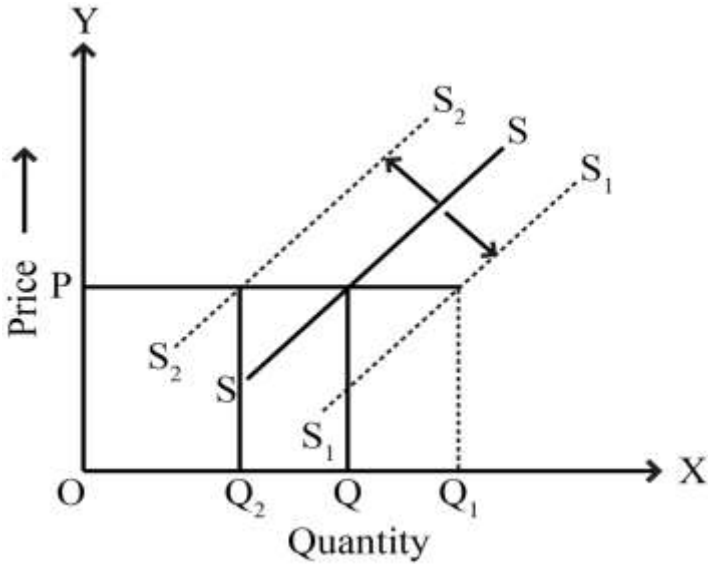
When the supply of a good rises due to rise in the price of the good alone, it is termed as an expansion of supply. When supply of a good falls due to fall in its price, it is called contraction of supply. Graphically, it means a movement along the supply curve.



In the given digram, at point OP, the supply is Q. When price rises to P1, supply rises to Q1. In this case, the producer moves from A to B upwards but remains on the same supply curve. When price falls to P2, supply falls to Q2. The producer moves from A to C but remains on the same supply curve.

Shifts in supply curve or change in supply

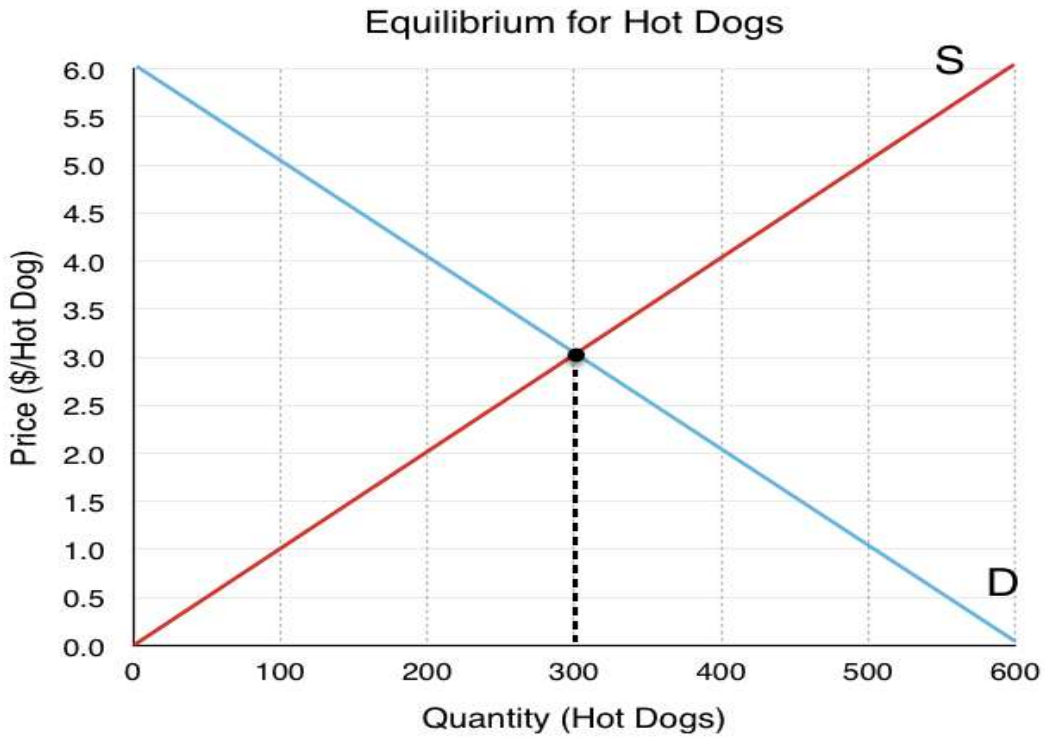
When at the given price, the supply of a good increases, it is called increase in supply. When at the given price, the supply decreases, it is called decrease in supply. Graphically, it means shift of supply curve. In the figure, at price P, the supply is Q. When there is increase in supply at the given price, the supply curve shifts to the right, If there is a decrease in supply at the given price, the supply curve shifts to the left.



2.3 Market Equilibrium

Equilibrium is formally defined as a state of rest or balance due to the equal action of opposing forces. In economics, these forces are supply and demand. As we will see, when supply and demand are not in balance, economic forces will work until the balance is restored.

Figure below shows the competitive market for hot dogs, with aggregate demand in blue and aggregate supply in yellow. As price rises, quantity demand for hot dog falls, and quantity supplied rises. There are two important points on this diagram. First is **equilibrium quantity (Q^*)**. Q^* is where the quantity supplied is equal to the quantity demanded. It is important to recognize this value and the mechanism that leads us there. There is only one price that corresponds with equilibrium quantity, and that is **equilibrium price (P^*).**



- The equilibrium point is the point where the supply and demand curves intersect. The point reveals the optimum price and quantity.
- It is calculated by solving equations for quantity demanded and quantity supplied (a – bP = a + bP). Solving it gives the value of "P," and applying the value of "P" in the Q_D or Qs equation gives the result.

Demand equation: **Q_D = a – bP**

- Q_D: Units demanded
- P: Price of each unit

Supply equation: **Qs = a + bP**

- Qs: Units supplied
- P: Price of each unit

At equilibrium, supply and demand intersect, pointing to the equilibrium price and quantity. At equilibrium price:

Quantity demanded = Quantity supplied : $Qs = Q_D$

Substituting the formula for Qs & Q_D : $a + bP = a - bP$

Solving the above gives the value of "P," and applying the value of "P" in the Q_D or Qs equation gives the equilibrium quantity.

Example 1 : For instance, let's say that you are calculating the equilibrium quantity of calculators. Therefore, the supply equation is **$Qs = 2 + 5P$ and** The demand equation is **$Q_D = 16 - 2P$**

$Qs = Q_D$

$2 + 5P = 16 - 2P$

$7P=14$ so **$P^* = 2$** You now know that the equilibrium price, or the price where is $2.

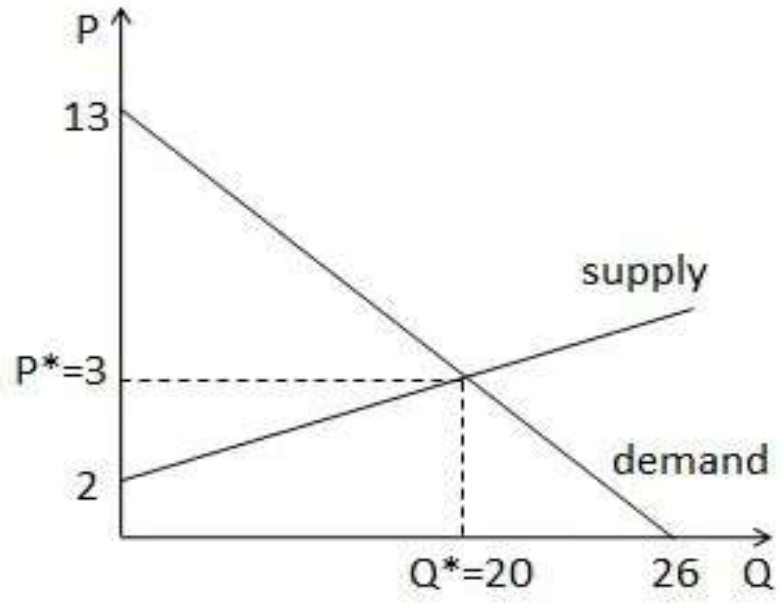
Plug the equilibrium price into the equation and solve. You can choose either the demand equation or the supply equation (since both are equal, they will both give you the same answer). In the example below, we will use the demand equation:

$Q^* = 16 - 2(2) = 16-4 = 12$

You now know that the equilibrium quantity is 12, which means that at $2 per calculator, consumers will purchase 12 of them.

Example 2

$Qs = -4 + 8P$ **$Q_D = 26 - 2P$** **$-4 + 8P = 26 - 2P$** **$P^* = 3$** **$Q^* = -4 + 8(3) = 20$**



Changes in Market Equilibrium: Impact of changes in demand and supply

Changes in either demand or supply cause changes in market equilibrium. Several forces bringing about changes in demand and supply are constantly working which cause changes in market equilibrium, that is, equilibrium prices and quantities.

Change in demand

The demand may increase or decrease, the supply curves remaining unchanged. This would cause a change in equilibrium price and quantity. Suppose there is increase in income of the working class due to the enhancement of their salaries by the Pay Commission. As a result of this increase in income, their demand for cloth for shirting will increase causing a shift in the entire demand curve for cloth to the right.

This will raise the equilibrium price and quantity of cloth, the supply curve of cloth remaining unchanged as is shown in Fig. below. It is important to understand the chain of causation which leads to the increase in price and quantity as a result of increase in demand.

Consider Fig. below, in which D0 and S are the initial demand and supply curves of cloth. The increase in income causes a shift in the entire demand curve to the right to the new position D1 while the supply curve S remains constant. It will be observed from Fig. below, that with the shift in demand curve to D1 at the old price P0 excess demand of cloth equal to E0 has emerged. This excess demand of the good exerts upward pressure on price. This will result in rise in price to OP where again quantity demanded equals quantity supplied and new market equilibrium is attained and excess demand is eliminated. It is worth noting that increase in demand is the most important factor causing inflation, that is, rise in prices and is generally described as demand-pull inflation.

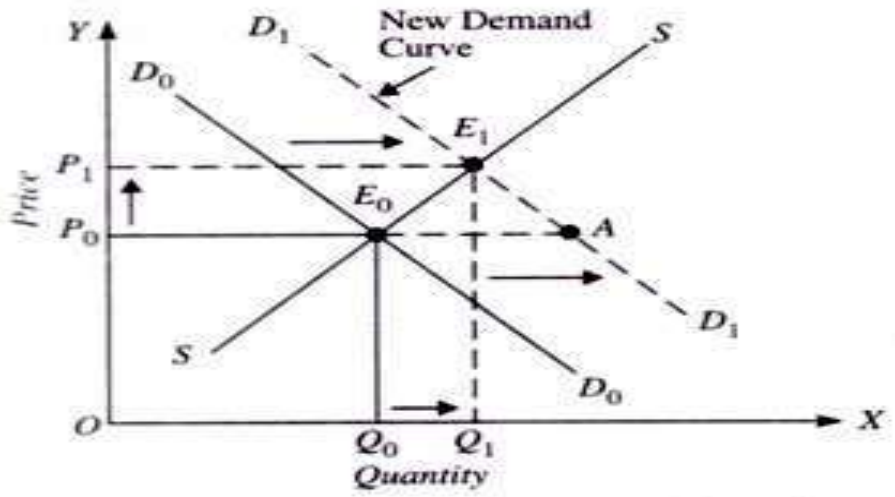


Fig. 24.2. *Impact of increase in Demand on Price and Quantity (P↑, Q↑).*

Now, take the opposite case of the impact of decrease in demand on market equilibrium, the supply curve remaining the same. The decrease in demand causes a shift in the entire demand curve to the left. This is graphically shown in Fig. below, where originally demand curve D_0 intersects the supply curve SS of eggs at point E_0 and determines equilibrium price equal to P_0 and equilibrium quantity Q_0. Now, suppose that doctors advise the people to take less eggs as it contains greater quantity of cholesterol

which increases the risk of heart disease. Consequently, demand for eggs decreases causing a shift in the demand curve to the left to the new position D2. The new equilibrium between demand and supply is attained at price P, and quantity Q2 which are lower than the initial equilibrium price P0 and quantity Q0.

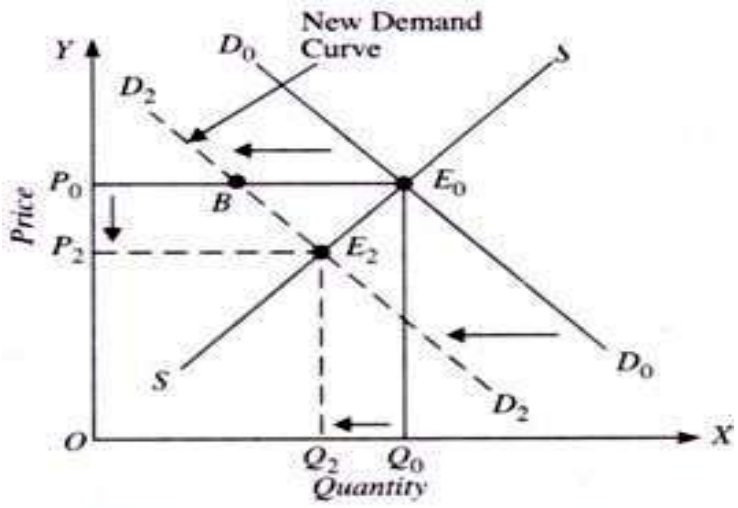


Fig. 24.3. *Impact of Decrease in Demand on Price and Quantity. (P↓, Q↓).*

Thus, the decrease in demand leads to the fall in both price and quantity. How does this come about? With the decrease in demand and consequently leftward shift in the demand curve to D_2D_2 supply curve remaining unchanged, at the original price OP_0, the surplus E_0B of the quantity supplied over the quantity demanded emerges which exerts a downward pressure on price.

The sellers which cannot sell the quantity which they want to sell at the original price will make offers to sell eggs at a lower price. As a result, price will fall. As price falls, the quantity supplied of eggs is reduced. At the new price OP_2 the quantity supplied again equals quantity demand and surplus is eliminated.

Change in supply

Now, we explain the impact of changes in supply on price and output of commodity, the demand for the commodity remaining the same. Let us first examine the case of increase in supply. Suppose in a year there is good Monsoon in India yielding bumper crop of wheat.

This will increase the supply of wheat in the market causing a shift in its supply curve to the right. The impact of increase in supply of wheat on equilibrium price and quantity is graphically depicted in Fig. below. Originally, demand curve D and supply curve S of wheat intersect at point E and determine equilibrium price equal to P^* and equilibrium quantity Q^* exchanged between the sellers and buyers.

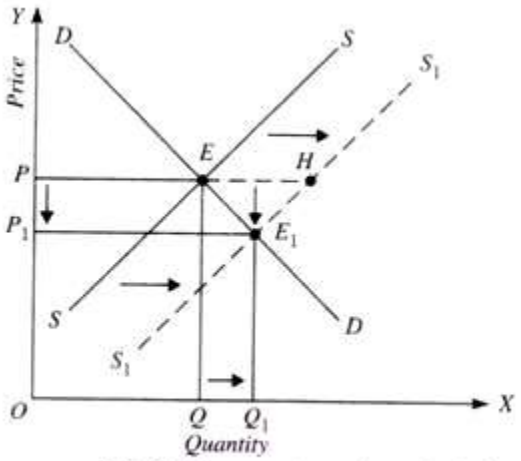


Fig. 24.4. *Increase in supply results in lowering of price and increase in quantity*

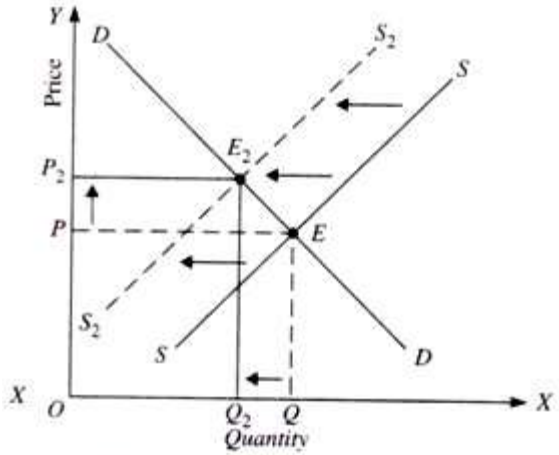


Fig. 24.5. *Decrease in supply cause rise in price and fall in quantity.*

Now, due to good monsoon resulting in bumper crop of wheat the supply curve of wheat shifts to the right from SS to the new position S_1. The new supply curve S_1 intersects the given demand curve D at point E_1, at which the new lower equilibrium price P_1 and larger quantity Q_1 are determined. Thus, the increase in supply leads to the fall in price and increase in equilibrium quantity.

Improvements in technology, reduction in the prices of factors and resources used in the production of a commodity or lowering of excise duty on a commodity also leads to the increase in supply of the commodity.

For example, in recent years improvements in technology in the manufacture of personal computers have served to increase the supply of personal computers causing their supply curve to shift to the right. This has resulted in lowering the prices of personal computers.

Series of Exercises No. 1 in Microeconomics 1 - Tutorials

Exercise °1

1.Economics is mainly about

a. efficiency only b. resource allocation

c. how to best use money d. deciding who is affected by taxation

2.How can we describe resources and human needs ?

3.What are the three fundamental economic questions?

4.What are the factors of production?

5.What are the market operations?

6.In the context of economics, define the consumption

7.Economics is a discipline that is divided into two broad branches, which are they?

8.The branch of economics which studies how household and firm makes choices, interact in markets is called:

A) macroeconomics. B) microeconomics.

9.Macroeconomics deals with:

a) the behaviour of firms b) the activities of individual units

c) economic aggregates d) the behaviour of the electronics industry

10.Which theory is generally included under microeconomics?

A) Price Theory B) Growth Theory

C) Employment Theory D) Internation Trade Theory

Exercise °2

Answer the following questions:

1. What is wrong with the statement: Demand refers to the willingness of buyers to purchase different quantities of a good at different prices during a specific time period:

a. Instead of "demand", it should be "quantity demanded".
b. Instead of "willingness", it should be "ability".
c. Demand refers to the willingness and ability of buyers, not just willingness.
d. There is nothing wrong with the statement.

2. _____ refers to the willingness and ability of buyers to purchase different quantities of a good at different prices during a specific time period whereas _____ refers to a specific number of units buyers want to buy at a specific price.

3. True or False :
   a. As the price of apples rises, the demand for apples falls
   b. The price of 1 kg apples, which was $5 last month, is $6 today: The demand curve for apples must have shifted rightward between last month and today.

4. Which of the following statements about demand curves is TRUE?

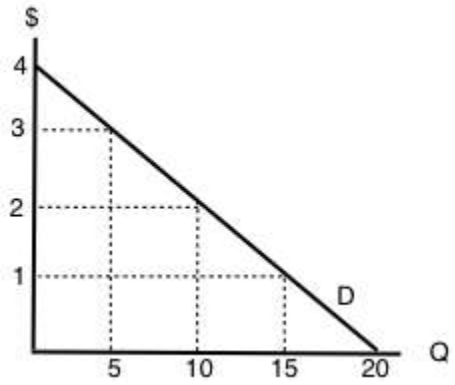
a) If price falls and quantity demanded increases, this is represented by a movement along a given demand curve.
b) If price falls and quantity demanded increases, this is represented by a shift of the demand curve.
c) If price falls and quantity demanded increases, this can be represented by either a movement along a given demand curve, or a shift of the demand curve.
d) None of the above are true.

5. Which of the following is NOT a determinant of the demand for good X?

a) The income of consumers who buy good X.
b) The cost of labor used to produce good X.
c) The price of good Y, a complement to X.
d) The number of buyers of good X.

Exercise °3

The following TWO questions refer to an individual's demand curve diagram, illustrated below.



1. If the price of this good is $1 per unit, what will be the quantity demanded?
2. Extract a demand schedule and demand function

Exercise ° 4

Suppose that Ahmed and Omar are the only consumers of candles in a particular market. The following table shows their annual demand schedules: **Find the market demand schedule**

Price	Ahmed's quantity demanded	Omar's quantity demanded
2	24	32
4	18	24
6	12	16
8	6	8
10	0	0

Exercise °5

Consider the demand curve for Ford fiesta in the United States. For simplicity, assume that:

The current market price of Ford Fiesta is $30,000 , Average Household income is $60,000 per year Price of a gallon of gas is $5 per gallon.

Suppose the price of a Ford fiesta decreased from $30,000 to $25,000. This would cause a _____ the demand curve. If an increase in average income causes a rightward shift of the demand curve, then you may conclude that Fiesta are a _____ good. Suppose that the price of a gallon of gas rises from $5 to $6. Because Fiesta and gasoline are _____, an increase in the price of a gallon of gas shifts the demand curve for Fiesta to the _____.

Exercise °6

Answer the following questions:

1. Indicate how each of the following will affect the current supply (Increase supply or Decrease Supply) for personal computers.

a) A rise in wage rates
b) An increase in the number of sellers of computers
c) A tax placed on the production of computers
d) A subsidy placed on the production of computers

2. Which of the following is NOT a determinant of the supply of good X?

a) The cost of inputs used to produce good X.
b) The technology used to produce X.
c) The number of sellers of good X.
d) All of the above are determinants of the supply of good X.

3. Which of the following will NOT shift the market supply curve of good X?

a) A change in the cost of inputs used to produce good X.

b) A change in the technology used to produce X.

c) A change number of sellers of good X.

d) A change in the price of good X.

4. A decrease in supply is, graphically, represented by :

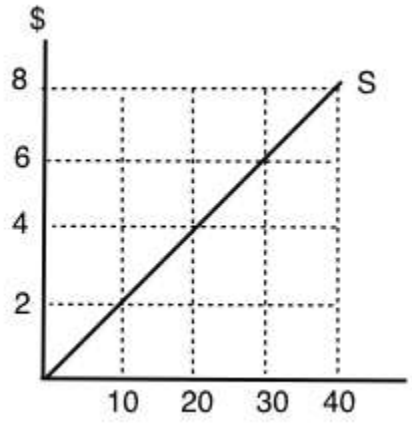
a) A leftward shift in the supply curve.

b) A rightward shift in the supply curve.
c) A movement up and to the right along a supply curve.
d) A movement down and to the left along a supply curve.

5. Consider the supply curve for sedans in an imaginary market. For simplicity, assume that all sedans are identical and sell for the same price
Suppose that the price of a sedan decreases from $30,000 to $25,000. This would cause the _____ of sedans to decrease , which is reflected on the graph by a _____ supply curve. Following a technological decline – for example, a decrease in the speed with which robots can attach bolts to cars – there is a _____ shift of the supply curve because the technological decline makes cars more expensive to build.

Exercise °7

The following TWO questions refer to the supply curve diagram below.



a. If price is $8 per unit, what will be the quantity supplied?

b. Extract a Supply schedule and supply function

Exercise °8

Suppose that the supply and demand schedule of lobsters is as follows and suppose that lobsters can be sold only in the United States. The U.S. demand schedule forMaine lobsters is as follows:

Price of lobster	Quantity of lobster supplied in USA	Quantity of lobster demanded in USA	Quantity of lobster demanded in France
$25	800	200	100
$20	700	400	300
$15	600	600	500
$10	500	800	700
$5	400	1,000	900

a. Draw the demand curve and the supply curve for lobsters. What are the equilibrium price and quantity of lobsters?

Now suppose that Maine lobsters can be sold in France. The French demand schedule for lobsters is as in the table.

b. What is the demand schedule for lobsters now that French consumers can also buy them? Draw a supply and demand diagram that illustrates the new equilibrium price and quantity of lobsters.What will happen to the price at which fishermen can sell lobster? What will happen to the price paid by U.S. consumers? What will happen to the quantity consumed by U.S. consumers?

Exercise °9

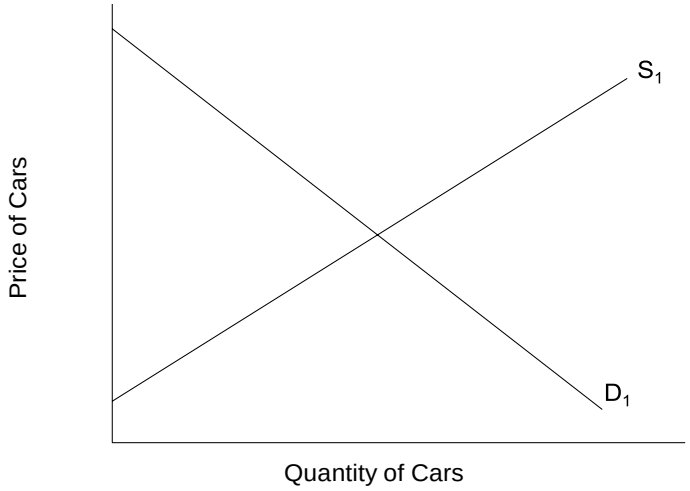
For the following questions, refer to the graph shown below.

a. Label the equilibrium point as E1, the equilibrium quantity as Q1, and the equilibrium price as P1.

b. Show how the supply curve will change if car manufacturers achieve a technological breakthrough that allows them to produce cars more cheaply.

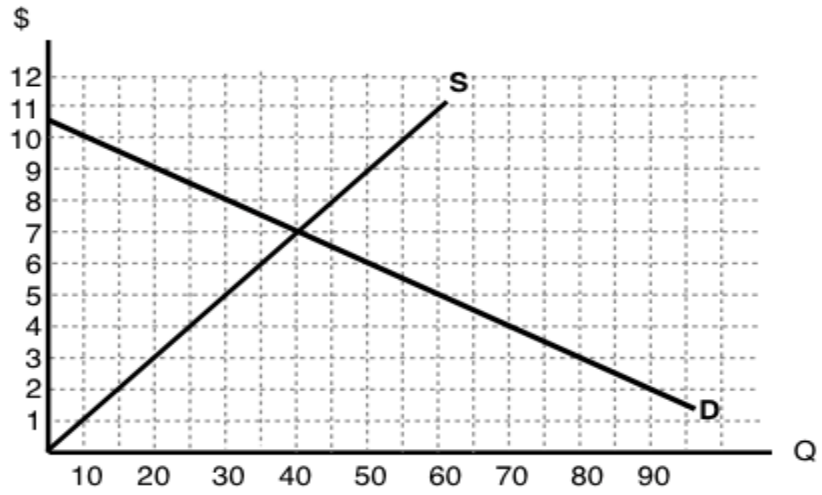
c. If the price stayed at P1, would a surplus or a shortage result from the technological breakthrough described in part (b)? Answer in words, and show on the graph.

d. Assuming market forces work quickly, show the new equilibrium price to which the market will adjust. Label this point as E2. Label the new equilibrium quantityas Q2, and the new equilibrium price as P2.



Exercise °10

The following TWO questions refer to the diagram below.



1. The equilibrium price is ____ the equilibrium quantity is _____.
2. Extract a Demand and Supply schedule

Exercise °11

Demand and supply equations of commodity X is given by

Qd = 100- P Qs = 70 + 2P

Solve algebraically to find equilibrium P* and Q*

Exercise ° 12

The demand and supply functions of a good are given by

Qd = 110-5P Qs = 6P

where P, Qd and Qs denote price, quantity demanded and quantity supplied respectively.

1.Find the inverse demand and supply functions

2.Find the equilibrium price and quantity

3.Represnt the equilibrium graphically

Exercise ° 13

1. Consider the market for oranges. Suppose that both of the following occur simultaneously: (i) the price of apples (a substitute for oranges) decreases; and (ii) world-wide droughts reduce the harvest of oranges by 30%. Then, in the market for oranges we would expect,

a) The equilibrium price of oranges could either increase or decrease, but equilibrium quantity will definitely decrease.

b) The equilibrium quantity of oranges could either increase or decrease, but equilibrium price will definitely decrease.

c) The equilibrium price of oranges could either increase or decrease, but equilibrium quantity will definitely increase.

d) The equilibrium quantity of oranges could either increase or decrease, but equilibrium price will definitely increase.

2. Suppose that in the market for good X (a normal good), the following occur simultaneously: (i) consumer incomes increase and (ii) the price of oil (an input to the production of X) increases. Which of the following statements is TRUE?

a) The equilibrium price of X could either increase or decrease, but equilibrium quantity will definitely decrease.
b) The equilibrium quantity of X could either increase or decrease, but equilibrium price will definitely decrease.
c) The equilibrium price of X could either increase or decrease, but equilibrium quantity will definitely increase.
d) The equilibrium quantity of X could either increase or decrease, but equilibrium price will definitely increase.

3. A recent news story reported that OPEC is expected to decrease the supply of oil next summer. Summer is traditionally a time of increased demand for oil because of the many families driving and flying to vacation sites. What would be the combined effect of these two activities on the summer market for gasoline?

a) An increase in the equilibrium price and the quantity.
b) An increase in the equilibrium price and an unpredictable change in the equilibrium quantity.
c) An unpredictable change in both the equilibrium price and the quantity.
d) An unpredictable change in the equilibrium price and a decrease in the equilibrium quantity.

Chapter 3 : Elasticity Analysis

CHAPTER OBJECTIVES

In this chapter, you will learn about :

- Price Elasticity of Demand and Price Elasticity of Supply
- Price Elasticity of Supply
- Elasticity and Pricing
- Elasticity in Areas Other Than Price

By the end of this section, you will be able to:

- Calculate the price elasticity of demand
- Calculate the income elasticity of demand and the cross-price elasticity of demand
- Calculate the price elasticity of supply
- Apply concepts of price elasticity to real-world situations

Introduction:

Anyone who has studied economics knows the law of demand: a higher price will lead to a lower quantity demanded. What you may not know is how much lower the quantity demanded will be. Similarly, the law of supply shows that a higher price will lead to a higher quantity supplied. The question is: How much higher? This topic will explain how to answer these questions and why they are critically important in the real world.

To find answers to these questions, we need to understand the concept of elasticity. **Elasticity** is an economics concept that measures the responsiveness of one variable to changes in another variable.

But how is this degree of responsiveness seen in our models? Both the demand and supply curve show the relationship between price and quantity, and elasticity can improve our understanding of this relationship.

3.1 Elasticity of Demand:

The elasticity of demand refers to the degree to which demand responds to a change in an economic factor. Price is the most common economic factor used when determining elasticity. Other factors include income level and substitute availability. Elasticity measures how demand shifts when economic factors change. When demand remains constant regardless of economic changes, a good or service is called **inelastic**, conversely, when demand changes for a good or service in relation to economic changes, it is known as **elastic**.

The three main types of elasticity of demand are price elasticity of demand, cross elasticity of demand, income elasticity of demand. They are based on price changes of the product, price changes of a related good, income changes.

3.1.1 Price elasticity of demand

The **own price elasticity of demand** is the percentage change in the quantity *demanded* of a good or service divided by the percentage change in the price. This shows the responsiveness of the quantity demanded to a change in price.

How Is Elasticity Measured?

Elasticity is measured by the ratio of two percentages: the percentage change in quantity demanded divided by the percentage change in price.

simple percentage changes Method

Our formula for elasticity can be used for most elasticity problems, we just use different prices and quantities for different situations.

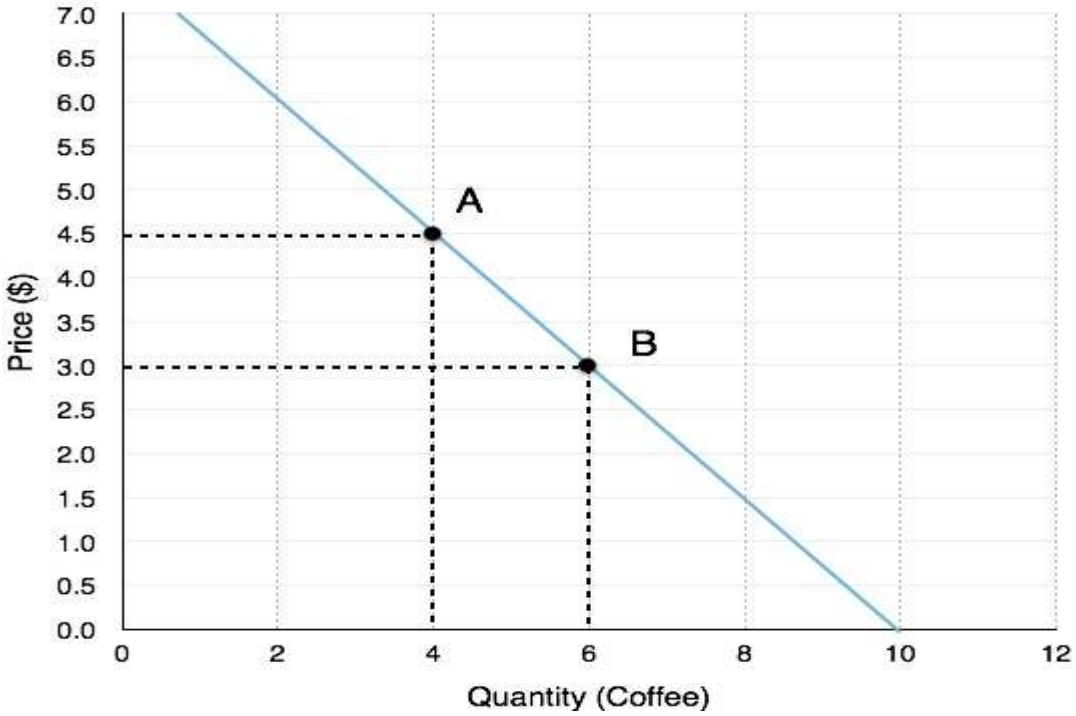
$$\text{Price Elasticity of Demand} = \frac{\text{Percentage change in Quantity Demanded}}{\text{Percentage change in Price}}$$

$$\%\text{ change in Quantity Demanded} = \frac{\text{New quantity demanded} - \text{Old quantity demanded} * 100}{\text{Old quantity demanded}}$$

$$\% \text{ change in Price} = \frac{\text{New Price} - \text{Old Price} * 100}{\text{Old Price}}$$

Suppose there is an increase in quantity demanded from 4 coffees to 6 coffees. Calculating percentage change ((6−4)/4) there has been a 50% increase in quantity demanded. Using the same numbers, consider what happens when quantity demanded decreases from 6 coffees to 4 coffees, ((4−6)/6) this change results in a 33% decrease in quantity demanded.

Right away, this should raise a red flag about calculating the elasticity between at two points, if percentage change is dependant on the direction (A to B or B to A) then how can we ensure a consistent elasticity value ?



Let's calculate elasticity from both perspectives :

Moving from A to B:

%ΔPrice: The coffee price falls from $4.50 to $3.00, meaning the percentage change is (3.00−4.50)/4.50 = -33%. Price has fallen by 33%.

%ΔQuantity: The quantity of coffee sold increases from 4 to 6, meaning the percentage change is (6−4)/4 = 50%. Quantity has risen by 50%

Elasticity: %ΔQuantity / %ΔPrice = −50%/33% = 1.5*

Moving from B to A:

%ΔPrice: The coffee price rises from $3.00 to $4.50, meaning the percentage change is (4.50−3.00) /3.00 = 50%. Price has risen by 50%.

%ΔQuantity:

The quantity of coffee sold falls from 6 to 4, meaning the percentage change is (4−6) / 6= -33%. Quantity has fallen by 33%

Elasticity: %ΔQuantity / %ΔPrice=33%/50% = 0.67

These two calculations give us different numbers. This type of analysis would make elasticity subject to direction which adds unnecessary complication. To avoid this, we will instead rely on averages.

*Note that elasticity is an absolute value, meaning it is not affected by positive of negative values.

Mid-point Method

To calculate elasticity, instead of using simple percentage changes in quantity and price, economists use the average percent change. This is called the mid-point method for elasticity, and is represented in the following equations:

%changeinquantity: Q2−Q1/(Q2+Q1)/2×100

%changeinprice: P2−P1(P2+P1)/2×100

Price Elasticity of Demand = [(Q1 – Q0) / (Q1 + Q0)] / [(P1 – P0)/(P1 + P0)]

The advantage of the **mid-point method** is that one obtains the same elasticity between two price points whether there is a price increase or decrease. This is because the denominator is an average rather than the old value.

Using the mid-point method to calculate the elasticity between Point A and Point B:

%changeinquantity : 6−4(6+4) /2×100 = 2 /5×100= 40%

%changeinprice : 3.00−4.50(3.00+4.50) /2×100 = −1.50 :3.75×100= −40% = 40%

Price Elasticity of Demand : E_d = 40%/40%=1

This method gives us a sort of average elasticity of demand over two points on our curve. Notice that our elasticity of 1 falls in-between the elasticities of 0.67 and 1.52 that we calculated in the previous example.

Cases of Price Elasticity of Demand

If P.E.D equals:	It is known as:	Which means:
Greater than 1 1 < PED < ∞	Elastic	Changes in price yield a significant change in demand
1	Unitary	Changes in price yield equivalent (percentage) changes in demand
Less than 1	Inelastic	Changes in price yield an insignificant change in demand
Infinity : PED = ∞ when the percentage of change in quantity demanded is infinite even if the percentage of change in price is zero	Perfectly elastic	the demand for the product is entirely dependent on the price of the product. This means that if any producer increases his price by even a minimal amount, his demand will disappear.
PED = 0	Perfectly inelastic	Changes in price yield no change in demand

Example 1

Let us assume that there is a company that supplies vending machines. The vending machines sell soft drinks at $3.50 per bottle. Now at this price, consumers buy 4,000 bottles per week. To increase sales, it has been decided to decrease the price to $2.50, increasing sales to 5,000 bottles. Now, the calculation of price elasticity of demand can be done as below:

Given, Q0 = 4,000 bottles, Q1 = 5,000 bottles, P0 = $3.50 and P1 = $2.50

Therefore,

- Price Elasticity of Demand = (5,000 – 4,000) / (5,000 + 4,000) ÷ ($2.50 – $3.50) / ($2.50 + $3.50)
- Price Elasticity of Demand = (1 / 9) ÷ (-1 / 6)
- Price Elasticity of Demand = 2/3 or 0.667 Inelastic

Example 2

Now let us take the case of a beef sale in the US in 2014. Due to certain food shortages, the prices of cattle surged. In January 2014, a family of four consumed around 10.0 lbs of beef at a price point of $3.47/lb. Due to the price surge, the price went up to $4.45/lb by the end of October 2014, bringing the consumption down to 8.5 lbs. Now, the calculation of the **price elasticity of demand formula business** can be done as below:

Given, Q0 = 10.0 lbs, Q1 = 8.5 lbs, P0 = $3.47 and P1 = $4.45

Therefore,

- Price Elasticity of Demand = (8.5 – 10.0) / (8.5 + 10.0) ÷ ($4.45 – $3.47) / ($4.45 + $3.47)
- Price Elasticity of Demand = (-0.081) ÷ (0.124)
- Price Elasticity of Demand = 0.653 Inelastic

Point price elasticity of demand

Point elasticity is the price elasticity of demand at a specific point on the demand curve instead of over a range of the demand curve. It uses the same formula as the general price elasticity of demand measure, but we can take information from the demand equation to solve for the "change in" values instead of actually calculating a change given two points. Here is the process to find the point elasticity of demand formula:

Point Price Elasticity of Demand = (% change in Quantity)/(% change in Price)

Point Price Elasticity of Demand = (ΔQ/Q)/(ΔP/P)

Point Price Elasticity of Demand = (P/Q)/(ΔQ/ΔP)

Where (ΔQ/ΔP) is the derivative of the demand function with respect to P. You don't really need to take the derivative of the demand function, just find the coefficient (the number) next to Price (P) in the demand function and that will give you the value for ΔQ/ΔP because it is showing you how much Q is going to change given a 1 unit change in P.

Example 1:

To find the point price elasticity of demand we begin with an example demand curve:

Q = 15,000 - 50P

Imagine that given this demand curve we are asked to figure out what the point price elasticity of demand is at two different prices, P = 100 and P = 10.

First we need to obtain the derivative of the demand function when it's expressed with Q as a function of P. Since quantity (Q) goes down by 50 each time price (P) goes up by 1,

This gives us (ΔQ/ΔP)= -50

Next we need to find the quantity demanded at each associated price and pair it together with the price: (100; 10,000), (10; 14,500)

Then we plug those values into our point elasticity of demand formula to obtain the following:

e = -50(100/10,000) = -.5

e = -50(10/14,500) = -.034

And these results make sense, first, because they are negative (which demonstrates a downward sloping demand relationship) and second, because the higher level results in a relatively more elastic price elasticity of demand measure.

Example 2:

How to find the point price elasticity of demand with the following demand function:

Q = 4,000 – 400P

We know that ΔQ/ΔP in this problem is -400, and we need to find the point price elasticity of demand at a price of 10 and at a price of 8.

At a price of ten, we demand 0 of the good, so the measure is undefined. At a price of 8 we will demand 400 of the good, so the associated measure is:

E = -400(8/400) = -8

Example 3:

What about a demand function of:

Q = 8,800 – 1,000P

Here our ΔQ/ΔP will be -1,000 and we will need to find the associated measure at prices of 0, 2, 4, and 6.

This means we will end up with:

e = -1,000(0/8,800) = 0

e = -1,000(2/6,800) = -0.294

e = -1,000(4/4,800) = -0.8333

e = -1,000(6/2,800) = -2.14

Sometimes you may be required to solve for quantity or price and are given a point price elasticity of demand measure. In this case you need to backwards solve by rearranging the point price elasticity of demand formula to get the quantity or price you need for the problem.

3.1.2 Cross-price elasticity of demand

Cross elasticity of demand, also known as **cross-price elasticity of demand**, is a measure of the responsiveness of the demanded quantity of one good to a change in the price of another good.

Imagine two closely related goods such as apples and pears. These goods are usually suitable for interchangeable consumption. Most people would not mind substituting one fruit for another. Now, imagine that the price of pears goes up. Since consumers are likely to prefer both fruits equally, they would shift their consumption towards apples as apples are now cheaper. The proportionate response of the quantity demanded of apples to a proportionate change in the price of pears is what the cross elasticity of demand measures.

Cross Elasticity of Demand Formula

$$E_{xy} = \frac{\text{Percentage Change in Quantity of X}}{\text{Percentage Change in Price of Y}}$$

$Exy = (\Delta Q_X/Q_X) \div (\Delta P_Y/P_Y)$

$$E_{xy} = \frac{\Delta Q_x}{\Delta P_y} \times \frac{P_y}{Q_x}$$

Example 1

The price (P) of Assam tea goes up from £2.20 to £2.50 leading to an increase in the quantity demanded (QD) of Ceylon tea from 10 to 18.

Let's calculate the cross elasticity of <u>demand</u> (E_{xy}) between the two goods:

Change in the QD of Ceylon tea = (18-10) / 10 = 80%

Change in the P of Assam tea = (2.50-2.20) /2.20 = 13.64%

E_{xy} = 80% / 13.64% = 5.87

Further, the formula for cross-price elasticity of demand can be elaborated into:

Cross Price Elasticity of Demand : E_{xy}= $(Q_{1X} - Q_{0X}) / (Q_{1X} + Q_{0X}) \div (P_{1Y} - P_{0Y}) / (P_{1Y} + P_{0Y})$,

Where,

- Q_{0X} = Initial **<u>demanded quantity</u>** of good X,
- Q_{1X} = Final demanded quantity of good X,
- P_{0Y} = Initial price of good Y and
- P_{1Y} = Final price of good Y.

Example 2

Let us assume that two companies are selling soft drinks. At present, company no. 2 sells soft drinks Y at $3.50 per bottle, while company no. 1 can sell 4,000 bottles of soft drinks Y per week. To bump the sales of company 1, company 2 decided to decrease the price to $2.50, which resulted in reduced sales of 3,000 bottles of soft drinks Y per week. Calculate the cross-price elasticity of demand in the case.

Given, Q0X = 4,000 bottles, Q1X = 3,000 bottles, P0Y = $3.50 and P1Y = $2.50

Therefore, the cross-price elasticity of demand can be calculated using the above formula as: –

- Cross price elasticity of demand = (3,000 – 4,000) / (3,000 + 4,000) ÷ ($2.50 – $3.50) / ($2.50 + $3.50) = (-1 / 7) ÷ (-1 / 6) = 6/7 or 0.857.

Since we can see a positive value for cross elasticity of demand, it indicates the competitive relationship between soft drink X and soft drink Y.

Understanding Cross Elasticity of Demand

In economics, the cross elasticity of demand refers to how sensitive the demand for a product is to changes in the price of another product. This means it determines the relationship between the quantity demanded of one good when the price for another good or product changes. Put simply, it measures how demand for one good changes when the price of another (usually related one) does.

– Substitute products

If both goods that are perfect substitutes for each other result in **perfect competition**, then an increase in the price of one good will lead to a rise in demand for the rival product. For example, various brands of cereal are examples of substitute goods. It is to be noted that the cross-price elasticity for two substitutes will be positive.

The price of Crest toothpaste goes up by 5%, leading to a contraction of demand. Consumers switch to Colgate toothpaste, causing an outward shift in the demand curve and an increase in the quantity demanded by 20%. The cross elasticity of demand between Colgate and Crest toothpastes is therefore: 20% / 5% = 4.

– Complementary products

If one good is complementary to the other good, a **goodwill** price decreases and increases the complementary good's demand. The stronger the relationship between the two products, the higher the coefficient of cross-price elasticity of the demand will be. For example, game consoles and software games are examples of **complementary goods**. It is to be noted that the cross elasticity will be negative for complementary goods.

The price of smartphones increases by 10% leading to a contraction of demand. This causes the demand curve for a complementary good (smartphone apps) to shift inwards, leading to a reduction in the demanded quantity by 20%. Cross elasticity of demand between smartphone apps and smartphones is: -20% / 10% = -2.

– Unrelated products

If there is no relationship between the goods, then an increase in the price of one good will not affect the demand for the other product. As such, unrelated products have a zero cross elasticity. For example, the effect of changes in taxi fares on the market demand for milk.

3.1.3 Income Elasticity of Demand

Income elasticity of demand measures the relationship between the consumer's income and the demand for a certain good. **It** measures the responsiveness of the quantity demanded to a change in consumer income.

Income elasticity of demand may be positive or negative, or even non-responsive for a certain product. The consumer's income and a product's demand are directly linked to each other, dissimilar to the price-demand equation.

The following formula is used:

Income Elasticity of Demand = % Change in Demand Quantity / % Change in Income of Consumer

E_{XI} **= (ΔQx/Qx) ÷ (ΔI/I)**

$$E_{XI} = \frac{\Delta Qx}{\Delta I} \times \frac{I}{Qx}$$

Example 1

Determine the measurement of income elasticity of demand based on given information.

Year	Snacks consumed per month (in $)	Income (in $)
2021	200	4000
2022	275	5000

First, we determine individual values required for the income elasticity formula. We compute the percentage change in demand as follows:

- Percentage change in demand = [(275-200)/ 200] x 100 = 37.5%
- Percentage change in income = [(5000-4000)/ 4000] x 100 = 25%

Now, we apply the values in the income elasticity formula:

$E_{XI} = \frac{\Delta Qx}{\Delta I} \times \frac{I}{Qx}$ = 37.5%/ 25% = 1.5

However, one can further expand the formula for income elasticity of demand as follows.

Income Elasticity of Demand = $(D_1 – D_0) / (D_1 + D_0) / (I_1 – I_0) / (I_1 + I_0)$

Example 2

Let us take the example of cheap garments. The weekly demand for cheap garments went down from 4,000 pieces to 2,500 pieces as the level of real income in the economy increased from $75 per day to $125 per day. The reason is the shift in preference due to the availability of extra money on the back of increased income level. Calculate the income elasticity of demand based on the given information.

	A	B
5		
6	Initial Quantity (D_0)	4000
7	Final Quantity, (D_1)	2500
8	Initial Real Income, (I_0)	$75
9	Final Real Income, (I_1)	$125
10		

- E_{XI} = [(2,500 – 4,000) / (2,500 + 4,000)] / [($125 – $75) / ($125 + $75)] = -0.92

Therefore, the income elasticity of demand for cheap garments is -0.92

Income Elasticity of Demand Types

Based on numerical value, the income elasticity of demand is divided into three classes as follows:

1. Positive income elasticity of demand

It refers to a condition in which demand for a commodity rises with a rise in consumer income and declines with a decline in consumer income. Commodities with positive income elasticity of demand are normal goods. There are three types of positive income elasticity:

- **Unitary:** The positive income elasticity is unitary when the change in product demand equals the change in consumer income. For example, if the consumer income rose by 15% and the demand for purchasing cars rose by 15%, the income elasticity of demand would be equal to one.
- **More than unitary:** The positive income elasticity is more than unitary (sometimes referred to as "high") when the positive change in product demand exceeds the positive change in consumer income. For example, if the consumer income rose by 15% but the demand for purchasing cars increased by 25%, making the income elasticity of demand equal to more than one.
- **Less than unitary:** The positive income elasticity is less than unitary (sometimes referred to as "low") if the positive change in product demand is less than the positive change in consumer income. For example, if the consumer income rose by 25% but the demand for purchasing cars increased by 15%, the income elasticity of demand is equal to less than one and more than zero.

Example

We want to calculate the income elasticity of demand for this year related to its washing machine sales. Due to an economic downturn, many community members have lost their jobs. The current average annual consumer income is $45,000 compared to $60,000 last year. The number of washing machines sold this year is 10,000 compared to 15,000 last year. Applebaum Appliances first needs to identify the percent change in demand and consumer income using the following calculations:

Percent change in demand = (10,000 - 15,000) / 15,000 = -33.33%

Percent change in consumer income = (45,000 - 60,000) / 60,000 = -25%

Income elasticity of demand = -33.33% / -25% = 1.32

Based on this outcome, we determine that washing machines have a positive and more than unitary income elasticity of demand because it's more than one. This result means that washing machines are luxury goods. If the company expects incomes to rise next year, it may consider ordering more washing machines for its inventory to help meet the demand.

2. Negative income elasticity of demand

It refers to a condition in which demand for a commodity decreases with a rise in consumer income and increases with a fall in consumer income. Inferior goods are such commodities. For example, the demand for millet will decrease if the income of consumers increases since they will prefer to purchase wheat instead of millet. Thus, millet is an inferior good to wheat for customers.

Example

Let's consider an example. Ahmed is a software engineer who just started working at a company in Oran. Ahmed makes $100,000 in a year. As Ahmed lives in Oran, where the living expenses are high, he has to consume a lot of fast food. In a year, Ahmed consumes 500 burgers.
The following year, Ahmed gets a rise in income from $100,000 to $150,000. As a result, Ahmed an afford more expensive food, such as dinners at Steakhouses. Therefore, Ahmed 's consumption of burgers drops to 250 burgers in a year.
What is the income elasticity of demand for burgers?

To calculate the income elasticity of demand for burgers, let's calculate the percentage change in quantity demanded and the percentage change in Ahmed 's income.

$\%\Delta Quantity=(250-500)/500=-250/500=-0.5\times100=-50\%$

$\%\Delta Income=(150000-100000)/100000=50000/100000=0.5\times100=50\%$

Income elasticity of demand is equal to:

$E_{XI}=\%\Delta Quantity\ demanded \%\Delta Income=-50\%/50\%=-1$

That means that when Ahmed 's income increases by 1%, the amount of burgers he eats will decline by 1%. An inferior good.

3. Zero income elasticity of demand

It corresponds to the situation when there is no impact of rising household income on commodity production. Such goods are termed essential goods. For example, a high-income consumer and a low-income consumer will need salt in the same quantity.

Type of Elastic Good	**Description**	**Examples**
High Demand	As incomes rise, these products and services see a significant increase in demand.	Luxury goods like jewelry, designer clothing, and luxury cars
Unitary Demand	These products and services see a proportional increase to the increase of incomes.	Electronics, restaurants, and small appliances
Low Demand	These products see a low rise in demand compared to incomes.	Ultra-luxury items and brand name essentials
Zero Demand	These products see no increase in demand.	Essential items such as toilet paper, water, and regular food items
Negative Demand	These products and services are referred to as *inferior goods* because demand declines as incomes rise.	Store brand products, cheap substitute goods, low-quality goods

3.2 Elasticity of Supply:

The elasticity of supply is a measure of the degree of responsiveness of the quantity supplied to the change in the price of a given commodity. It is an important parameter in determining how the supply of a particular product is affected by fluctuations in its market price. It also gives an idea about the profit that could be made by selling that product at its price difference.

The price elasticity of supply refers to the response to a change in a good or service's price by the supply of that good or service. According to basic economic theory, the supply of goods decreases when its price increases.

Elasticity of Supply Formula

After having understood the elasticity of supply definition in economics, we now move to the elasticity of supply formula which is based on its definition.

Elasticity of Supply = E_S**= (**$\Delta Q_S/Q_S$**) ÷ (**$\Delta P/P$**)**

$$E_S = \frac{\Delta QS}{\Delta P} \times \frac{P}{QS}$$

However, one can further expand the formula for **Elasticity of Supply** as follows :

Elasticity of Supply = E_S = **[(Q1 – Q0) / (Q1 + Q0)] / [(P1 – P0)/(P1 + P0)]**

Example 1

As an example of elasticity of supply, let's assume that the price of a chocolate bar increases from $1 to $1.30. In response to the price increase of the chocolate bar, firms increased the number of chocolate bars produced from 100,000 to 160,000.

To calculate the price elasticity of supply for chocolate bars, let's first calculate the percentage change in price.

%ΔPrice=(1.30−1) / 1=0.30/1=30%

%ΔQuantity=(160,000−100,000) /100,000=60,000/100,000=60%

$$E_S = \frac{60000}{0,3} \times \frac{1}{10000} = 2$$

Price elasticity of Supply=60% / 30%= 2

As the price elasticity of supply equals 2, it means that a change in the price of chocolate bars changes the quantity supplied for chocolate bars by twice as much.

Types of Supply Elasticity

Price elasticity of supply is of 5 types :

- ***Perfectly Elastic Supply(∞):*** A commodity becomes perfectly elastic when its elasticity of supply is infinite. This means that even for a slight increase in price, the supply becomes infinite. For a perfectly elastic supply, the percentage change in the price is zero for any change in the quantity supplied.
- ***Elastic Supply (More than Unit):*** When the percentage change in the supply is greater than the percentage change in price, then the commodity has the price elasticity of supply greater than 1.
- ***Unit Elastic Supply:*** A product is said to have a unit elastic supply when the change in its quantity supplied is proportionate or equal to the change in its price. The elasticity of supply, in this case, is equal to 1.
- ***inelastic supply (between zero and one):*** When the change in the supply of a commodity is lesser as compared to the change in its price, we can say that it has an ***inelastic supply***. In such a case, the price elasticity of supply is less than 1.
- ***Perfectly Inelastic Supply(0):*** Product supply is said to be perfectly inelastic when the percentage change in the quantity supplied is zero irrespective of the change in its price. This type of price elasticity of supply applies to exclusive items. For example, a designer gown styled by a famous personality.

Examples

- If the price of a cappuccino increases by 10%, and the supply increases by 20%. We say the PES is 2.0. ***Elastic Supply***
- If the price of bananas falls 12% and the quantity supplied falls 2%. We say the PES = 0.16 ***inelastic supply***
- An inelastic example is nuclear power, which has a long lead time given the construction, technical know-how, and long ramp-up process for plants.

Example 2

Let us assume that a company has installed vending machines for supplying soft drinks. The vending machines sell soft drinks at $3.50 per bottle. Now at this price, the manufacturer supplies 4,000 bottles per week. However, due to some governmental ban, the price has declined to $3.00, resulting in a lower supply of 3,000 bottles per week. Now, the price elasticity of supply can be calculated as below:

Given, Q_{0S} = 4,000 bottles, Q_{1S} = 3,000 bottles, P_0 = $3.50 and P_1 = $3.00

Therefore, Price elasticity of supply formula : $E_S = (Q_{1S} - Q_{0S}) / (Q_{1S} + Q_{0S}) \div (P_1 - P_0) / (P_1 + P_0)$

E_S = (3,000 – 4,000) / (3,000 + 4,000) ÷ ($3.00 – $3.50) / ($3.00 + $3.50) = (-1/7) ÷ (-1/13) = 13/7 or 1.857

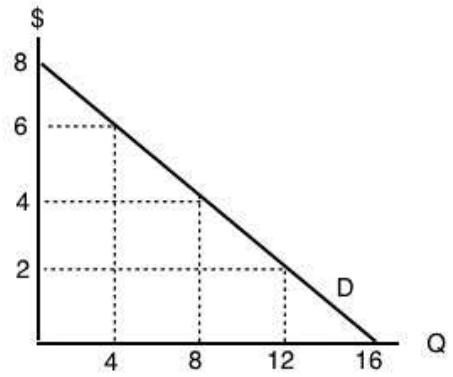
Therefore, the soft drink supplier exhibited elastic supply characteristics.

Series of Exercises No. 2 in Microeconomics 1 - Tutorials

Exercise °1

Answer the following questions:

1. Suppose that a 2% increase in price results in a 6% decrease in quantity demanded. What is the price elasticity of demand
2. Use the demand curve diagram below to answer the following question.



What is the price elasticity of demand as price increases from $2 per unit to $4 per unit and as price decreases from $4 to $2? Use the simple percentage method then use mid-point formula in your calculation.

3. If price elasticity of demand equals 0.3 in absolute value, then what percentage change in price will result in a 6% decrease in quantity demanded?

Exercise °2

From the data shown in Table below about demand for smart phones, calculate the price elasticity of demand from: point B to point C, point D to point E, and point F to point E. Classify the elasticity at each point as elastic, inelastic, or unitary elastic.

Points	P	Q
A	60	3,000
B	70	2,800
C	80	2,600
D	90	2,400
E	100	2,200
F	110	2,000

Exercise °3

Imagine a given demand equation: Q = 8,800 – 1,000P

We are asked to figure out what the point price elasticity of demand at prices of 0, 2, 4, and 6.

Exercise °4

Suppose the demand curve for iPad is given by

$$q = 500 - 10p.$$

(a) Compute the elasticity of this demand function.

(b) What is the price elasticity of demand when the price is $30?

(c) What is the percent change in the demand if the price is $30 and increases by 4.5%?

Exercise °5

Consider the market for bicycles. The demand is given by P= -1.5Qd+ 60.

a) Suppose that the price changes from $15 to $30. Using the simple percentage change formula, what is the price elasticity of demand?
b) Suppose that the price changes from $15 to $30. Using the midpoint method, what is the price elasticity of demand?
c) When P=15, what is the price elasticity of demand using the point method? Is it elastic or inelastic?
d) When Qd =10, what is the price elasticity of demand using the point method? Is it elastic or inelastic?
e) At what price is the price elasticity of demand equal to 1, using the point method?

Exercise °6

The following is the data used to calculate and explain the cross-price elasticity of demand:

1. Calculate the cross-price elasticity of demand. For example, the percentage change in the price of apple juice changed by 18%, and the percentage change in the quantity of demand od orange juice changed by 12%.
2. A company producing torches and batteries is analyzing the cross-price elasticity of the two goods. For example, the demand for torches was 10,000 when the price of batteries was $10, and the demand rose to 15,000 when the price of batteries was reduced to $8.
3. The annual price of cinema tickets sold in 2010 was $3.5, whereas the number of popcorn sold at cinema halls was 100,000. The ticket price increased from $3.5 in 2010 to $6 in 2015. There was a decrease in the sale of popcorn to 80,000 units.

Exercise °7

When the consumer's real income is $40,000, the quantity demanded of economy seats in the flight are 400 seats. When the consumer's real income is increased to $45,000, the quantity demanded decreases to 350 seats. Mr. Newman wants to study this behavior as an economist student and wants to know why the seat demand decreased even though there was an increase in the consumer's real income.
You are required to calculate the Income Elasticity of Demand.

Exercise ° 8

The income elasticity of demand for doughnuts is equal to 1.2, you read in the newspaper that the economy has entered a recession and you are interested in how this recession will affect your doughnut business. Holding everything else constant, what do you anticipate will happen to the demand for doughnuts? Are doughnuts a normal good given this information?

Exercise °9

1. If goods X and Y are SUBSTITUTES, then which of the following could be the value of the cross price elasticity of demand for good Y?
   a) -1. b) -2.
   c) Neither a) nor b). d) Both a) and b).

2. If pizza is a normal good, then which of the following could be the value of income elasticity of demand?
   a) 0.2. b) 0.8.
   c) 1.4 d) All of the above.

3. If goods X and Y are COMPLEMENTS, the which of the following could be the value of cross price elasticity of demand?
   a) 0. b) 1.
   c) -1. d) All of the above could be the value of cross price elasticity of demand.

4. Suppose you are told that the price elasticity of supply equal 0.5. What does this mean?

Exercise °10

From the data shown in Table below about supply of alarm clocks, calculate the price elasticity of supply from: point J to point K, point L to point M, and point N to point P. Classify the elasticity at each point as elastic, inelastic, or unit elastic.

Point	Price	Quantity Supplied
J	$8	50
K	$9	70
L	$10	80
M	$11	88
N	$12	95
P	$13	100

Exercise °11

A vegetable fiber is traded in a competitive world market, and the world price is $9 per pound. Unlimited quantities are available for import into the United States at this price. The U.S. domestic supply and demand for various pr ice levels are shown below.

Price	**U.S. Supply (million lbs.)**	**U.S. Demand (million lbs.)**
3	**2**	**34**
6	**4**	**28**
9	**6**	**22**
12	**8**	**16**
15	**10**	**10**

a. What is the equation for demand? What is the equation for supply?
b. At a price of $9, what is the price elasticity of demand? At a price of $12?
c. What is the price elasticity of supply at $9? At $12?

Exercise °12

In 1998, Americans bought 470 billion chocolate pack. The average retail price was $2 per pack. Statistical studies have shown that the price elasticity of demand is -0.4, and the price elasticity of supply is 0.5. Using this information, derive linear demand and supply curves for the chocolate market.

Chapter 4 : Applications on Supply and Demand - Government Intervention

CHAPTER OBJECTIVES

In this chapter, you will learn about :

- Price Ceiling and Price Floor
- Taxes and Subsidies

By the end of this section, you will be able to:

- Explain price controls, price ceilings, and price floors
- Understand why price controls result in deadweight loss
- Distinguish between Ad volerm ans specific tax
- Understand the quantity and price affect from a tax
- Describe why both taxes and subsidies cause deadweight loss

Introduction:

Government intervention refers to the regulatory action taken by a government that aims to change decisions made by individuals, organizations, or groups regarding economic and social matters. Its primary goal is to maximize a country's social welfare by correcting market failure.

The three main types of government intervention in the market: price controls, taxes and subsidies. Each of these government interventions are modelled to show their effects on supply and demand, and the market equilibrium for a good and service. Thus, each type of intervention will have an effect on the price of a good or service, and the quantity demanded and the quantity supplied in the market.

4.1 Price controls:

The first government policy we will explore is price controls. National and local governments sometimes implement **price controls**, legal minimum or maximum prices for specific goods or services, to attempt managing the economy by direct intervention. Price controls can be **price ceilings** or **price floors**. we examine what will occur if price is below or above equilibrium price, and concluded that market pressures will return the market to equilibrium. But what if the government regulates the market so that it cannot move ?

4.1.1 Price ceilings

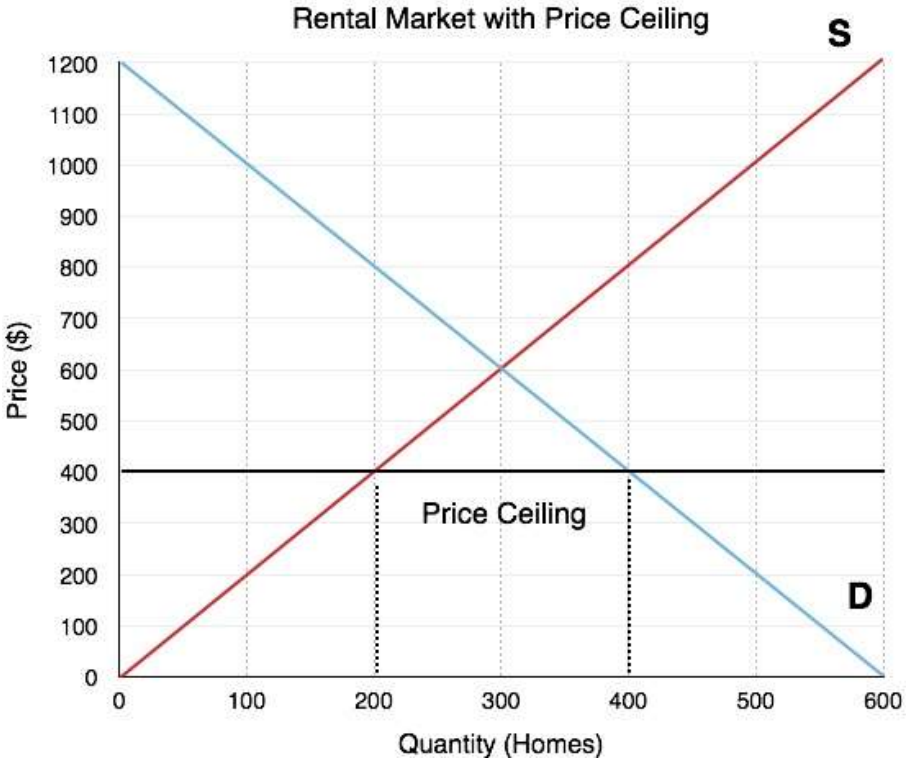
We can use the demand and supply framework to understand price ceilings.

In many markets for goods and services, demanders outnumber suppliers. Consumers, who are also potential voters, sometimes unite to convince the government to hold down a certain price.

A price ceiling is a legal maximum price that one pays for some good or service. A government imposes price ceilings in order to keep the price of some necessary good or service affordable.

A common example of a price ceiling is the rental market. Consider a rental market with an equilibrium of $600/month. If the government wishes to decrease this price to make it more affordable for renters, it may place a binding **price ceiling** of $400/month. This policy means the landlords cannot charge more than $400 per month. What will this do to our equilibrium? Refer to Figure 4.1. Whereas before 300 homes were rented, there is now a housing shortage. At the lower price of $400/month, quantity supplied is only 200 housing units and a quantity demanded is 400 housing units. This means that 200 renters who want to rent can no longer find homes! This is important, because when quantity demanded and quantity supplied are unequal, the market is restrained by the lower value.

Despite this information, it is not enough to tell us if the market is more or less efficient – our metric for that is market surplus. Even though some renters cannot find homes, the government still successfully lowered the price for some consumers. So how do these effects weigh out?



Let's expand this example by thinking about a hypothetical town. Rent was fairly stable. But then, the town was featured on a top-ten-places-to-live article in a popular magazine. Eventually, rent control laws were passed.

We can use the demand and supply model below to understand how the market changed based on this event.

In the beginning, before the article was published, the equilibrium, E0, lay at the intersection of supply curve S0 and demand curve D0, corresponding to an equilibrium price of $500 and an equilibrium quantity of 15,000 units of rental housing.

When the article inspired more people to want to move to our imaginary town, it shifted the demand curve for rental housing to the right, as shown by the data in the table below and the shift from D0 to D1 on the graph. In the new market, at the new equilibrium E1, the price of a rental unit rose to $600 and the equilibrium quantity increased to 17,000 units.

The graph shows a shift in demand with a price ceiling. The original intersection of demand and supply occurs at E0. If demand shifts from D0 to D1, the new equilibrium would be at E1—unless a price ceiling prevents the price from rising. If the price is not permitted to rise, the quantity supplied remains at 15,000. However, after the change in demand, the quantity demanded rises to 19,000, resulting in a shortage.

Price	Original quantity supplied	Original quantity demanded	New quantity demanded
$400	12,000	18,000	23,000
$500	15,000	15,000	19,000
$600	17,000	13,000	17,000
$700	19,000	11,000	15,000
$800	20,000	10,000	14,000
Rent control			

Now, let's suppose that a bunch of residents were pretty unhappy with paying a 20% increase in their rent. They pressured local politicians to pass a rent control law to keep the price at the original equilibrium of $500 for a typical apartment.

In the demand and supply model above, the horizontal line at the price of $500 shows the legally fixed maximum price set by the rent control law. However, the underlying forces that shifted the demand curve to the right are still there. At the fixed maximum price of $500, the quantity supplied remains at the same 15,000 rental units, but the quantity demanded is 19,000 rental units. In other words, the quantity demanded exceeds the quantity supplied, so there is a shortage of rental housing.

The effects of price ceilings are complex and sometimes unexpected. In the case of rent control, the price ceiling doesn't simply benefit renters at the expense of landlords. Rather, some renters—or potential renters—lose their housing as landlords convert apartments to co-ops and condos. There are actually fewer apartments rented out under the price ceiling—15,000 rental units—than would be the case at the market rent of $600—17,000 rental units. And, even when housing remains in the rental market, landlords tend to spend less on maintenance and on essentials like heating, cooling, hot water, and lighting.

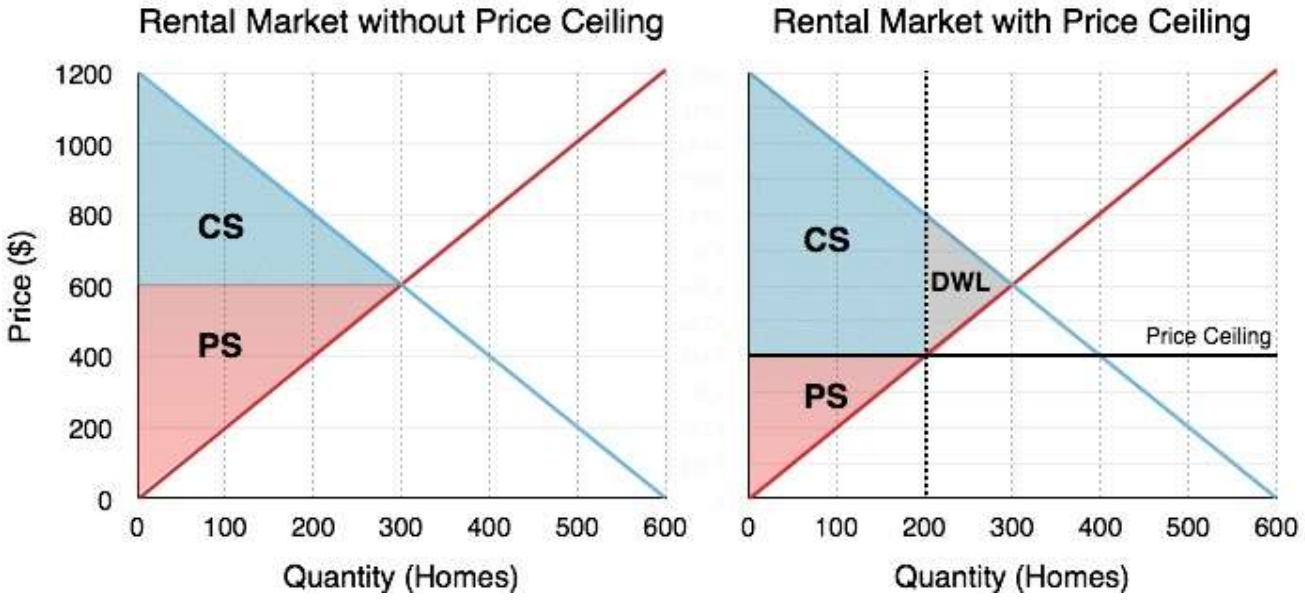
The first rule of economics is you do not get something for nothing—everything has an opportunity cost. So if renters get “cheaper” housing than the market requires, they tend to also end up with lower quality housing.

Price ceilings are enacted in an attempt to keep prices low for those who demand the product—be it housing, prescription drugs, or auto insurance. But when the market price is not allowed to rise to the equilibrium level, quantity demanded exceeds quantity supplied, and thus a shortage occurs.

Those who manage to purchase the product at the lower price given by the price ceiling will benefit, but sellers of the product will suffer, along with those who are not able to purchase the product at all. Quality is also likely to deteriorate.

Calculating Market Surplus

To find out the impact of government’s price ceiling, we must calculate market surplus before, and after a policy. This method will be an important gauge for all our policy analysis in this topic. Consider Figure 4.2, where the effects of the Price Ceiling is shown.



Cs : A **Consumer Surplus** is present when the actual prices paid by consumers for goods and services are less than the maximum prices at which they would be willing to pay.

Consumer Surplus = (1/2) × Quantity at Equilibrium × (Maximum Price – Equilibrium Price)

- Quantity → The total market demand for a given good or service at equilibrium.
- Maximum Price → The maximum price that consumers are willing to pay.
- Equilibrium Price → The price at equilibrium per the supply and demand graph.

Ps : A Producer surplus is the difference between how much a producer is willing to sell a product for and how much the producer actually sells the product for.

Producer surplus = ½ x Q1 x (P1 -P2)

Here,

- Q1 = quantity.
- P1 = price.
- P2 = producer's minimum acceptable price.

Market Surplus : A market surplus occurs when there is excess supply. This means that the quantity supplied is greater than quantity demanded. Some producers will not be able to sell all their goods in such situation. In order to stay competitive many firms will lower their prices thus lowering the market price for the product.

Total Market Surplus = Consumer Surplus + Producer Surplus

Before

The calculation of market surplus before policy intervention should be straight forward by now. Market surplus is equal to the sum of consumer surplus and producer surplus, calculating from Figure 4.5b:

Consumer Surplus (Blue Area): [(1200-600) x 300]/2 = $90,000

Producer Surplus (Red Area): [(600-0) x 300]/2 = $90,000

Market Surplus: $180,000

After

The calculation of market surplus after intervention is less obvious. Consumers have lost surplus in some areas, but gained surplus in others. Producers have lost surplus.

Consumer Surplus (Blue Area): [(1200-800) x 200]/2] + (400×200) = $120,000

Producer Surplus (Red Area): [(400-0) x 200]/2 = $40,000

Market Surplus: $160,000

Looking before and after we see that producer surplus has decreased and consumer surplus increased – but the decrease in producer surplus outweighed the effects of the increase in consumer surplus, causing deadweight loss**.** This means that the market is less efficient, because by removing the regulation, the market as a whole is better off.

What About Redistribution?

It's easy to look at the total numbers and show that market surplus has decreased, but how does this change affect individual consumers and firms?

In Figure 4.3 the areas which change as a result of the policy are shown.

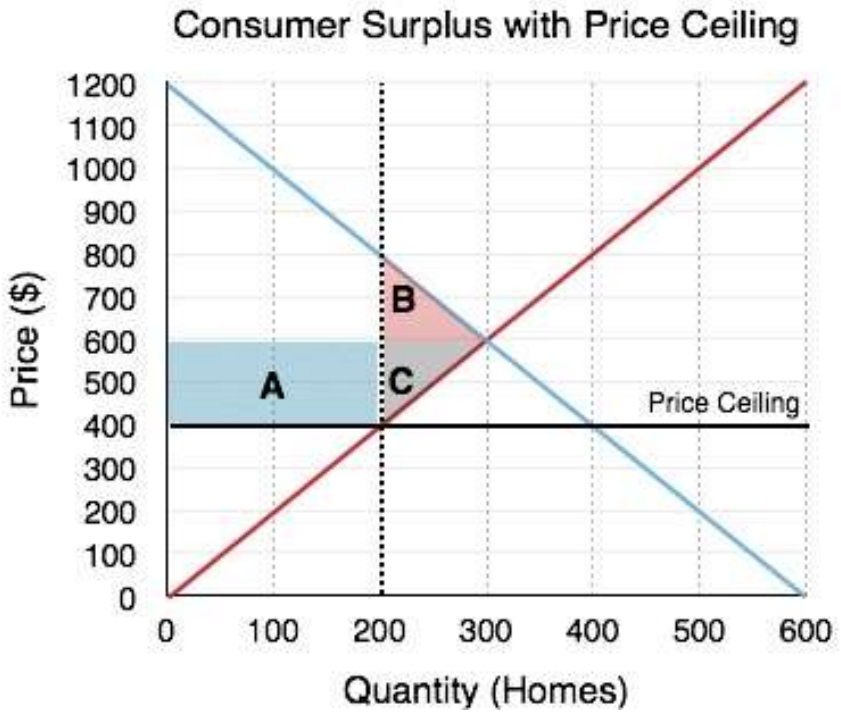


Figure 4.3

Consumers

Consumers gain an area of A and lose an area of B.

Surplus Decrease in Area B

As mentioned previously, the quantity supplied in the market decreases from 300 rental units to 200. This means that 100 renters can no longer find homes. We can assume that the consumers who are willing to pay most for the homes will end up with the rental units (they will start looking earlier, exploring more options etc.) so consumers on the demand curve WTP between $800 and $600 will be cut out of the market. This results in a $10,000 loss in consumer surplus, shown in Figure 4.3 as area B.

Surplus Increase in Area A

Alternatively, the 200 consumers who are able to find homes now go from paying $600/month to paying $400/month, resulting in a $40,000 increase in consumer surplus. This is shown in Figure 4. 3 as area A.

Overall, consumers gain $30,000, which is consistent with the calculations above.

Producers:

Producers lose areas C and A

Surplus Decrease in Area C

The price ceiling causes the landlords to reconsider staying in the rental market, as fewer landlords can make a profit with the lower price. This causes 100 landlords to leave the market, reducing their producer surplus to nothing. This forgone surplus amounts to $10,000 and is represented in Figure 4.3 as area C.

Surplus Decrease in Area A

Like consumers, some producers will remain in the market, but these producers now have to face the reality of lower rent revenue. Each of the 200 landlords loses $200 of revenue. This results in a $40,000 decrease, represented as area A.

Overall, producers lose $50,000, which is consistent with the calculations above.

Transfer and Deadweight Loss:

We can summarize the overall effects in the market as two categories: a transfer of surplus and a deadweight loss.

Transfer

Notice that Area A was a transfer from the landlords to the renters who remain in the market. 200 renters now save $200 each, and 200 landlords now lose $200 each. It is important to recognize that this transfer is a result of the **price effect** of the policy, meaning it occurred because price differed from equilibrium.

DWL

Alternatively, the deadweight loss results because there are players who are no longer able to be a part of the market. 100 renters and 100 landlords all lose a varied amount based on their willingness to pay and marginal costs. This change is a result of the **quantity effect** on the policy, meaning it occurred because quantity differed from equilibrium.

A change in quantity from the equilibrium value is the only thing that causes a DWL. Changes in price will cause transfers. While the two effects work together, it is important to be able to distinguish between the two.

This was a fairly lengthy explanation of price ceilings, but it is one that will lead into the discussion of all policy. Every policy we will look at in microeconomics has both a quantity effect and a price effect, and it is important to understand how the policy impacts individual market players.

4.1.2 Price floors

While the price floor has a very similar analysis to the price ceiling, it is important to look at it separately. A common example of a price floor is a minimum wage policy. The labor market is unique in that the workers are the producers of labor and the firms are consumers of labor. Price can be denominated in hourly wage, with the quantity of workers on the x-axis. If the government sets a binding minimum wage (price floor), it must be set above the equilibrium price.

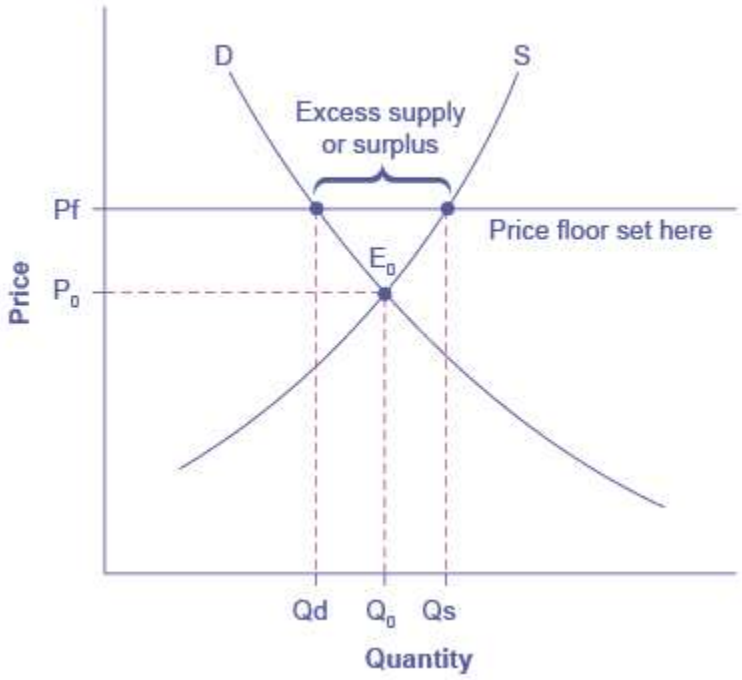
A price floor is the lowest legal price that can be paid in a market for goods and services, labor, or financial capital. Perhaps the best-known example of a price floor is the minimum wage, which is based on the normative view that someone working full time ought to be able to afford a basic standard of living. The federal minimum wage at the end of 2014 was $7.25 per hour, which yields an income for a single person slightly higher than the poverty line. As the cost of living rises over time, Congress periodically raises the federal minimum wage.

Price floors are sometimes called price supports because they support a price by preventing it from falling below a certain level. Around the world, many countries have passed laws to create agricultural price supports. Farm prices, and thus farm incomes, fluctuate—sometimes widely. So even if, on average, farm incomes are adequate, some years they can be quite low. The purpose of price supports is to prevent these swings.

The most common way price supports work is that the government enters the market and buys up the product, adding to demand to keep prices higher than they otherwise would be.

We can take a look at the demand and supply model below to understand better the effects of a government program that creates a price above the equilibrium. This particular model represents the market for wheat in Europe.

In the absence of government intervention, the price of wheat would adjust so that the quantity supplied would equal the quantity demanded at the equilibrium point E0, with price P0 and quantity Q0. However, policies to keep prices high for farmers keep the price above what would have been the market equilibrium level—the price Pf shown by the horizontal line in the diagram. The result is a quantity supplied in excess of the quantity demanded—Qd. When quantity supplied exceeds quantity demanded, a surplus exists.



The graph shows an example of a price floor which results in a surplus. The intersection of demand, D, and supply, S, would be at the equilibrium point E0. However, a price floor set at Pf holds the price above E0 and prevents it from falling. The result of the price floor is that the quantity supplied, Qs, exceeds the quantity demanded, Qd. There is excess supply, also called a surplus.

Our example is hypothetical, but the concept plays out in the real world as well. If a government is willing to purchase excess agricultural supply—or to provide payments for others to purchase it—then farmers will benefit from the price floor, but taxpayers and consumers of food will pay the costs.

In Figure 4.4, the equilibrium wage is shown as $10/hour. This is where the demand for labor is equal to the number of workers who want to find jobs. At this level there is no unemployment. However, if the government sets a minimum wage of $13/hour, this will change. The Quantity of Labor Supplied (workers looking for jobs) will be 400, but the quantity demanded will be 200. This means that 200 workers will be unemployed! Again, this is not enough information to determine whether the market is inefficient – we have to calculate the change in market surplus!

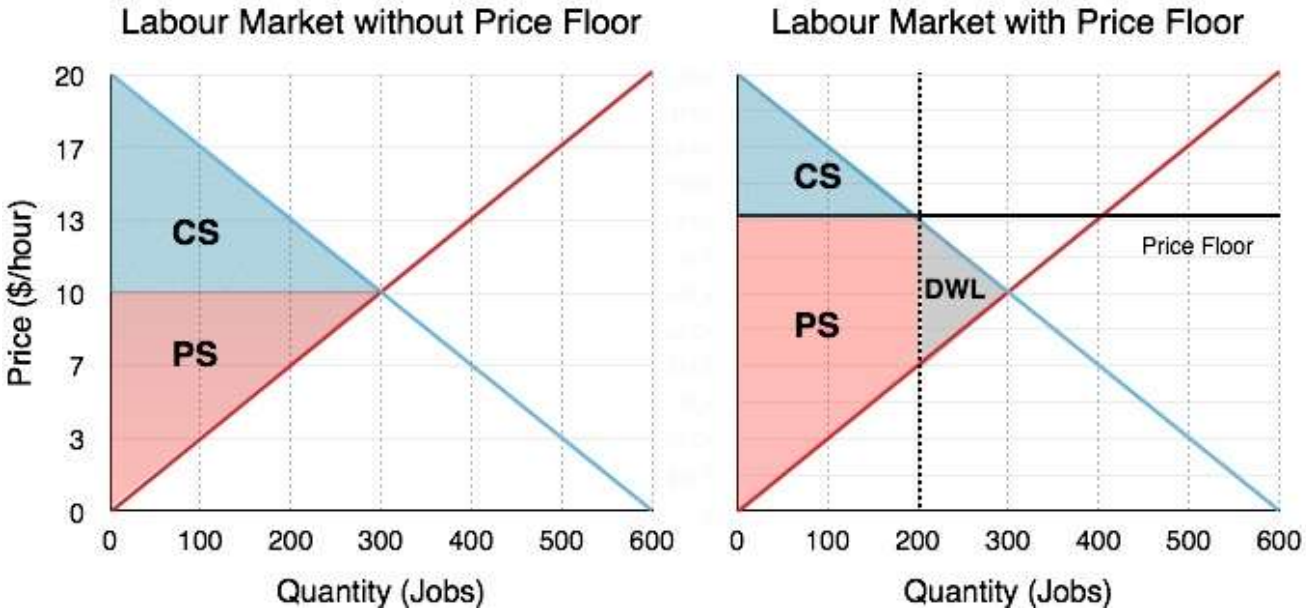


Figure 4.5

Using the same process as before:

Before

Consumer Surplus (Blue Area): [(20-10) x 300]/2 = $1500

Producer Surplus (Red Area): [(10-0) x 300]/2 = $1500

Market Surplus: $3000

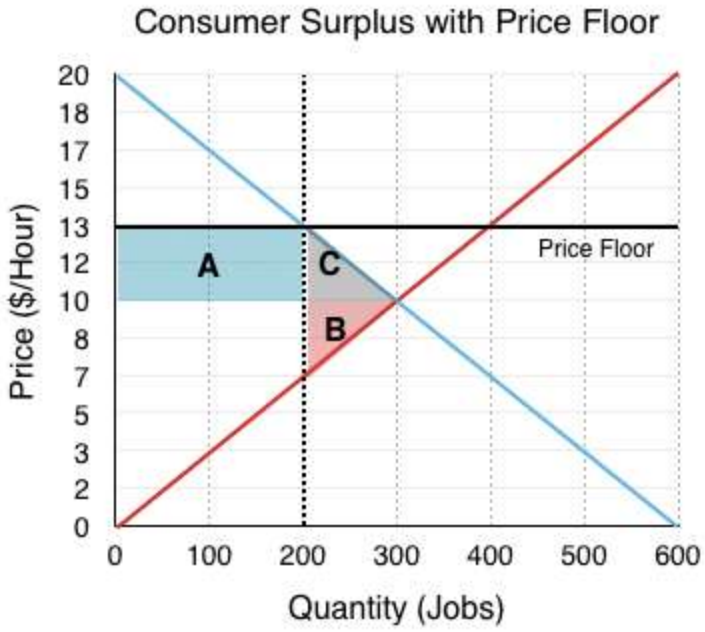
After

Consumer Surplus (Blue Area): [(20-13) x 200]/2= $700

Producer Surplus (Red Area): [(13-7) x 200] + ((7-0) x 200)/2 = $1900

Market Surplus: $2600

Since the market surplus after the policy is less than the market surplus before, there is a deadweight loss!



Again, the changes in the market can be categorized as a transfer and a deadweight loss. This time, the transfer is from consumers (firms) to producers (workers), since the workers who are able to find work are better off. This causes no change to market surplus in isolation but is coupled with the deadweight loss caused by workers who are no longer able to find jobs as firms leave the market.

4.2 Taxes and Subsidies:

The government can influence markets and its citizens in many ways. Two of these types of tools are taxes and subsidies. Let's start off by establishing the difference between taxes and subsidies!

Taxes are a charge the government imposes on individuals' and firms' income and revenue. At the same time, subsidies are grants or tax breaks given to individuals and firms to incentivize them to pursue a social objective that the government that issues the subsidy wishes to promote.

Taxes and subsidies are two financial mechanisms the government uses; we'll cover why these exist and what implications they have for the government, citizens, and businesses.

4.2.1 Taxes

When a government imposes tax on particular goods, this action would have effects on equilibrium price and quantity. Basically, a tax is money collected by a government from businesses or individuals directly or indirectly against services provided to the community.

Two Types of Tax Systems

1. **Direct Taxation:** A direct tax is assessed on the income of the taxpayer and is generally collected before the taxpayer collects his wages.
2. **Indirect Taxation:** An indirect tax is an avoidable tax assessed on certain activities, such as purchasing goods or services. Examples of an indirect tax include sales tax and VAT (value added tax).

Specific Tax vs Ad Valorem

Ad Valorem (or Value Added) and Excise Taxes are types of indirect taxes. Both are generally assessed on the sale of goods. These two taxes differ in three ways:

1. An excise tax typically applies to a narrower range of products, such as gasoline, tobacco, and alcohol.
2. An excise tax is typically heavier than an ad valorem, accounting for a higher fraction of a product's retail price.

3. Excise taxes are typically a fixed fee per unit, meaning that the government earns its revenue based on volume sold. Ad valorem taxes are proportional to the price of the good, so the government earns revenue based on the value of the good or service being sold.

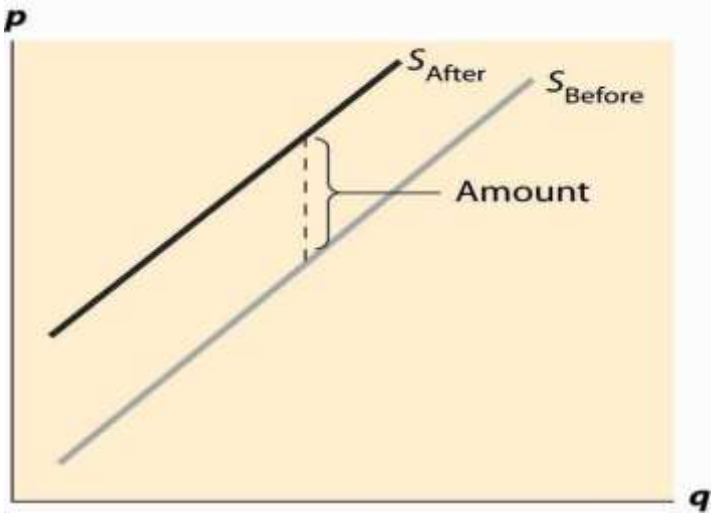
First, consider a tax imposed on the seller. At a given price p, and tax t, each seller obtains $p - t$, and thus supplies the amount associated with this net price. Taking the before-tax supply to be S_{Before}, the after-tax supply is shifted up by the amount of the tax. This is the amount that covers the marginal value of the last unit, plus providing for the tax. Another way of saying this is that, at any lower price, the sellers would reduce the number of units offered. The change in supply is illustrated in Figure 4.2.1 "Effect of a tax on supply"

We notice from the figure that the equilibrium point before the imposition of the tax is point A(p^, Q^). However, after the imposition of the tax, the equilibrium point has changed due to the shift of the supply curve to the left. The price difference between them reflects the amount of the tax, as follows: T = p_c - p_p. The amount of the tax can also be found using the following relationship:

$T=t_c+t_p$ Where:

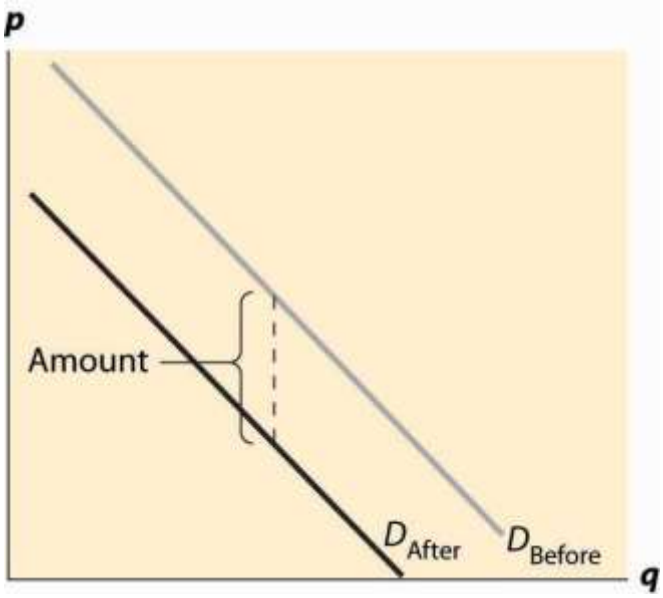
- p_c represents the price that the buyer pays to obtain the commodity after the tax is imposed.
- p_p represents the price received by the seller after the tax is imposed.
- T represents the amount of the tax.
- t_c represents the amount the consumer bears from the tax ($t_c=p_c-p_*$).
- t_p represents the amount the seller bears from the tax ($t_p=p_*-p_p$ or $t_p=T-t_c$).

Figure4.2.1 Effect of a tax on supply

4. 

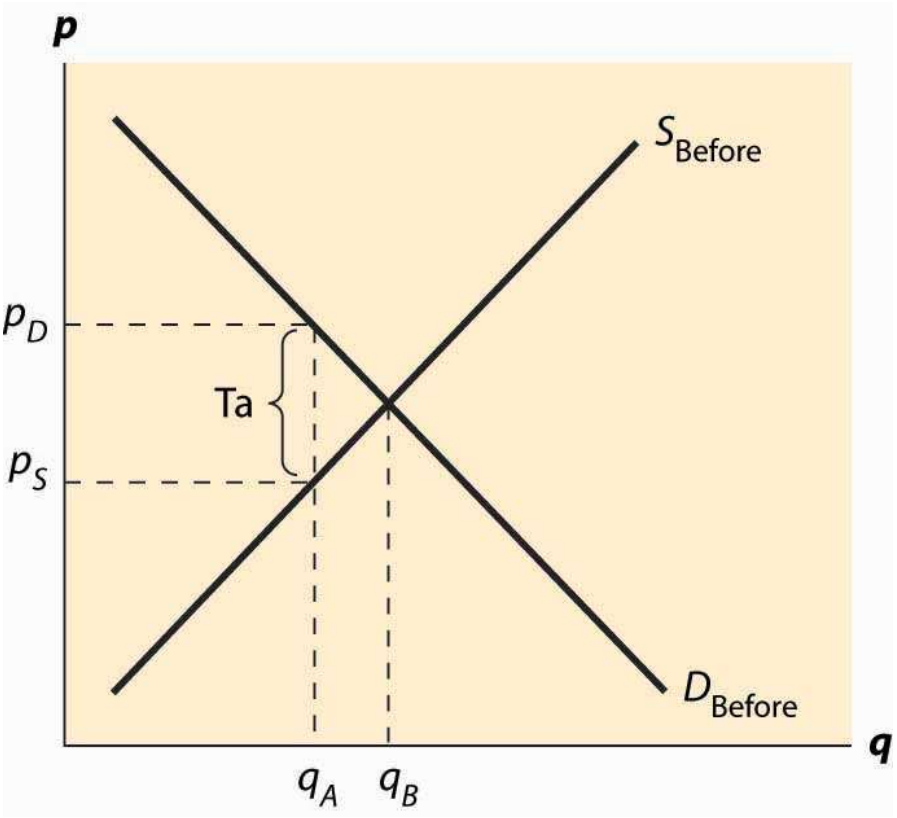
Now consider the imposition of a tax on the buyer, as illustrated in Figure 5.2 "Effect of a tax on demand". In this case, the buyer pays the price of the good, *p*, plus the tax, *t*. This reduces the willingness to pay for any given unit by the amount of the tax, thus shifting down the demand curve by the amount of the tax.

Figure 4.2.2 Effect of a tax on demand



In both cases, the effect of the tax on the supply-demand equilibrium is to shift the quantity toward a point where the before-tax demand minus the before-tax supply is the amount of the tax. This is illustrated in Figure 5.3 "Effect of a tax on equilibrium". The quantity traded before a tax was imposed was q_B*. When the tax is imposed, the price that the buyer pays must exceed the price that the seller receives, by the amount equal to the tax. This pins down a unique quantity, denoted by q_A*. The price the buyer pays is denoted by p_D* and the seller receives that amount minus the tax, which is noted as p_S*. The relevant quantities and prices are illustrated in Figure *4.2.3* "Effect of a tax on equilibrium".

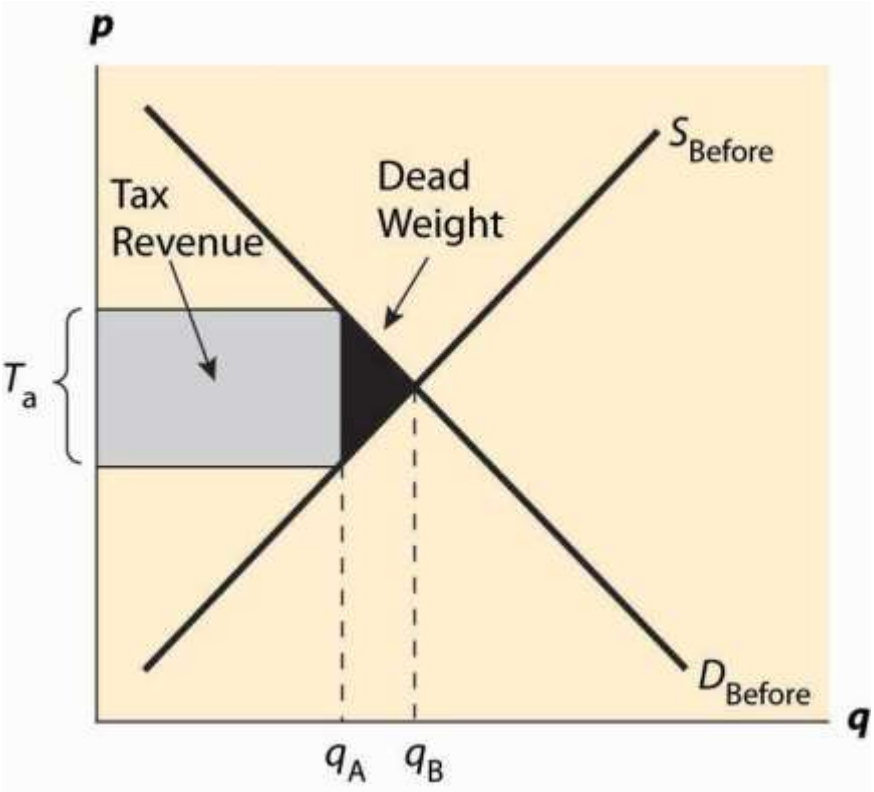
Figure 4.2.3 Effect of a tax on equilibrium



Also noteworthy in this figure is that the price the buyer pays rises, but generally by less than the tax. Similarly, the price that the seller obtains falls, but by less than the tax. These changes are known as the incidence of the tax—a tax mostly borne by buyers, in the form of higher prices, or by sellers, in the form of lower prices net of taxation.

There are two main effects of a tax: a fall in the quantity traded and a diversion of revenue to the government. These are illustrated in Figure 5.4 "Revenue and deadweight loss". First, the revenue is just the amount of the tax times the quantity traded, which is the area of the shaded rectangle. The tax raised, of course, uses the after-tax quantity q_A* because this is the quantity traded once the tax is imposed.

Figure 4.2.4 Revenue and deadweight loss



In addition, a tax reduces the quantity traded, thereby reducing some of the gains from trade. Consumer surplus falls because the price to the buyer rises, and producer surplus (profit) falls because the price to the seller falls. Some of those losses are captured in the form of the tax, but there is a loss captured by no party—the value of the units that would have been exchanged were there no tax. The value of those units is given by the demand, and the marginal cost of the units is given by the supply. The difference, shaded in black in the figure, is the lost gains from trade of units that aren't traded because of the tax. These lost gains from trade are known as a deadweight loss. That is, the deadweight loss is the buyer's values minus the seller's

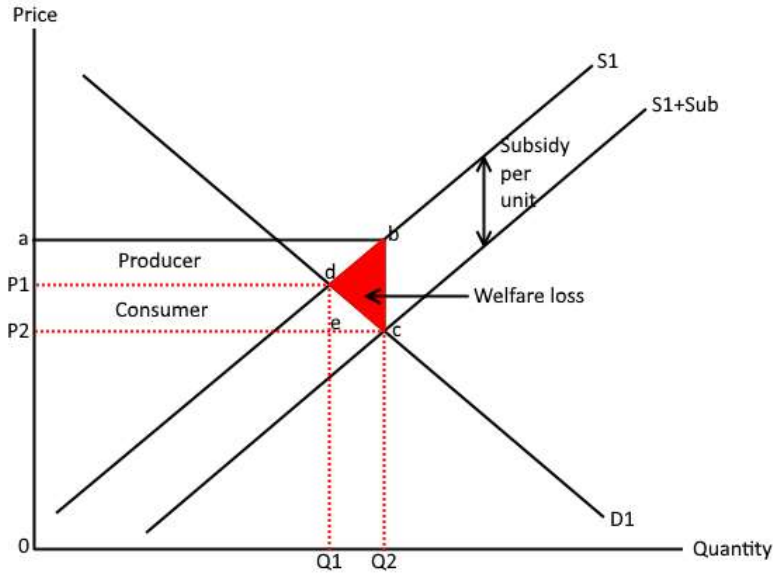
costs of units that are not economic to trade only because of a tax or other interference in the market. The net lost gains from trade (measured in dollars) of these lost units are illustrated by the black triangular region in the figure.

The deadweight loss is important because it represents a loss to society much the same as if resources were simply thrown away or lost. The deadweight loss is value that people don't enjoy, and in this sense can be viewed as an opportunity cost of taxation ; that is, to collect taxes, we have to take money away from people, but obtaining a dollar in tax revenue actually costs society more than a dollar. The costs of raising tax revenues include the money raised (which the taxpayers lose), the direct costs of collection, like tax collectors and government agencies to administer tax collection, and the deadweight loss—the lost value created by the incentive effects of taxes, which reduce the gains for trade. The deadweight loss is part of the overhead of collecting taxes. An interesting issue, to be considered in the subsequent section, is the selection of activities and goods to tax in order to minimize the deadweight loss of taxation.

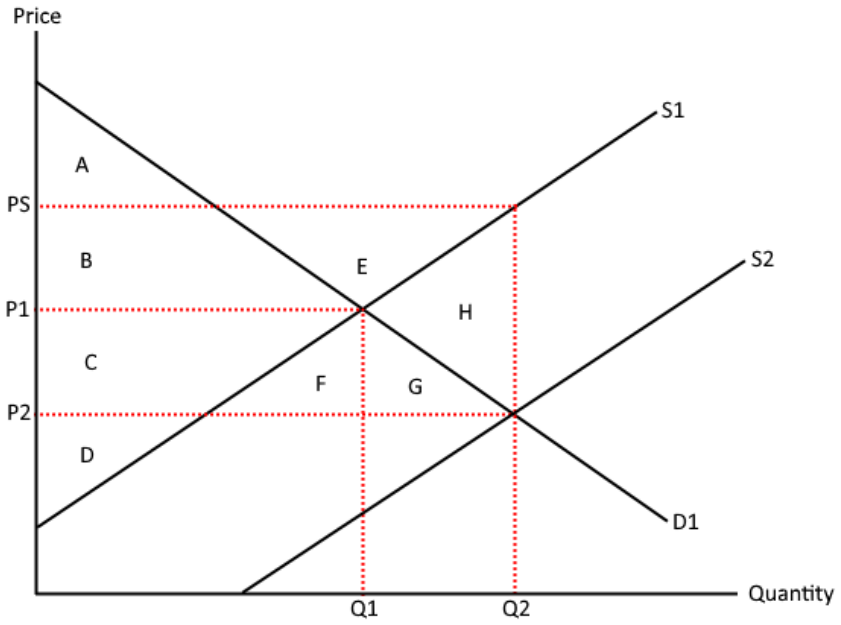
Without more quantification, only a little more can be said about the effect of taxation. First, a small tax raises revenue approximately equal to the tax level times the quantity, or tq. Second, the drop in quantity is also approximately proportional to the size of the tax. Third, this means the size of the deadweight loss is approximately proportional to the tax squared. Thus, small taxes have an almost zero deadweight loss per dollar of revenue raised, and the overhead of taxation, as a percentage of the taxes raised, grows when the tax level is increased. Consequently, the cost of taxation tends to rise in the tax level.

4.2.2 Subsidies:

A subsidy is a certain amount of money given to a firm by the government in order to try and increase production or consumption of a good/service. This is due to the fact that some of the subsidy is kept by the firm thus increasing their profits and incentivising more firms to enter the market and those currently in the market to produce more. Furthermore, some of the subsidy is passed on to the consumer allowing firms to offer the good/service at a lower price causing an increase in quantity demanded.



This can be shown on the diagram above as the subsidy lowers costs of production causing supply to increase from S1 to S1+Sub. As a result of this, price decreases from P1 to P2 and quantity increases from Q1 to Q2. This is because the introduction of a subsidy means that firms are more incentivised to produce more of the good/service and those firms that weren't currently in the market are more incentivised to join the market. The cost of the subsidy to the government per unit is shown by the vertical difference between S1 and S1+Sub. Using this you can work out the total cost of the subsidy to the government by multiplying the subsidy cost per unit by the quantity Q2. This can be shown by the area a-b-c-P2. Unlike the tax diagram the producer area is on top and the consumer area is on the bottom. Consumers before the subsidy were paying price P1 at a quantity of Q1. They're now paying price P2 at a quantity of Q2. This means the overall consumer saving from the subsidy is P1-d-e-P2. Although the intention of a subsidy is usually to reduce the price for consumers, the producers also keep some of the subsidy. Before the subsidy, producers were getting P1-d-Q1-0. After the subsidy Producers are getting 0-a-b-Q2 and therefore gaining the extra revenue of a-b-c-P2. The welfare loss is shown by the area d-b-c and can be explained using the diagram below.



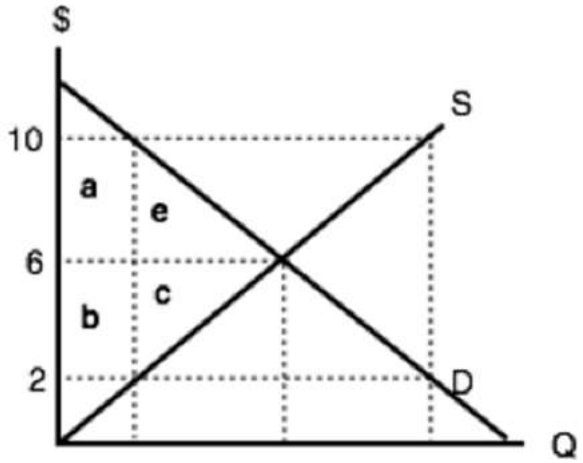
	Free market	Subsidy
Consumer surplus	A+B	A+B+C+F+G
Producer Surplus	C+D	B+C+D+E
Government Cost	0	B+E+C+F+G+H
Total surplus	A+B+C+D	A+B+C+D-H

In the free market consumer surplus is A+B, which is the area above the market price (P1). After the subsidy market price decreases to P2 causing consumer surplus to increase to A+B+C+F+G (the area above P2 within the demand curve). Producer surplus increases from C+D to B+C+D+E (the area below PS and above S1). This is due to the fact that the producer keeps some of the subsidy giving them a producer surplus up to price PS rather than P2.

Series of Exercises No. 3 in Microeconomics 1 - Tutorials

Exercise °1

The following TWO questions refer to the supply and demand curves illustrated below.



Assume that : $Q_1 = 4$ $Q_2 = 8$ $Q_3 = 12$

1. Find excess demand and market surplus and deadweight loss when A price ceiling of 2 $.

2. Find excess supply and market surplus and deadweight loss when A price Floor of 10 $.

Exercise °2

If you have the demand and market supply functions for the commodity (Qx) as follows:

$Q_d = 120 - 4P$ $Q_s = 4P$

1. Find the equilibrium price and quantity mathematically
2. What happens to the market if the government decides to set a maximum price of 10 $?
3. Assuming that the government decided to impose a minimum price estimated at 20 $, what is the impact of this on the equilibrium values?

Exercise °3

The demand and supply equations for a particular commodity are as follows:

$Q_d = 10 - 0.25P$ $Q_s = -2 + 0.5P$

If the government imposes a specific tax on the product of 6 $, explain how the tax burden is distributed between the consumer and the producer.

Exercise ° 4

The demand and supply equations for a particular commodity are as follows:

$\mathrm{Q_d} = 20 - \frac{21}{4}p \qquad Q_s = 2 + p$

Show the effect of imposing an ad valorem tax of 25% on the equilibrium point.

Exercise °5

The demand and supply equations for a particular commodity are as follows:

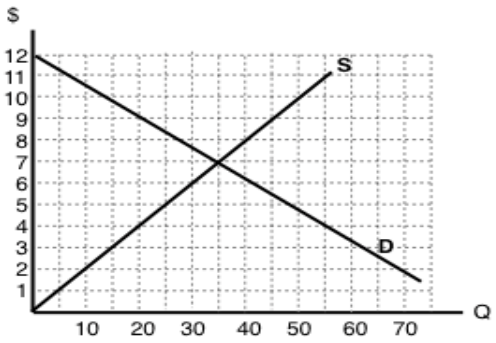
$Q_d = 8 - 2P \qquad Q_s = -2 + 3P$

If we assume that the government granted a subsidy of 5 $ for each unit sold, then is required is to find:

- The price that the consumer pays, specifying the amount of his benefit from this subsidy ?
- The price that the seller receives, specifying how much he benefits from this subsidy?

Exercise °6

Consider the supply and demand diagram below.



If a $2 per unit subsidy is introduced, what will be the equilibrium quantity?

Chapter 5 : Consumer Behavior Theory

CHAPTER OBJECTIVES

In this chapter, you will learn about :

- Cardinal utility approach
- Ordinal utility approach

By the end of this section, you will be able to:

- Explain the concept of utility ;
- Analyse and use cardinal utility approach for measurement of utility ;
- Explain Law of Diminishing Marginal utility ;
- Describe consumer equilibrium with the help of law of equi-marginal utility ;
- Distinguish between cardinal and ordinal utility approaches ;
- State ordinal utility approach for measurement of utility;
- Use Indifference curve analysis to explain consumer behaviour;
- explain the concept of Budget line;
- Describe consumer equilibrium through Indifference curve approach;

Introduction:

The topic of consumer behavior is most concerned with how people make their buying decisions in an economy. In the real economy consumer are free to choose which goods and services to purchase. This freedom of choice is best demonstrated when consumer cast their money for or against products. Naturally, consumer are not financially able to buy unlimited quantities of products. Instead, consumer must make choices, and these choices are influenced by many factor.

The analysis in this chapter will dive deeper into the demand side of our supply and demand model, which will help us develop a deeper undertanding of all the impacts of a price change beyond a simple difference in quantity demanded. There are specifically two measures of economic utility definition namely cardinal utility and ordinal utility which is discussed under :

5.1 Cardinal Utility Approach

In this part of the chapter we are concerned with the theory of demand, which explains the demand for a good and the factor determining it. Individual's demand for a product depends upon the price of the product, income of the individual, and the prices of related goods….

It can be stated in the following functional form:

$D_x = f(P_x, I, P_y, P_z \text{ etc.})$

Where D_x stands for the demand for good X, P_x for price of good X, I for individual's income, P_y, P_z etc., for the prices of related goods. But among these determinants of demand, economists single out price of the good in question as the most important factor governing the demand for it. Indeed, the function of a theory of demand is to establish a relationship between quantity demanded of a good and its price and to provide an explanation for it.

From time to time, different theories have been advanced to explain consumer's demand for a good and to derive a valid demand theorem. Cardinal utility analysis is the oldest theory of demand which provides an explanation of consumer's demand for a product and derives the law of demand which establishes an invere relationship between price and quantity demanded of a product.

Cardinal utility final shape emerged at the hands of Marhall. Therefore, it is Marhallian utility analysis of demand which has been discussed in this lecture.

5.1.1 The Meaning of Utility:

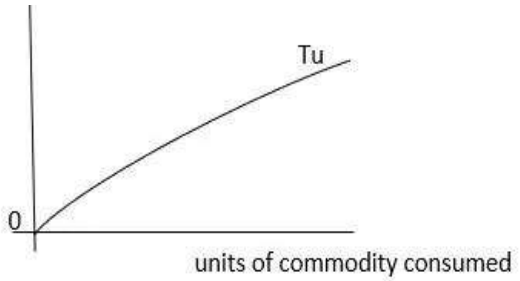
People demand goods because they satisfy their wants. The utility means want-satisfying power of a commodity. It is also defined as property of the commodity which satisfies the wants of the consumer. Utility is a subjective thing and resides in the mind of men. Being subjective it varies with different perons, that is, different perons derive different amounts of utility from a given good. People know utility of goods by their psychological feeling.

The Concepts of Utility

The term utility refer to the amount of satisfaction derived from the consumption of a commodity at a particular time.

Concepts of total utility, marginal utility and average utility

1. Total Utility: this refer to the total amount of satisfaction derived from all the units of a commodity consumed at a particular time.



Total Utility Curve

2. Marginal Utility: This refers to the additional satisfaction derived by consuming an extra unit of a commodity.

$$MU = \frac{\text{change in Tu}}{change\ in\ Quantity} = \frac{\Delta Tu}{\Delta Q} = \frac{Tu_1 - Tu_0}{Q_1 - Q_0}$$

Where ΔQ = Change in total utility

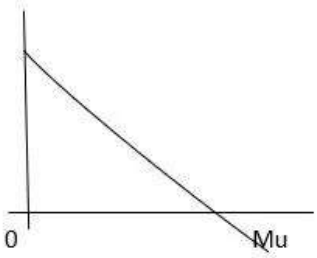
ΔQ = Change in quantity

Tu_1 = New level of total utility

Tu_0 = Old Level of total utility

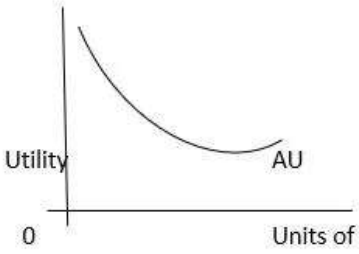
Q_1 = New level of quantity

Q_1 = Old level of quantity



3. Average Utility: this is the amount of satisfaction derived by a consumer per unit of a commodity consumed.

$$= \frac{\text{Total in Utility}}{change\ in\ Quantity}$$



Relationship between total utility and marginal utility schedule of Total, marginal and average utility.

Relationship between total utility and marginal utility schedule of Total, marginal and average utility.

Quantity of Goods consumed	Total Utility	Marginal Utility	Average Utility
0	0	–	-
1	15	15	15
2	25	10	12.5
3	32	7	10.7
4	38	6	9.5
5	41	3	8.2
6	43	2	7.2
7	43	0	6.1
8	42	-1	5.3

Example to distinguish between total and marginal utulity

It is important to distinguish between total utility and marginal utility. Consider Table 5.1 where a utility of a consumer from cups of tea per day is given.

Table 5.1. Diminishing Marginal Utility

Cups of Tea consumed per day	*Total utility (utils)*	*Marginal utility (utils)*
1	12	12
2	22	10
3	30	8
4	36	6
5	40	4
6	41	1
7	39	– 2
8	34	– 5

Total Utility

Total utility of a commodity to a consumer is the sum of utilities which he obtains from consuming a certain number of units of the commodity per period. If the consumer consumes one cup of tea per day, he gets utility equal to 12 utils.

On consuming two units of the commodity per day his utility from the two units of the commodity rises to 22 utils and so on. When he takes 6 cups of tea per day, his total utility, that is, total utility of all the 6 units taken per day goes up to 41 utils. Generally, the greater the number of units of a commodity consumed by an individual, the greater the total utility he gets from the commodity. Thus, total utility is the function of the quantity of the commodity consumed.

It should however be noted that as the units of a commodity increases, total utility increases at a diminishing rate. When want of the consumer for a particular commodity is fully satisfied by consuming a certain quantity of the commodity, further increases in consumption of the commodity will cause a decline in total utility of the consumer. The number of units of commodity consumed at which a consumer is fully satisfied is called satiation quantity.

Beyond the satiation point, total utility decreases if more is consumed. It will be seen from Table 5.1 that total utility declines when the consumer consumes more than 6 units of the commodity. This happens because beyond satiety point more consumption of a good actually harms the consumer which causes a decline in utility or satisfaction from the commodity.

Marginal Utility:

Marginal utility of a commodity to a consumer is the extra utility which he gets when he consumes one more unit of the commodity. In other words, marginal utility is the addition made to the total utility when one more unit of a commodity is consumed by an individual. The concept of marginal utility can be easily undertood from Table 5.1.

When the consumer takes two cups of tea instead of one cup his total utility increases from 12 to 22 utils. This means that the consumption of the second unit of the commodity has made addition to the total utility by 10 utils. Thus marginal utility is here equal to 10 utils.

Further when the number of cups of tea consumed per day from 2 to 3, the total utility increases from 22 to 30 utils. That is, the third unit of tea has made an addition of 8 utils to the total utility. Thus 8 is the marginal utility of the third of consumption of tea. Beyond 6 cups of tea consumption per day, total utility declines and therefore marginal utility becomes negative.

Marginal utility can be expressed as under: $MU_n = TU_n - TU_{n-1}$

Where n is any given number?

In terms of calculus, it can be expressed as $MU_n = \frac{\Delta TU}{\Delta Q}$ where $\Delta Q = 1$

Therefore, in graphical analysis, marginal utility of a commodity can be known by measuring the slope of the total utility curve.

5.1.2 Law of Diminishing Marginal Utility:

An important tenet of marginal utility analysis relates to the behaviour of marginal utility. This familiar behaviour of marginal utility has been stated in the Law of Diminishing Marginal Utility according to which marginal utility of a good diminishes as an individual consumes more units of the good.

In other words, as a consumer takes more units of a good, the extra utility or satisfaction that he derives from an extra unit of the good goes on falling. It should be carefully noted that it is the marginal utility and not the total utility that declines with the increase in the consumption of a good. The law of diminishing marginal utility means that the total utility increases but at a decreasing rate.

Marhall who was the famous exponent of the marginal utility analysis has stated the law of diminishing marginal utility as follows:

"The additional benefit which a peron derives from a given increase of his stock of a thing diminishes with every increase in the stock that he already has."

This law is based upon two important facts. Firtly, while the total wants of a man are virtually unlimited, each single want is satiable. Therefore, as an individual consumes more and more units of a good, intensity of his want for the good goes on falling and a point is reached where the individual no longer wants any more units of the good.

That is, when saturation point is reached, marginal utility of a good becomes zero. Zero marginal utility of a good implies that the individual has all that he wants of the good in question. The second fact on which the law of diminishing marginal utility is based is that the different goods are not perfect substitutes for each other in the satisfaction of various particular wants.

When an individual consumes more and more units of a good, the intensity of his particular want for the good diminishes but if the units of that good could be devoted to the satisfaction of other wants and yielded as much satisfaction as they did initially in the satisfaction of the firt want, marginal utility of the good would not diminish.

It is obvious from above that the law of diminishing marginal utility describes a familiar and fundamental tendency of human nature. This law has been arrived at by introspection and by observing how people behave.

Illustration of the Law of Diminishing Marginal Utility :

Consider Table 5.1, in which we have presented the total and marginal utilities derived by a peron from cups of tea consumed per day. When one cup of tea is taken per day, the total utility derived by the peron is 12 utils. And because this is the firt cup its marginal utility is also 12. With the consumption of 2nd cup per day, the total utility rises to 22 but marginal utility falls to 10. It will be seen from the table that as the consumption of tea increases to six cups per day, marginal utility from the additional cups goes on diminishing (i.e., the total utility goes on increasing at a diminishing rate).

Table 5.1. Diminishing Marginal Utility

Cups of Tea consumed per day	*Total utility (utils)*	*Marginal utility (utils)*
1	12	12
2	22	10
3	30	8
4	36	6
5	40	4
6	41	1
7	39	– 2
8	34	– 5

However, when the cups of tea consumed per day increase to seven, then instead of giving positive marginal utility, the seventh cup gives negative marginal utility equal to 2. This is because too many cups of tea consumed per day (say more than six for a particular individual) may cause him acidity and gas trouble. Thus, the extra cups of tea beyond six to the individual in question gives him disutility rather than positive satisfaction.

We have graphically represented the data of the above table in Fig. 5.1. We have constructed rectangles representing the total utility obtained from various number of cups of tea consumed per day. As will be seen in the figure, the length of the rectangle goes on increasing up to the sixth cup of tea and beyond that length of the rectangle declines, indicating thereby that up to the sixth cup of tea total utility obtained from the increasing cups of tea goes on increasing whereas beyond the 6th cup, total utility declines.

In other words, marginal utility of the additional cups up to the 6th cup is positive, whereas beyond the sixth cup marginal utility of tea is negative. The marginal utility obtained by the consumer from additional cups of tea as he increases the consumption of tea has been shaded. A glance at the Fig. 5.1 will show that this shaded area goes on declining which shows that marginal utility from the additional cups of tea is diminishing.

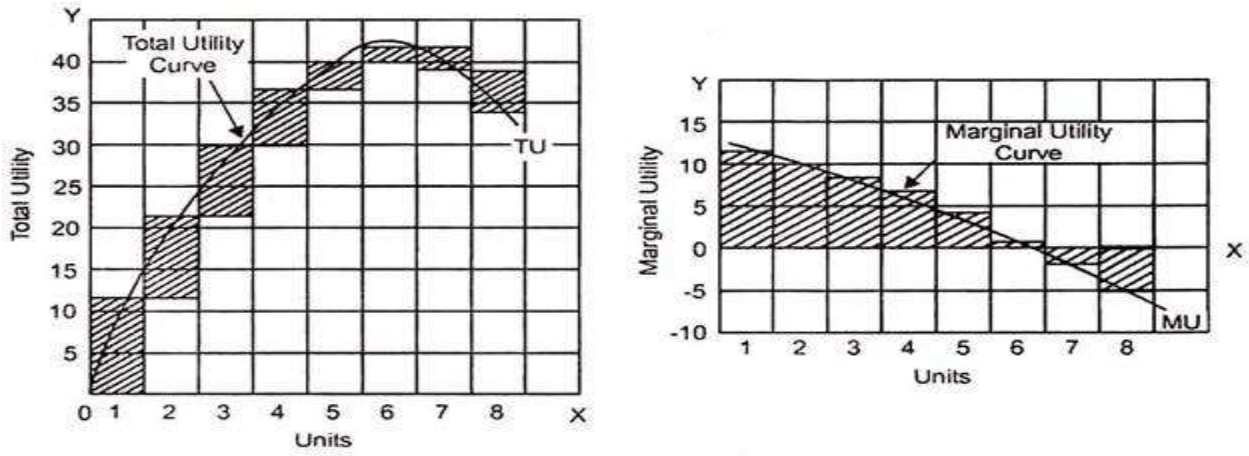


Fig. 5.1. Diminishing Marginal Utility

We have joined the various rectangles by a smooth curve which is the curve of total utility which rises up to a point and then declines due to negative marginal utility. Moreover, the shaded areas of the rectangle representing marginal utility of the various cups of tea have also been shown separately in the figure 5.1.

We have joined the shaded rectangles by a smooth curve which is the curve of marginal utility. As will be seen, this marginal utility curve goes on declining throughout and even falls below the X-axis. Portion below the X-axis indicates the negative marginal utility.

This downward-sloping marginal utility curve has an important implication for consumer's behaviour regarding demand for goods. We shall explain below how the demand curve is derived from marginal utility curve. The main reason why the demand curves for goods slope downward is the fact of diminishing marginal utility.

The significance of the diminishing marginal utility of a good for the theory of demand is that the quantity demanded of a good rises as the price falls and vice-vera. Thus, it is because of the diminishing marginal utility that the demand curve slopes downward.

If properly undertood the law of diminishing marginal utility applies to all objects of desire including money. But it is worth mentioning that marginal utility of money is generally never zero or negative. Money represents general purchasing power over all other goods, that is, a man can satisfy all his material wants if he possesses enough money. Since man's total wants are practically unlimited, marginal utility of money to him never falls to zero.

Applications and Uses of Diminishing Marginal Utility:

The marginal utility analysis has a good number of uses and applications in both economic theory and policy.

We explain below some of its important uses:

a. It Explains Value Paradox:

The law of diminishing marginal utility is of crucial significance in explaining determination of the prices of commodities. The discovery of the concept of marginal utility has helped to explain the paradox of value which troubled Adam Smith in The Wealth of Nations.

Adam Smith was greatly perplexed to know why water which is so very essential and useful to life has such a low price (indeed no price), while diamonds which are quite unnecessary, have such a high price. This value paradox is also known as water-diamond paradox. He could not resolve this water-diamond paradox. But modern economists can solve it with the aid of the concept of marginal utility.

According to the modern economists, the total utility of a commodity does not determine the price of a commodity and it is the marginal utility which is crucially important determinant of price. Now, the water is available in abundant quantities so that its relative marginal utility is very low or even zero. Therefore, its price is low or zero.

On the other hand, the diamonds are scarce and therefore their relative marginal utility is quite high and this is the reason why their prices are high.

Prof. Samuelson explains this paradox of value in the following words:

"The more there is of a commodity, the less the relative desirability of its last little unit becomes, even though its total usefulness grows as we get more of the commodity. So, it is obvious why a large amount of water has a low price. Or why air is actually a free good despite its vast usefulness. The many later units pull down the market value of all units."

b. This Law Helps in Deriving Law of Demand:

Further, as shall be seen below, with the aid of the law of diminishing marginal utility, we are able to derive the law of demand and to show why the demand curve slopes downward. Besides, the Marhallian concept of consumer's surplus is based upon the principle of diminishing marginal utility.

c. This Law Shows Redistribution of Income will Increase Social Welfare:

Another important use of marginal utility is in the field of fiscal policy. In the modern welfare state, the Governments redistribute income so as to increase the welfare of the people. This redistribution of income through imposing progressive income taxes on the rich sections of the society and spending the tax proceeds on social services for the poor people is based upon the diminishing marginal utility.

The concept of diminishing marginal utility demonstrates that transfer of income from the rich to the poor will increase the economic welfare of the community. Law of diminishing marginal utility also applies to the money; as the money income of a consumer increases, the marginal utility of money to him falls. How the redistribution of income will increase the welfare of the community, is illustrated in Fig. 5.2.

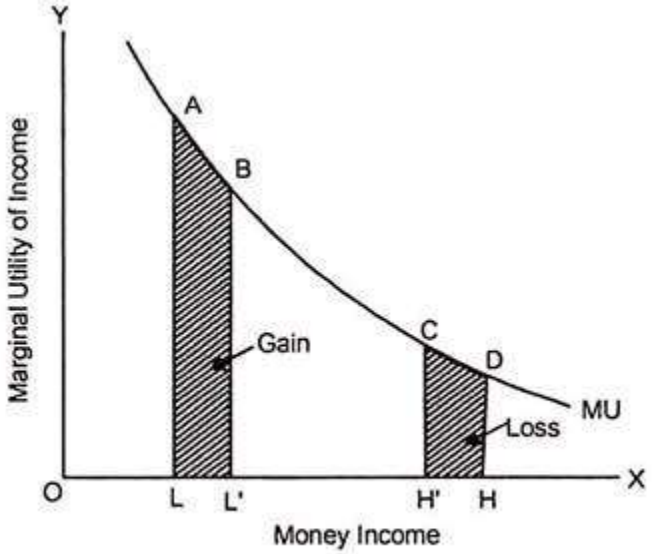


Fig. 5.2. Redistribution of Income to Increase Social Welfare

In the Fig. 5.2, money income is measured along X-axis and marginal utility of income is measured along Y-axis. MU is the marginal utility curve of money which is sloping downward. Suppose OL is the income of a poor peron and OH is the income of a rich peron. If rich peron is subjected to the income tax and amount of money equal to HH' is taken from him and the same amount of money LL' (equal to HH') is given to the poor man, it can be shown that the welfare of the community will increase.

As a result of this transfer of income, the income of the rich man falls by HH" and the income of the poor peron rises by LL' (HH' = LL'). Now, it will be seen in Fig. 5.2 that the loss of satisfaction or utility of the rich man as a result of decline in his income by HH' is equal to the area HDCH'. Further, it will be seen that the gain in satisfaction or utility by the increase of an equivalent amount of income LL' of the poor man, is equal to LABL'.

It is thus obvious from the figure that the gain in utility of the poor peron is greater than the loss of utility of the rich man. Therefore, the total utility or satisfaction of the two perons taken together will increase through transfer of some income from the rich to the poor.

Thus, on the basis Money Income of the diminishing marginal utility of money many economists and political scientists have advocated that Government must redistribute income in order to raise the economic welfare of the society. However, it may be pointed out that some economists challenge the validity of such redistribution of income to promote the social welfare.

They point out that the above analysis of marginal utility is based upon interperonal comparison of utility which is quite inadmissible and unscientific. They argue that people differ greatly in their preferences and capacity to enjoy goods and, therefore, it is difficult to know the exact shapes of the marginal utility curves of the different perons. Therefore they assert that the losses and gains of utility of the poor and the rich cannot be measured and compared.

5.1.2 Law of Equimarginal Utility: Consumer's Equilibrium

Principle of Equimarginal Utility:

Principle of equimarginal utility occupies an important place in marginal utility analysis. It is through this principle that consumer's equilibrium is explained. It is also called law of substitution because in it for reaching equilibrium position consumer substitutes one good for another. A consumer has a given income which he has to spend on various goods he wants.

Now, the question is how he would allocate his money income among various goods that is to say, what would be his equilibrium position in respect of the purchases of the various goods. It may be mentioned here that consumer is assumed to be 'rational', that is, he coldly and carefully calculates and substitutes goods for one another so as to maximise his utility or satisfaction.

Suppose there are only two goods X and Y on which a consumer has to spend a given income. The consumer's behaviour will be governed by two factor Firtly, the marginal utilities of the goods and secondly, the prices of two goods. Suppose the prices of the goods are given for the consumer.

The law of equimarginal utility states that the consumer will distribute his money income between the goods in such a way that the utility derived from the last rupee spent on each good is equal. In other words, consumer is in equilibrium position when marginal utility of money expenditure on each good is the same. Now, the marginal utility of money expenditure on a good is equal to the marginal utility of a good divided by the price of the good.

In symbols:

$$MU_m = \frac{MU_x}{P_x}$$

MU_m where marginal utility of money expenditure and MU_m , is the marginal utility of X and P_x is the price of X. The law of equimarginal utility can therefore be stated thus the consumer will spend his money income on different goods in such a way that marginal utility of each good is proportional to its price.

That is, consumer is in equilibrium in respect of the purchases of two goods X and Y when:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

Now, if Mu_x/P_x and Mu_x/P_x are not equal and Mu_x/P_x is greater than Mu_y/P_y, then the consumer will substitute good X for good Y. As a result of this substitution, the marginal utility of good X will fall and marginal utility of good Y will rise. The consumer will continue substituting good X for good Y till Mu_x/P_x becomes equal to Mu_y/P_y .When Mu_x/P_x becomes equal to Mu_y/P_y the consumer will be in equilibrium.

But the equality of Mu_x/P_x with Mu_y/P_y can be achieved not only at one level but at different levels of expenditure. The question is how far a consumer goes in purchasing the goods he wants. This is determined by the size of his money expenditure. With a given money expenditure on a good, the consumer will derive some utility from it. Now, the consumer will go on purchasing goods till the marginal utility of money expenditure on each good becomes equal.

Thus the consumer will be in equilibrium when the following equation holds good:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$$

If there are more than two goods on which the consumer is spending his income, the above equation must hold good for all of them.

Let us illustrate the law of equimarginal utility with the aid of Tables 5.2 and 5.3.

Table 5.2. Marginal Utilities of Goods X and Y.

Units	MU_x *(Utils)*	MU_y *(Utils)*
1	20	24
2	18	21
3	16	18
4	14	15
5	12	12
6	10	9

Table 5.3. Marginal Utility of Money Expenditure.

Units	$\frac{MU_x}{P_x}$	$\frac{MU_y}{P_y}$
1	10	8
2	9	7
3	8	6
4	7	5
5	6	4
6	5	3

Let the prices of goods X and Y be r. 2 and r. 3 respectively and the consumer has r. 24 to spend on the two goods. It is worth noting that in order to maximise his utility the consumer will not equate marginal utility of the goods because prices of the two goods are different. He will equate the marginal utility of the last rupee (i.e., marginal utility of money expenditure) spent on these two goods.

In other words, he will equate Mu_x/P_x with MU_y/P_y while spending his given money income on the two goods. Therefore, reconstructing the above Table 5.2 by dividing marginal utilities of X(MU_x) by r. 2 and marginal utilities of Y(MU_y) by r. 3 we get Table 5.3 which show marginal utility of money expenditure.

By looking at the Table 5.2 it will become clear that MU_x/P_x is equal to 5 utils when the consumer purchases 6 units of good X and MU_y/P_y is equal to 5 utils when he buys 4 units of good Y. Therefore, the consumer will be in equilibrium when he is buying 6 units of good X and 4 units of good Y and will be spending (r. 2 × 6 + r. 3 × 4) = r. 24 on them.

Thus, in the equilibrium position where he maximizes his utility:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$$

$$\frac{10}{2} = \frac{15}{3} = 5$$

Thus 5 is the marginal utility of the last rupee spent on each of the two goods he purchases is the same, that is, r. 5.

Consumer' equilibrium is graphically portrayed in Fig. 5.3. Since marginal utility curves of the goods slope downward, curves depicting Mu_x/P_x and MU_y/P_y also slope downward.

Thus when the consumer is buying OH of X and OK of Y, then:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m$$

Therefore, the consumer is in equilibrium when he is buying 6 units of X and 4 units of Y. No other allocating of money expenditure will yield greater utility than when he is buying 6 units of X and 4 units of commodity Y. Suppose the consumer buys one unit less of good X and one unit more of good Y.

This will lead to the decrease in his total utility It will be observed from Fig. 5.3 (a) that the consumption of 5 units instead of 6 units of commodity X means a loss in satisfaction equal to the shaded area ABCH and consumption of 5 units of commodity Y instead of 4 units will mean gain in utility by the shaded area KEFL. It will be noticed that with this rearrangement of purchases of the two goods, the loss in utility ABCH exceeds gain in utility KEFL. Therefore, his total satisfaction will fall as a result of this rearrangement of purchases.

Thus when the consumer is making purchases by spending his given income in such a way that $MU_x/P_x = MU_y/P_y$, he will not like to make any further changes in the basket of goods and will therefore be in equilibrium situation by maximizing his utility.

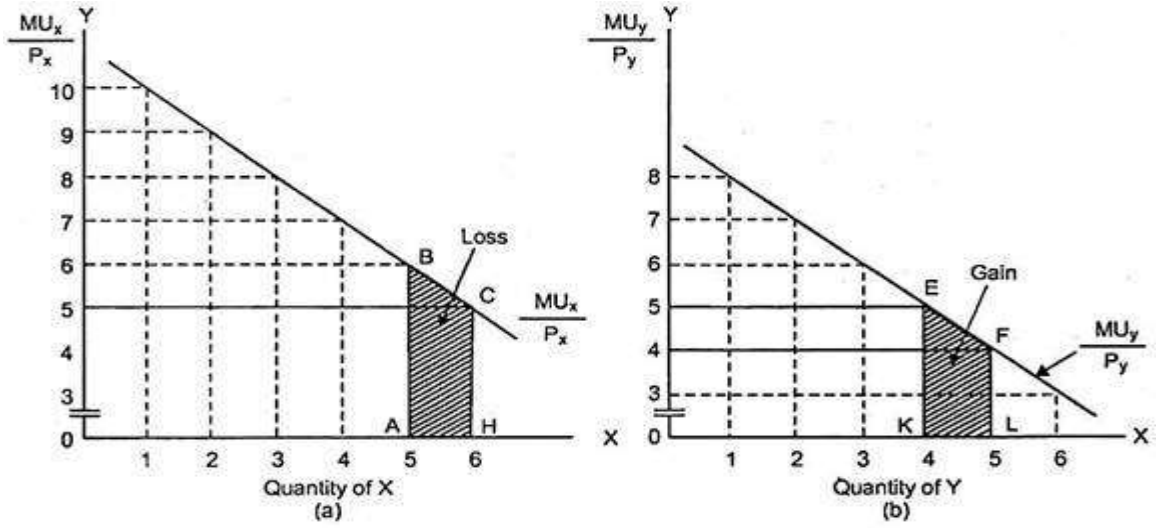


Fig. 5.3. Equimarginal Principle and Consumer's Equilibrium

The above equimarginal condition for the equilibrium of the consumer can be stated in the following ways:

(i) A consumer is in equilibrium when he equalises the ratios of marginal utilities of goods and their prices with each other. In other words, he is in equilibrium when

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} \text{ ..... } = \frac{MU_n}{P_n} = MU_m.$$

(ii) By rearranging the above equation we find that a consumer is in equilibrium when he equalises the ratio of marginal utilities of goods with the ratio of corresponding prices for each pair of goods consumed, that is, when

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y} \text{ and } \frac{MU_y}{MU_z} = \frac{P_y}{P_z}$$ and so forth.

(iii) Since Mu_x/P_x or MU_y/P_y measure the marginal utility of a rupee's worth of each good consumed at the given price, consumer can be said to be in equilibrium when the marginal utility of the last rupee spent on each good purchased is equal. Marginal utility of the last rupee spent on a good means the marginal utility of a rupee's worth of the good. Thus, consumer is equilibrium when he spends his given income on various commodities in such a way that utility from the last rupee spent on each good is the same.

If the marginal utility of the last rupee spent on each good is denoted by MU_m, then equilibrium condition of consumer's equilibrium can also be stated as under:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_y}{P_z} = MU_m$$

Derivation of the Demand Curve and the Law of Demand

We now turn to explain how the demand curve and the law of demand is derived in the cardinal utility analysis. The demand curve or the law of demand shows the relationship between price of a good and its quantity demanded. Marhall derived the demand curves for goods from their utility functions. It should be further noted that in his cardinal utility analysis of demand Marhall assumed the utility functions of different goods to be independent of each other.

In other words, Marhallian technique of deriving demand curves for the goods from their utility functions rests on the hypothesis of additive utility functions, that is, utility functions of each good consumed by a consumer does not depend on the quantity consumed of any other good. In case of independent utilities or additive utility functions, the relations of substitution and complementarity between goods are ruled out.

Further, in deriving a demand curve or law of demand Marhall assumes that marginal utility of money to remain constant. The law of demand or the demand curve can be derived in two ways firt, with the aid of law of diminishing marginal utility, and secondly, with the help of the law of equimarginal utility. We shall explain below these two ways of deriving the demand curve and the law of demand.

Derivation of Demand Curve from Law of Diminishing Marginal Utility

In order to derive the demand curve (and accordingly law of demand) we measure marginal utility of a good in terms of money (i.e., in terms of rupees) as Marhall did. Measuring marginal utility in terms of money or rupees implies how much value in terms of rupees an individual places on the successive units of the commodity consumed. In other words, how much money a consumer is prepared to pay for a unit of commodity will measure the marginal utility of that unit of the commodity in terms of money?

The law of marginal utility states that as the quantity of a good with a consumer increase marginal utility of the good to him falls. In other words, the marginal utility curve of a good is downward sloping. Now, a consumer will go on purchasing a good until the marginal utility of the good equals the market price.

In other words, the consumer will be in equilibrium in respect of the quantity of the good purchased where marginal utility of the good equals its price. His satisfaction will be maximum only when marginal utility equals price. Thus the "marginal utility equal's price" is the condition of equilibrium.

When the price of the good falls, downward-sloping marginal utility curve implies that the consumer must buy more of the good so that its marginal utility falls and becomes equal to the new price. It therefore follows that the diminishing marginal utility curve of a good implies the down-ward-sloping demand curve, that is, as the price of the good falls, more of it will be bought.

The whole argument will be more clearly undertood from Fig. 5.4. In panel (a) of Fig. 5.4 the curve MU represents the diminishing marginal utility of the good measured in terms of money. In panel (b) of Fig. 5.4 we measure price on the Y-axis. Suppose the price of the good is OP_1. At this price the consumer will be in equilibrium when he purchases Oq_1 quantity of the goods since at Oq_1 the marginal utility of good X equal to MU_X is equal to the given price OP_1.

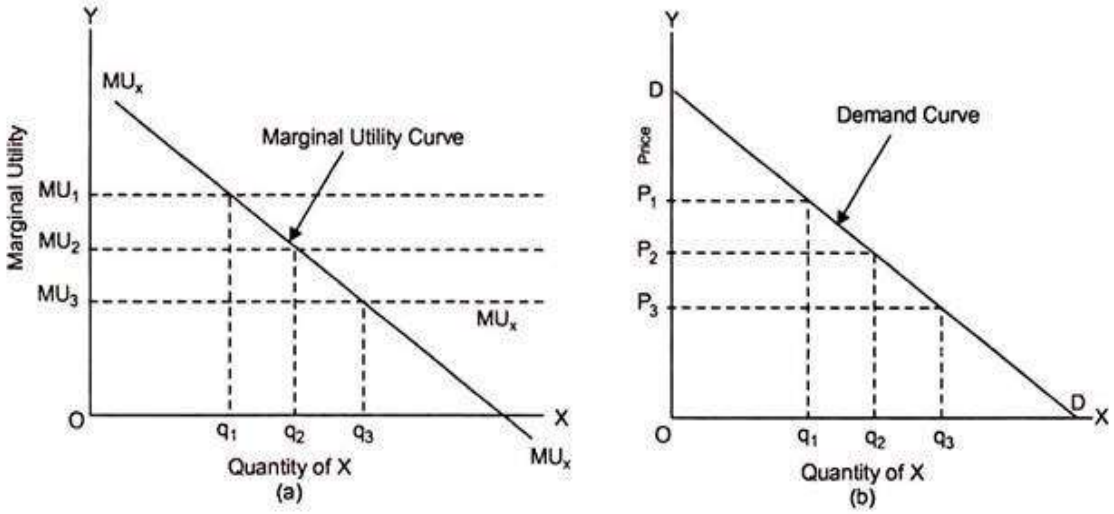


Fig. 5.4. Derivation of Demand Curve in Marshallian Cardinal Utility Analysis

Now, if the price of the good falls to OP_2, the equality between the marginal utility and the price will be disturbed. Marginal utility MU_X from good X at the quantity Oq_1 will be greater than the new price OP_2. In order to equate the marginal utility with the lower price OP_2, the consumer must buy more of the good. It is evident from Fig. 5.4 that when the consumer increases the quantity purchased to Oq_2 the marginal utility of the good falls to MU_2 and becomes equal to the new price OP_2.

Hence, at price OP_2, consumer demands Oq_2 amount of the commodity. Further, if the price falls to OP_3, this is equal to the marginal utility MU_3 of the good at the larger quantity Oq_3. Thus at price OP_3, the consumer will demand Oq_3 quantity of the good X. It is in this way the downward-sloping marginal utility curve is transformed into the downward-sloping demand curve when we measure marginal utility of a good in terms of money. It is worth noting that negative segment of the marginal utility curve MU_X will not constitute a part of the demand curve. This is because no rational consumer will buy any further units of the commodity which reduces his total utility and make marginal utilities negative.

It is thus clear that when the price of the good falls, the consumer buys more of the good so as to equate its marginal utility to the lower price. It follows therefore that the quantity demanded of a good varies inverely with price; the quantity rises when the price falls and vice-vera, other things remaining the same.

This is the famous Marhallian Law of Demand. It is quite evident that the law of demand is directly derived from the law of diminishing marginal utility. The downward-sloping marginal utility curve is transformed into the downward-sloping demand curve. It follows therefore that the force working behind the law of demand or the demand curve is the force of diminishing marginal utility.

Derivation of Law of Demand: Multi-Commodity Model:

We now proceed to derive the law of demand and the nature of the demand curve from the principle of equimarginal utility in case when a consumer spends his money income on more than one commodity. Consider the case of a consumer who has a certain given income to spend on a number of goods. According to the law of equimarginal utility, the consumer is in equilibrium in regard to his purchases of various goods when marginal utilities of the goods are proportional to their prices.

Thus, the consumer is in equilibrium when he is buying the quantities of the two goods in such a way that satisfies the following proportionality rule:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} ..... = \frac{MU_n}{P_n} = MU_m$$

Where, MU_m stands for marginal utility of money expenditure. Thus, in the equilibrium position, according to the above principle of equimarginal utility, the ratios of the marginal utility and the price of each commodity a consumer buys will equal the marginal utility of the last rupee spent on each good. It follows therefore that a rational consumer will equalise MU_x/P_x of good X with MU_y/P_y of good Y and so on.

Given that other things such tastes and preferences of a consumer, his income, prices of other related commodities remain constant, we consider the demand for good X. Assume the price of good X is equal to P_x. The consumer will allocate his given money income on various goods he purchases so that $MU_x /P_x = MU_y/P_y = MU_m$ and so forth.

Let us suppose that price of good X falls. With the fall in the price of good X, the price of good Y, consumer's income and his tastes remaining unchanged, the equality of $MU_x, /P_x = MU_y/P_y$ or with MU_m in general would be disturbed. With lower price of good X than before, $MU_x /P_x > MU_y/P_y$ or $MU_x, /P_x > MU_m$. (It is of coure assumed that marginal utility of money expenditure in general (MU_m) does not change as a result of the change in the price of one good).

Then, in order to restore the equality, marginal utility of good X has to be reduced which can be done only if consumer buys more of good X. It is thus clear from the equimarginal principle that as the price of a good falls, its quantity demanded will rise, other things remaining the same. This proves the law of demand which states that there is invere relationship between price of a good and its quantity demanded. The operation of this law of demand makes the demand curve downward sloping.

5.2 Ordinal Utility Approach: The Indifference Curves

The modern economists have discarded the concept of cardinal utility and instead applied ordinal utility approach to study the behavior of the consumer. While the neo-classical economists believed that the utility can be measured and expressed in cardinal number, but the modern economists maintain that the utility being the psychological phenomena cannot be measured theoretically, quantitatively and even cardinally.

The modern economist, Hicks, in particular, have applied the ordinal utility concept to study the consumer behavior. He introduced a tool of analysis called "Indifference Curve" to analyze the consumer behavior.

Definition

The Ordinal Utility approach is based on the fact that the utility of a commodity cannot be measured in absolute quantity, but however, it will be possible for a consumer to tell subjectively whether the commodity derives more or less or equal satisfaction when compared to another.

Assumptions of Ordinal Utility Approach

- **Rationality:** It is assumed that the consumer is rational who aims at maximizing his level of satisfaction for given income and prices of goods and services, which he wish to consume. He is expected to take decisions consistent with this objective.
- **Ordinal Utility:** The indifference curve assumes that the utility can only be expressed ordinally. This means the consumer can only tell his order of preference for the given goods and services.
- **Transitivity and Consistency of Choice:** The consumer's choice is expected to be either transitive or consistent. The transitivity of choice means, if the consumer prefer commodity X to Y and Y to Z, then he must prefer commodity X to Z. In other words, if X= Y, Y = Z, then he must treat X=Z. The consistency of choice means that if a consumer prefer commodity X to Y at one point of time, he will not prefer commodity Y to X in another period or even will not consider them as equal.
- **Nonsatiety:** It is assumed that the consumer has not reached the saturation point of any commodity and hence, he prefer larger quantities of all commodities.
- **Diminishing Marginal Rate of Substitution (Mr):** The marginal rate of substitution refer to the rate at which the consumer is ready to substitute one commodity (A) for another commodity (B) in such a way that his total satisfaction remains unchanged. The Mr is denoted as DB/DA. The ordinal approach assumes that DB/DA goes on diminishing if the consumer continues to substitute A for B.

To undertand how the consumer reaches his equilibrium using the ordinal approach we need to undertand the following terms:

5.2.1 The Indifference Curve

J.R Hicks used the concept of Indifference curve to analyse consumer behaviour. A consumer facing choice between large number of bundles of twogoods tries to maximise his satisfaction by choosing a combination which gives him maximum utility. In the coure of decision making, consumer finds out that goods can be substituted for each other and identifies various combinationsof commodities that give him equal level of satisfaction. When all these combinations are plotted graphically, it produces a curve called Indifference curve.

Indifference Schedule

An indifference schedule is a table which represents various combinations of two goods, which yield equal satisfaction to consumer. Since all the combinations give equal level of satisfaction, consumer is indifferent betweenthem.

Table 5.2.1 presents an imaginary indifference schedule representing the variouscombinations of two goods X and Y.

Table 5.2.1: Indifference schedule of two commodities 'X' and 'Y'

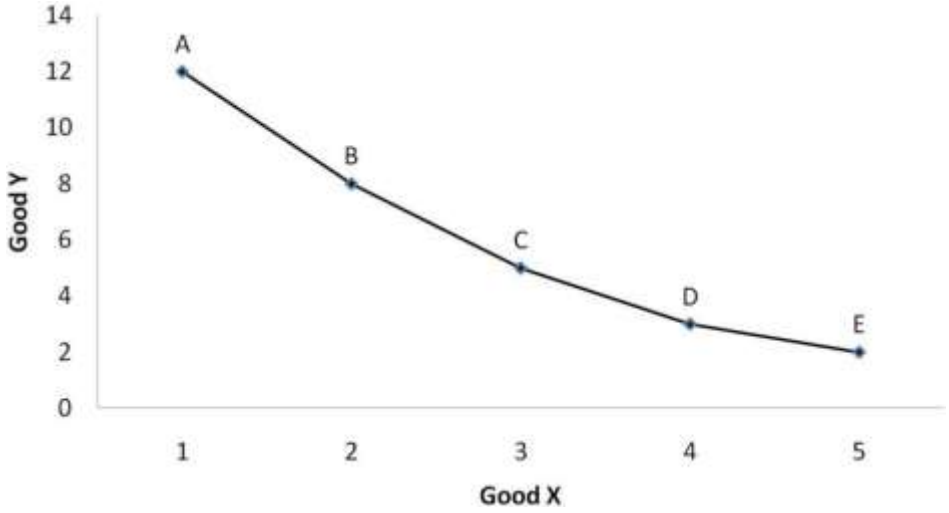
Combinations	Units of 'X' Goods (Cup of Tea)	Units of 'Y' Goods (Biscuits)	Satisfaction
A	**1**	**12**	**K**
B	**2**	**8**	**K**
C	**3**	**5**	**K**
D	**4**	**3**	**K**
E	**5**	**2**	**K**

In above table, five different combinations of Tea and Biscuits are depicted. All these combinations give equal level of satisfaction i.e. K. The consumer isindifferent whether he buys 1 cup of tea and 12 biscuits or 2 cups of tea and 8biscuits. Different schedules can be formed showing different levels of satisfaction.

Indifference Curve

The graphical presentation of Indifference schedule is known as Indifference curve. The indifference curve is locus of all the combinations of two commodities which give same level of satisfaction to the consumer.

Fig. 5.1 is graphical representation of Table 5.1. It shows all the combinationsof good X and good Y i.e. A, B, C, D and E which yield equal level of satisfaction to the consumer. The curve is downward sloping, convex to the point of origin.



Properties Of Indifference Curve

An Indifference Curve Is Downward Sloping From Left To Right

This is because if a consumer is simultaneously consuming two commodities, he can increase consumption of one good in such a manner that total **ordinal utility** meaning remains unchanged/ constant. This is due to the monotonic preferences of the consumer.

According to monotonicity, a consumer prefer more of at least one good with no less of the other or more of both the goods. Hence, to lie on the same indifference curve, a consumer must decrease consumption of other goods to increase consumption of given goods. This makes the indifference curve downward sloping.

The Indifference Curve Is Convex To The Origin

This is due to the diminishing marginal rate of substitution. Mr is the amount of good Y that a consumer is willing to sacrifice to increase the consumption of good X by one unit leaving total ordinal utility meaning unchanged. As consumption of X increases, the marginal utility of X decreases. Hence, a consumer is willing to sacrifice lesser and lesser of Y. In other words, Mr decreases.

Indifference Curve Lying To The Right Represents A Higher Satisfaction

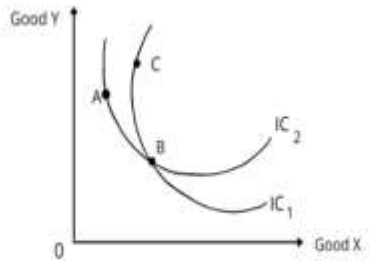
Any consumption bundle on a higher indifference curve represents either more of both the goods or more of both the goods or more of at least one good with no less of the other.

Indifference curve analysis is based on assumption that preferences are monotonic which means more consumption gives more satisfaction. Hence, a higher indifference curve represents higher satisfaction.

Two Indifference Curves Cannot Interect Each Other

Suppose two indifference curves interect each other at point B, then we get a contradictory result in terms of preference writing. In the diagram, the consumer is indifferent between A and B opting for both.

According, to the property of transitivity, the consumer will be indifferent between consumption bundles A and B but it is clear that C is preferred over A as it has more of both goods. Therefore, a contradiction appear.



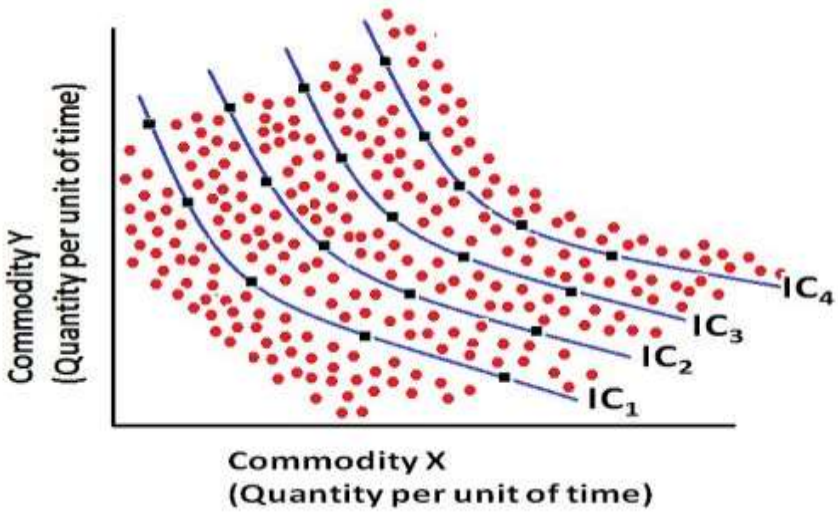
5.2.2 Indifference Map

The indifference map contains different indifference curves showing the combinations of different quantities of two substitute goods on the basis of the consumer preferences. The consumer can make different combinations of goods by consuming less of one commodity or the other in such a way that all the combinations yield the same level of satisfaction.

Definition

The **Indifference Map** is the graphical representation of two or more indifference curves showing the several combinations of different quantities of commodities, which consumer consumes, given his income and the market price of goods and services.

The consumer preferences give rise to several combinations of commodities, each yielding the same level of satisfaction. Hence, it is critical to undertand the preferences of the consumer as these vary from individual to individual and market to market. The concept of the indifference map can be further undertood through a figure given below:



The space between axis X and Y is called as the **Indifference Plane** or **Commodity Space**. This plane is comprised of finite points, each point representing the different combinations of goods X and Y. It is possible to identify two or more points on the indifference plane, which shows different combinations of good X and Y, yielding the same level of utility.

Thus, it is always possible to draw a number of indifference curves without interecting or being tangent to each other. These indifference curves Viz. IC_1, IC_2, IC_3, IC_4, drawn graphically represents the indifference map. Thus, an indifference map may contain several IC curves positioned on the basis of the consumer's preferences.

5.2.3 Marginal Rate of Substitution

Marginal rate of substitution may be defined as the rate at which a consumer will exchange successive units of a commodity for another. In other words, Marginal rate of substitution is the rate at which, in order to get the additional units of a commodity, the consumer is willing to sacrifice or give up to get one additional unit of another commodity.

The Marginal Rate of Substitution can symbolically be represented as under :

$$\mathbf{MRS_{xy} = \Delta Y / \Delta X}$$

Where Mr_{xy}= Marginal rate of substitution of X for Y

ΔY= Change in 'Y' commodity ΔX= Change in 'X' commodity.

Diminishing Marginal rate of Substitution

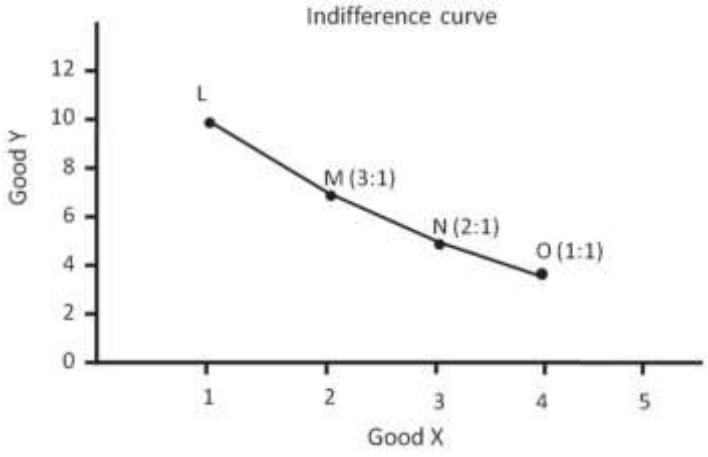
One of the basic postulates of ordinal utility theory is that Marginal rate of substitution (Mr_{xy} or Mr_{yx}) decreases. It means that the quantity of a commodity that a consumer is willing to sacrifice for an additional unit of another commodity goes on decreasing. Law of diminishing Marginal rate of substitution is an extensive form of the law of diminishing Marginal Utility. As discussed in previous section, Law of diminishing marginal Utility states that as a consumer increases the consumption of a good, his marginal utility goes on diminishing. Similarly, as consumer gets more and more unit of good X, heis willing to sacrifice less and less units of good Y for each extra unit of X. The significance of good X in terms of good Y goes on diminishing with each addition of good X. The law can be undertood with the help of following Table 5.2.2

Table 5.2.2 : Marginal rate of Substitution

Units of 'X'Good	Units of 'Y'Good	MRS of 'X' for'Y'
1	10	-
2	7	-3
3	5	-2
4	4	-1

To have the second combination and yet to be at the same level of satisfaction, the consumer is ready to forgo 3 units of Y for obtaining an extra unit of X. The marginal rate of substitution of X for Y is 3:1. The rate of substitution is units of Y for which one unit of X is a substitute. As the consumer desires to have additional unit of X, he is willing to give away less and less units of Y so that the marginal rate of substitution falls from 3:1 to 1:1 in the fourth combination.

In Fig. 5.2.1 given below at point M on the Indifference curve I, the consumer is willing to give up 3 units of Y to get an additional unit of X. Hence, Mrxy =3. As he moves along the curve from M to N, Mrxy, = 2. When the consumer moves downwards along the indifference curve, he acquires more of X and less of Y. The amount of Y he is prepared to give up to get additional units of X becomes smaller and smaller.



The marginal rate of substitution of X for Y (Mr_{xy}) is, in fact, the slope of thecurve at a point on the indifference curve, such as points M, N or P in Fig. 5.3.Thus $Mr_{xy} = \Delta Y/\Delta X$

Marginal Rate of Substitution in Different Preferences

1. Firstly, in the case of perfect substitutes, the indifference curve is linear whereas Mr = constant. The consumer is indifferent between both the commodities and gives him the same level of satisfaction (ordinal utility approach).
2. Secondly, in the case of perfect complements, the indifference curve is L-shaped where Mr = 0 or infinity. Here the consumer wants both goods equally with each other together.
3. Thirdly, the indifference curve has a typical convex shape by COBB-Douglas where the diminishing marginal rate of substitution prevails. Moreover, the consumer chooses the combination which gives the maximum level of satisfaction (ordinal utility approach).

5.2.4 Budget Line

As discussed above, a rational consumer always acts according to his budget constraint and tries to maximise his level of satisfaction. Thus, the knowledge of the concept of budget line or what is also called budget constraint is essential for undertanding the theory of consumer's equilibrium.

A consumer in his attempt to maximise his satisfaction will try to reach the highest possible indifference curve. But in his puruit of maximising satisfaction by buying more and more goods, he has to consider two constraints: firt, he has to pay the prices for the goods and, secondly, he has a limited money income to purchase the goods. Thus, how much a peron is capable to buy, depends upon the prices of the goods and the money income which he has at his disposal.

Price line or budget line represents all possible combinations of two goods that a consumer can purchase with his given income and the given prices of two goods. Let us try to undertand the concept with the help of an example:

Suppose a consumer has an income of $. 100 to spend on Oranges and Apples which cost $. 10 each. He can either spend his limited income only on one good or both the goods. All the possible alternative combinations of two goods are presented in Table 5.2.3.

Table 5.2 .3 : Alternative consumption possibilities

Income	Apples ($. 10/piece)	Oranges ($. 10/piece)
100	10	0
100	9	1
100	8	2
100	7	3
100	6	4
100	5	5
100	4	6
100	3	7
100	2	8
100	1	9
100	0	10

It can be observed from the above table that if the consumer spends his total income of r. 100 on Apples, he is able to buy 10 Apples. On the other hand, if he buys Oranges alone, he can get 10 Oranges by spending his total income. Further, a consumer can also buy both the goods in different combinations.

The budget line can be written algebraically as follows:

Algebraic Expression for Budget Set: The consumer can buy any bundle (A, B), such that:

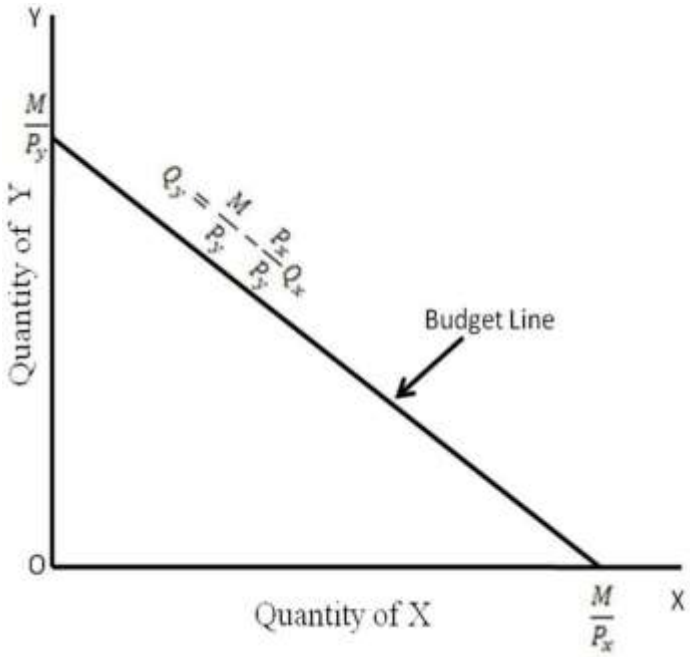
$$M = (P_X * Q_X) + (P_Y * Q_Y)$$

Where P_X and P_Y denote prices of goods X and Y respectively and M standsfor money income

We can rewrite the budget line as: $P_Y Q_Y = M - P_X Q_X$

dividing both sides by P_Y yields: $Q_Y = (- Px / Py) . Q_X + M/ Py$

This is the budget line plotted in Next Fig.



SLOPE OF BUDGET LINE

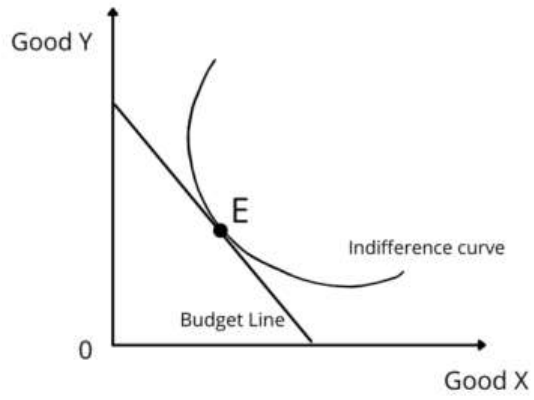
As we know that the slope of a curve is calculated as a change in variable on the Y-axis divided by change in variable on the X-axis, slope of the budget linein given example will be number of units of Oranges, that the consumer is willing to sacrifice for an additional unit of Apple.

Slope of Budget Line = Units of Oranges (Y) willing to Sacrifice/ Units ofApples (X) willing to Gain = $\Delta Y/\Delta X$

In above example, 1 Apple need to be sacrificed each time to gain 1 Orange.So, Slope of Budget Line = –1/1 = –1

This slope of budget line is equal to 'Price Ratio' of two goods.**Price Ratio = Price of X (P_X)/Price of Y (P_Y) = –P_X /P_Y**

5.2.5 Consumer Equilibrium Indifference Curve /Ordinal Utility Analysis



Conditions for consumer equilibrium indifference curve /*ordinal utility* analysis are:

- The slope of indifference curve = Slope of budget line OR

MRS = Px / Py OR MRS = MRE

- If MRSxy> Px/Py, it means that the consumer is willing to pay more for X than the price prevailing in the market. As a result, the consumer buys more of X. As a result, MRS falls till it becomes equal to the ratio of prices and the equilibrium is established.

- If MRSxy< Px/Py, it means that the consumer is willing to pay less for X than the price prevailing in the market. It induces the consumer to buys less of X and more of Y. As a result, MRS rises till it becomes equal to the ratio of prices and the equilibrium is established.

- The marginal rate of substitution should be diminishing i.e indifference curve should be convex to the origin.

Note: MRS is defined as the amount of good Y that a consumer is willing to sacrifice (ordinal utility approach) to increase consumption of good X by 1 unit leaving total ordinal utility theory unchanged. While the ratio of prices is defined as the amount of good Y that a consumer is required to sacrifice to obtain/ increase consumption of X by 1 unit.

Explanation

- Initially, when a consumer starts consumption, Mr is greater than Px/ Py i.e to obtain one more unit of X a consumer is willing to sacrifice more than what he is required to sacrifice. Hence, the consumer gains and increases consumption of X. as a result, MUx decreases.
- Therefore, a consumer is willing to sacrifice less and less of Y each time he obtains one more unit of good X. As a result, Mr decreases and ultimately becomes equal to Px / Py at some combination of X and Y. At this combination, the consumer equilibrium is achieved.
- If the consumer intends to consume more X beyond consumer equilibrium, Mr will be less than Px/ Py i.e to obtain one more unit of X a consumer is willing to sacrifice less than what he is required to sacrifice.
- Hence, the consumer loses and decreases consumption of X. As a result, MUx increases. Therefore, the consumer is willing to sacrifice more and more of Y each time he obtains one more unit of good X. Mr increases and ultimately becomes equal to Px/Py at some combination of X and Y. At this combination, the **consumer equilibrium** is attained.

5.2.5 PRICE EFFECT AS COMBINATION OF INCOME EFFECT AND SUBSTITUTION EFFECT

As discussed above, a consumer's equilibrium position is affected by the changes in his income, prices of substitute and changes in the price of goods consumed. These effects are known as:

1) Income effect
2) Substitution effect
3) Price effect

Income Effect

In the analysis of the consumer's equilibrium, it is assumed that the income ofthe consumer remains constant, and the prices of the goods X and Y are given. Thus, given the tastes and preferences of the consumer and the prices of the two goods, if the income of the consumer changes, the effect it will have on his purchases is known as the Income effect.

The Income effect may be defined as the effect on the purchases of consumercaused by the changes in income, if the prices of goods remain constant. If theincome of the consumer increases his budget line will shift upward to the right,parallel to the original budget line. On the contrary, a fall in his income will shift the budget line inward to the left. The budget lines are parallel to each other because relative prices remain unchanged.

Kinds of Income Effect

Income effect may be of three types:

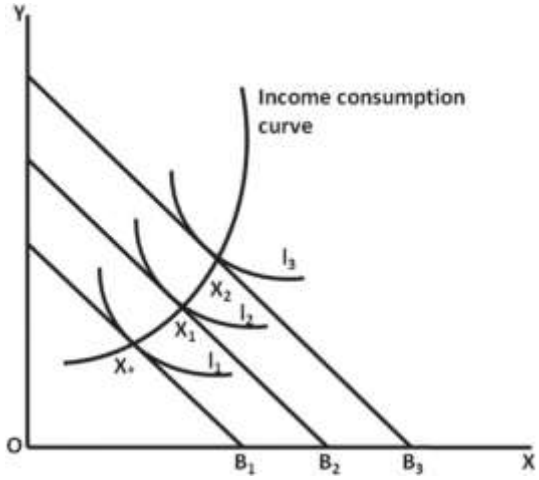
1) **Positive Income effect:** When an increase in income leads to an increasein demand for a commodity or for both the commodities the income effect is positive. In case of Normal goods, income effect is positive andIncome consumption curve slopes upwards to the right.
2) **Negative Income effect:** Income effect is negative, when with theincrease in his income, the consumer reduces his consumption of the good. Income effect is negative in case of inferior goods.
3) **Zero Income effect:** If with the change in income, there is no change inthe quantity purchased of a commodity, than the income effect is said tobe zero. Zero income effect is in case of goods like medicines, necessitieslike salt etc.

All the three effects are explained diagrammatically.

In Fig. 5.18, when the budget line is B_1, the equilibrium point is X* where it touches the indifference curve I_1. If now the income of the consumer increases,B_1 will move to the right as the budget line B_2, I_1, and the new equilibrium point is X_1 where it touches the indifference curve I_2. As income increases further, B_3 becomes the budget line with X_2 as its equilibrium point.

The locus of these equilibrium points X*, X_1 and X_2 traces out a curve which is called the income-consumption curve (ICC). The ICC curve shows the incomeeffect of changes in consumer's income on the purchases of the two goods, given their relative prices.

Normally, when the income of the consumer increases, he purchases larger quantities of two goods. Usually, the income consumption curve slopes upwards to the right as shown in Fig. 5.18. Here the income effect is also positive and both X and Y are normal goods.



Substitution Effect

The substitution effect relates to the change in the quantity demanded resulting from a change in the price of one good it prompts the substitution of relativelycheaper good for a dearer one, while keeping the price of the other good, real income and tastes of the consumer as constant. Prof. Hicks has explained the substitution effect independent of the income effect through compensating variation in income.

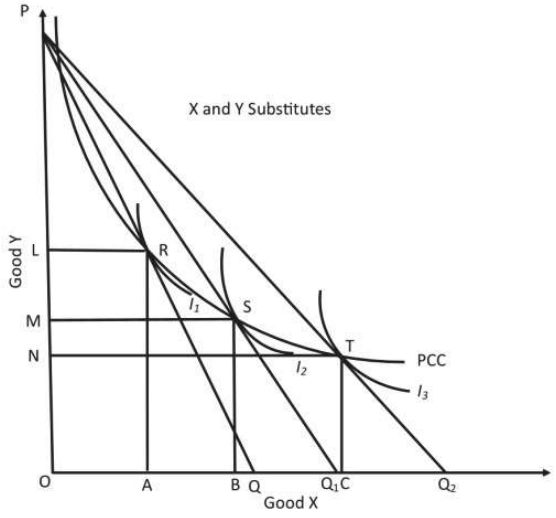
"The substitution effect is the increase in the quantity bought as the price of a commodity falls, after adjusting income so as to keep the real purchasing power of the consumer the same as before. This adjustmentin income is called compensating variations and is shown graphically by a

parallel shift of the new budget line until it become tangent to the initial indifference curve."

Thus, on the basis of the methods of compensating variation, the substitution effect measures the effect of change in the relative price of a good. The increase in the real income of the consumer as a result of fall in the price of, say good X, is so withdrawn that he is neither better off nor worse off than before.

The substitution effect is explained in Fig. 5.22 where the original budget line is PQ with equilibrium at point R on the indifference curve I_1. At R, the consumer is buying OB of X and BR of Y. Suppose the price of X falls so thathis new budget line is PQ_1. With the fall in the price of X, the real income of the consumer increases. To make the compensating variation in income or to keep the consumer's real income constant, take away the increase in his income equal to PM of good Y or Q_1N of good X so that his budget line PQ_1 shifts to the left as MN and is parallel to it so that new budget line tangentto I_1 at point H.

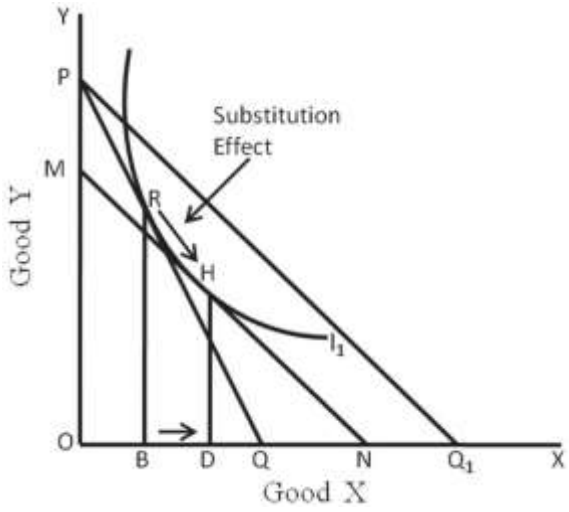
As MN is tangent to the original indifference curve I_1, at point H, the consumerbuys OD of X and DH of Y. Thus PM of Y or Q_1N of X represents the compensating variation in income, as shown by the line MN being tangent to the curve I_1 at point H. Now the consumer substitutes X for Y and moves frompoint R to H or the horizontal distance from B to D. This movement is called the substitution effect. The substitution affect is always negative because whenthe price of a good falls (or rises), more (or less) of it would be purchased, thereal income of the consumer and price of the other good remaining constant. In other words, the relation between price and quantity demanded being inverse,the substitution effect is negative.



Price Effect

The price effect indicates the way the consumer's purchases of good X change, when its price changes, given his income, tastes and preferences and the price of good Y. This is shown in Fig. 5.23. Suppose the price of X falls. The budgetline PQ will extend further out to the right as PQ_1, showing that the consumerwill buy more X than before as X has become cheaper. The budget line PQ_2 shows a further fall in the price of X. Any rise in the price of X will be represented by the budget line being drawn inward to the left of the original budget line towards the origin.

If we regard PQ_2, as the original budget line, a two time rise in the price of X will lead to the shifting of the budget line to PQ_1, and PQ_2 – PQ. Each of the budget lines fanning out from P is a tangent to an indifference curve I_1, I_2, andI_3 at R, S and T respectively. The curve PCC connecting the locus of these equilibrium points is called the price-consumption curve (PCC). The price-consumption curve indicates the price effect of a change in the price of X on the consumer's purchases of the two goods X and Y, given his income, tastes,preferences and the price of good Y.



Series of Exercises No.4 in Microeconomics 1 - Tutorials

Exercise °1

1.The approach where utility can be measured in terms of Units is known as

A. Ordinal utility approach B.Cardinal utility approach

2.Total utility is constant when marginal utility is
A.Maximum B. zero

C.Negative D. none of these

3.The formula for calculating marginal utility is

MU=TUn-TUn-1 MU=TUn+TUn-1

MU=MU1=MU2=MU3 MU=MU1+MU2+MU3+.....+Mun

4.Which of the following can be referred to as 'point of satiety'?
A.MU is negative B.TU is rising

C.MU is zero D.TU is falling

5.When marginal utility is zero, total utility is

A.Maximum B. zero

C.Negative D.minimum

Exercise °2

Calculate:

Units of X	TU	MU
1	50	50
2	90	-
3	-	30
4	140	-
5	155	-

Exercise ° 3

Observe the given table. Complete it and answer the questions :

Units of Com. 'X'	TU Units	MU Units
1	6	
2	11	
3	15	
4	15	
5	14	

1) Draw total utility curve and marginal utility curve.

2)

a) When total utility is maximum marginal utility is …….

b) When total utility falls, marginal utility becomes ……

3) Find the point of satiety

Exercise ° 4

Let's consider the demand for apples. Suppose that a consumer has a utility function for apples that is given by:

$$U(x) = 10x - 2x^2$$

Find the point of satiety (consumer equilibrium), then derive the demand curve for apples

Exercise ° 5

Suppose a consumer has a budget of 100 dollars and the prices of goods x and y are 2 dollars per unit and 5 dollars per unit, respectively. The consumer's utility function is given by: $U(x, y) = x^2 + y$

Find the equilibrium quantities of x and y that maximize the consumer's utility.

Exercise ° 6

Suppose a consumer has a budget of 100 dollars and the prices of goods x and y are 8 dollars per unit and 4 dollars per unit, respectively. The consumer's utility function is given by: $U(x, y) = x^{0.5}y^{0.5}$

Find the equilibrium quantities of x and y that maximize the consumer's utility.

Exercise ° 7

Let us have a consumer who consumes two goods X and Y, At two prices, Px =6 $ and Py =2 $, respectively, within the limits of his income, which equals 52 $. The following table shows the marginal benefits resulting from consuming different quantities of both commodities.

Qx	MUx	MUx/Px	Qy	MUy	MUy/Py
1	120		1	64	
2	108		2	60	
3	96		3	50	
4	84		4	38	
5	72		5	34	
6	60		6	28	
7	48		7	26	
8	36		8	20	
9	30		9	18	
10	24		10	16	

Complete the table, then find the equilibrium quantities of x and y that maximize the consumer's utility

Exercise ° 8

Let us have a consumer who consumes two goods X and Y, At two prices, Px =8 $ and Py =4 $, respectively, within the limits of his income, which equals 64 $.

Y	X
12	3
8	4
6	5
5	6
4.4	7
3	8

1. Represent the indifference curve for different commodity combinations and calculate the marginal rate of substitution
2. Write and draw down the equation of the budget line.
3. What combination of X and Y should he buy to maximize his utility?

Exercise °9

Let us have a consumer who consumes two goods X and Y, At two prices, Px =18 $ and Py =12 $,

If you know that the equation for the level of satisfaction that one wants to obtain (the indifference curve) is written as follows : $y = 6/x$

- Determine the combination of consumption that achieves satiety
- Calculate the income that should be allocated to consumption
- Check the consumer's equilibrium point graphically

Exercise °10

A consumer wants to consume two goods. The prices of the two goods are $ 4 and $ 5 respectively. The consumer's income is $20.

1. Write down the equation of the budget line.
2. How much quantify of good x can the consumer consume if he spends his entire income on that good?
3. How much of good Y can he consume if he spends his entire income on that good?
4. What is the slope of the budget line?
5. How does the budget line change if the consumer's income increases to 40 ? but the prices remain unchanged?
6. How does the budget line change if the price of good y decreases by a 1$ but the price of good Y and the consumer's income remain unchanged?

Exercise ° 11

Suppose a consumer wants to consume two goods which are available only in integer units. The two goods are equally priced at $ 10 and the consumer's income is $ 40.

1. Write down all the bundles that are available to the consumer.
2. Among the bundles that are available to the consumer's. Identify those which cost him exactly 40.