THE ULTIMATE **CREDIT-BY-EXAM** STUDY GUIDE FOR:

Microeconomics

1st Edition

03/06/2024

Acknowledgements
We would like to thank the author for their patience, support, and expertise in contributing to this study guide; and our editors for their invaluable efforts in reading and editing the text. We would also like to thank those at Achieve Test Prep whose hard work and dedication to fulfilling this project did not go unnoticed. Lastly, we would like to thank the Achieve Test Prep students who have contributed to the growth of these materials over the years.

Printed in the United States of America

First Printing, 2024

Achieve
PO Box 10188 #29831
Newark, NJ 07101-3188
Tel: 888.900.8380
Visit the Achieve website at http://www.achievetestprep.com/student for more information.

Contents

Chapter 1: Basic Economic Concepts

Chapter Overview

This chapter introduces the fundamental principles of microeconomics, specifically examining how individuals and societies allocate resources under conditions of scarcity. It explores the concept of opportunity cost, the essential trade-off present in every decision. Additionally, the chapter analyzes the production possibilities curve, a tool that visualizes the inherent limitations within production processes. Following this, it progresses to explain comparative advantage and its contribution to mutually beneficial trade through specialization.

Furthermore, it delves into the various mechanisms that coordinate economic activity through different systems, including market, command, and mixed economies. Understanding property rights and their impact on incentives becomes crucial, while the powerful tool of marginal analysis, focusing on incremental changes, allows for examining nuances in economic behavior. The materials in this chapter aim to establish the foundation for the intricate choices, constraints, and incentives that shape our economic world.

Learning Objectives

By the end of this chapter, you should be able to:

- Define the concept of scarcity and its impact on individual and societal decision-making.
- Explain the production possibilities curve (PPC) and identify the trade-offs inherent in production choices.
- Discuss the concept of comparative advantage and its role in promoting mutually beneficial trade and specialization.
- Analyze and compare the characteristics and functions of different economic systems, including market, command, and mixed economies.
- Apply marginal analysis to evaluate the impact of marginal changes in costs and benefits on individual and market behavior.

Introduction

Economics examines the fundamental tension between society's "unlimited wants" for goods and services and the ultimately finite availability of resources, which results in scarcity. The social science of economics studies how individuals, businesses, and societies navigate decision-making processes amidst the challenging conditions of scarcity and aims to identify optimal strategies for efficiently allocating and utilizing resources.

Economics has two main branches: Macroeconomics and Microeconomics. **Macroeconomics** focuses on the overall behavior of an economy and examines broader economic factors such as growth, inflation,

and unemployment. **Microeconomics** focuses on the behavior of individual components of the economy such as consumers, firms, and markets. It seeks to understand how these entities make decisions and interact with each other, ultimately influencing the prices and quantities of goods and services in the economy.

In this study guide, we will delve deeper into the fascinating world of **microeconomics**. We will explore the underlying principles that guide individual decision-making, analyze how markets function, and understand how these micro-level choices come together to shape the macroeconomy we experience daily.

A. Scarcity, Choice, and Opportunity Cost

People Face Trade-Offs

In contrast to an idealized scenario of unlimited resources, real-world conditions present limitations in the availability of goods and services. This scarcity necessitates **trade-offs**, where the production and consumption of one good or service requires the allocation of resources away from others. In essence, choosing one option inherently implies forgoing another, reflecting the fundamental concept of opportunity cost.

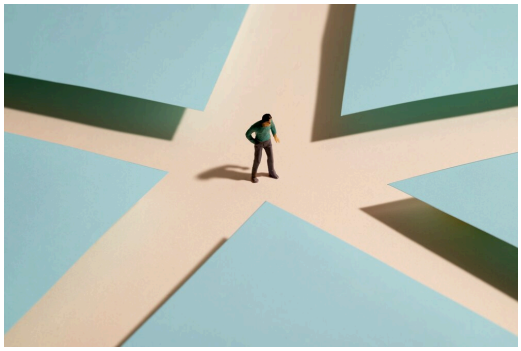
Examples:

- Person *A* is a student and faces the dilemma of allocating a limited amount of time to studying or doing something else. *A* can spend 8 hours just studying or just having fun or doing a combination of both. For every hour *A* spends studying, *A* gives up an hour that could have been spent watching TV or on any other leisure activity, such as playing video games or eating out with friends.
- This Christmas, person *B's* parents are thinking of whether to use their "cash bonus" to fund a weekend camping trip or to buy gifts for their children. When they choose to spend an extra dollar to pay for the camping trip, they have one less dollar to spend on buying gifts for their children.
- *C*, the CEO of a large firm, is planning to take advantage of Artificial Intelligence (AI) to improve production at a cheaper cost. However, by adopting AI, *C* will need to lay off workers due to the decrease in job opportunities.
- The government needs to allocate its national budget to various public services such as education and healthcare. Once the government has designated a certain amount of money for one service, those funds will no longer be accessible for allocation to other services.

Concept Check 1.1.	
Scarcity	refers to the limited availability of resources (i.e., income, time, capital, land, etc.) to satisfy people's wants and needs
Choice	a decision made between alternatives given the constraints to choose another
Trade-off	the act of gaining something at the expense of giving up something else

The Cost of Something is What One Gives Up to Get it

Some individuals approach decisions with careful consideration by comparing the pros and cons of all the probable choices. Consider the decision of whether to attend college or not. An individual who chooses to go to college may expect to primarily gain additional knowledge and a better position in the job market upon graduation. But with the decision to further one's education, there may be other costs to consider. For example, the direct costs such as tuition and other miscellaneous educational expenses such as books, rent, etc.



When deciding to choose option X over option Y, an individual should consider both the direct (explicit) and indirect (implicit) costs. By adding both together, one can calculate **opportunity cost** – the value of what one has to give up in order to choose a certain option over the other. In the example, the opportunity cost of attending college includes 1) tuition and miscellaneous educational expenses (direct cost) and 2) the income one could have earned from a job given up (implicit cost).

In economic decision-making, **opportunity cost** plays a crucial role when evaluating mutually exclusive options. Consider attending college versus entering the workforce. Choosing college often entails forgoing immediate earnings through employment, representing a significant trade-off. This exemplifies the core principle of opportunity cost: the sacrificed benefit of the unchosen alternative. Notably, opportunity cost can be quantified in monetary terms, capturing the potential income forgone by selecting one path over another.

Example 1:

For one hour on a Sunday night, person *A* can either paint 5 boxes or bake 10 donuts. What is the opportunity cost of choosing to paint 5 boxes? To bake 10 donuts?

Table 1.1.1. Person A's Opportunity Cost

Choice	Paint	Bake
Choose to paint	1 [5/5]	2 [10/5]
Choose to bake	1/2 [5/10]	1 [10/10]

As shown in Table 1.1.1., for every 1 box *A* chooses to paint during that one hour on a Sunday night, *A* is forgoing baking 2 donuts. For every 1 donut *A* chooses to bake during that one hour on a Sunday night, *A* is forgoing painting 1/2 a box.

Example 2:

Person *C* is considering watching *Movie X*, which costs $25. At the same time, *C* also has free tickets to watch *Movie Y*.

If *Movie Y* was not free, the most *C* would be willing to pay to watch that movie is $15. Hence, the cost of *C's* next best alternative is $15.

When *C* watches *Movie X*, *C's* opportunity cost will be the amount of *Movie X*'s price ticket ($25) plus the implicit cost ($15), with a total amount of $40.

C's decision will depend on whether *C* highly values *Movie X* or not. The only scenario where *C* will not watch *Movie X* and choose *Movie Y* is if *C's* willingness to pay for *Movie X* is less than $40.

To illustrate, consider the two scenarios shown in Table 1.1.2.:

1) *C* assigns a high value to *Movie X*, and

2) *C* assigns a low value to *Movie X*. When *C* assigns a high value to *Movie X* (greater than the opportunity cost of $40), *C* receives a positive economic rent, which is the difference between willingness to pay and opportunity cost. When *C* assigns a low value to *Movie X* (less than the opportunity cost of $40), *C* incurs a negative economic rent or a loss.

Table 1.1.2. C's Decision

Choice	High Value on Movie X	Low Value on Movie X
Willingness To Pay (enjoyment for Movie X)	$50	$35
Less: Opportunity Cost	($40)	($40)
Out-Of-Pocket Cost (price ticket for Movie X)	($25)	($25)
Implicit Cost (forgone pleasure of Movie Y)	($15)	$15
Economic Rent (willingness to pay minus opportunity cost)	$10	($5)
Decision	Watch Movie X	Watch Movie Y

B. Production Possibilities Curve

The **Production Possibilities Curve (PPC)**, also known as the Production Possibilities Frontier (PPF), is an economic model that illustrates all the possible combinations of two goods or services that can be produced if all of an economy's resources are used efficiently. In other words, it is a simple graphical representation of the maximum level of output or production that an economy can achieve, given its current resources and technology.

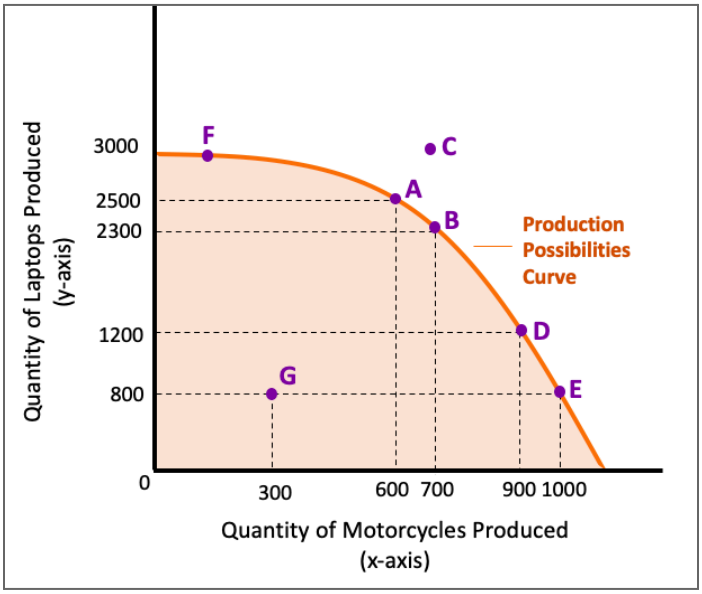
Imagine an economy that has limited resources and technology to produce goods and/or services. The PPC helps to see the different combinations of goods and/or services it can produce. This production decision is similar to planning how to spend one's time and money – an individual has to make choices. The PPC helps individuals visualize these choices.

The PPC shown in Figure 1.2.1. represents the production choices of an economy that only produces two goods: motorcycles on the x-axis and laptops on the y-axis. Assuming that all available resources are exhausted and other factors remain constant (ceteris paribus), then this economy can produce any

combination of laptops and motorcycles on the PPC. For example, at point A (2,500 laptops and 600 motorcycles) and at point B (2,300 laptops and 700 motorcycles). The production possibilities for points D, E, and F are also presented. As seen with point C, points **outside the curve** are combinations of laptops and motorcycles produced that are **infeasible** because the current resources are **insufficient**. Points **inside the curve**, as seen with point G, represent combinations of laptops and motorcycles that are **feasible but inefficient**. Inefficiency means that resources are not fully utilized; thus, the economy can still produce more.

The PPC also shows the trade-off that the economy faces once efficient production is achieved. The only way of producing more of one good is to produce less of another. In the given example, when point A moves to point B, the economy produces an additional 100 motorcycles but sacrifices the production of 200 laptops in exchange. There are not enough resources to produce both 200 laptops and 100 motorcycles.

Figure 1.2.1. Production Possibilities Curve



The slope of the PPC represents the opportunity cost of choosing one good over another. The PPC is also concave or bowed out, meaning that as one moves to the right along the PPC, the slope increases and gets steeper.

As seen in Figure 1.2.1, the number of laptops given up differs for every additional 100 motorcycles produced. From 600 to 700 motorcycles produced (points A to B), the economy only needs to give up 200 laptops, while from 900 to 1000 motorcycles produced (points D to E), the economy needs to give up 400 laptops, which is twice as much as before. This movement illustrates increasing marginal (or additional) opportunity cost. That is, the economy incurs a higher cost as it increases its production of motorcycles.

Concept Check 1.2.	
Opportunity Cost	the value of what one gives up to obtain another thing (i.e., explicit plus implicit cost)
Explicit Cost	direct costs associated with the option chosen
Implicit Cost	indirect (not obvious) costs associated with the option chosen (i.e., value of option given up)
Production Possibilities Curve	a graph that shows the relationship between two goods, X and Y, that the economy is capable of producing given its limited resources or factors of production

C. Comparative Advantage, Specialization, and Trade

Trade Can Make Everyone Better Off

Instead of associating "market" exclusively with competition, it can similarly be viewed as a domain of "cooperation." From this viewpoint, market players pursue their own self-interests while simultaneously fostering amicable collaboration with others. As a result, participants collaborate to produce and distribute goods and services, often leading to outcomes that surpass purely competitive or purely cooperative approaches.

Global markets foster unintentional cooperation on a vast scale. The laptop manufacturer likely never met the consumer directly, yet its expertise in production, combined with global trade systems, enables it to provide a product the consumer needs. The consumer's purchase empowers the manufacturer to engage in further trade with other unknown entities, creating a complex web of interconnected transactions. This is an example of the unexpected collaboration facilitated by market forces.

Markets permit specialization, given that people or countries have different circumstances and abilities to produce goods and services. In microeconomics, the concept of specialization refers to the allocation of an economy's resources, such as land, labor, and capital, toward a specific type of production in order to enhance efficiency and create a comparative advantage. It is worth noting that, surprisingly, specialization is beneficial to all participating producers. Although Country A is capable of producing good X at a lower cost than Country B, it is still possible for Country B to specialize in producing good X, thereby enabling both Country A and Country B to optimize their resource utilization.

Consider a hypothetical world consisting of just two individuals, *A* and *B*. These individuals rely on the sustenance provided by oranges and corn to survive. In this world, however, *A* and *B* do not cultivate the same amounts of oranges and corn.

As shown in Table 1.3.1., if *A* spent all their time, say 2,000 hours per year, producing oranges, *A* would produce 1,250 bushels of oranges. If *A* only produced corn, *A* would produce 50 tons of corn annually. On the other hand, if *B* devoted all 2,000 hours to producing oranges, *B* would produce 1,000 bushels per year. If *B* only produced corn, *B* would produce 20 tons.

Table 1.3.1. Full Production

PRODUCTION if 100% (2,000 hours per year) of time is spent on one good	
Individual *A*	1,250 bushels of oranges or 50 tons of corn
Individual *B*	1,000 bushels of oranges or 20 tons of corn

- Relative to *B*, *A* can produce 250 more orange bushels and 30 more tons of corn. For both crops, *A* is at a better position than *B*.
- *B* can only produce 0.80 (20%) less oranges and 0.40 (60%) less corn.
- For both crops, *B* is in a worse position than *A*. However, between the two, *B* is in a better position producing oranges than corn, given that *B's* production of oranges is closer to what *A* can produce.
- One might say *B* has an absolute disadvantage in producing both crops, and *B* has a comparative advantage in producing oranges.

One can also determine who has the comparative advantage in each crop by calculating who has the lowest opportunity cost.

Table 1.3.2. Opportunity Cost of Producing 1 Orange Bushel

Individual	Orange Bushels	Tons of Corn
A	1 [1,250/1,250]	0.04 [50/1,250]
B	1 [1,000/1,000]	0.02 [20/1,000]

Table 1.3.2. shows who has a comparative advantage for orange production.

- For every 1 orange bushel *A* produces, *A* is giving up 0.04 tons of corn.
- For every 1 orange bushel *B* produces, *B* is giving up 0.02 tons of corn.
- Since *B* has a lower opportunity cost, *B* has a comparative advantage in producing oranges.

Table 1.3.3. Opportunity Cost of Producing 1 Ton of Corn

Individual	Orange Bushels	Tons of Corn
A	25 [1,250/50]	1 [50/50]
B	50 [1,000/20]	1 [20/20]

Table 1.3.3. shows who has a comparative advantage for corn production.

- For every 1 ton of corn *A* produces, it is giving up 25 orange bushels.
- For every 1 ton of corn *B* produces, it is giving up 50 orange bushels.
- Since *A* has a lower opportunity cost, it has a comparative advantage in producing corn.

By definition, **absolute advantage** is the ability to produce a good using fewer inputs than another producer, while **comparative advantage** is the ability to produce a good at a lower opportunity cost than another producer. The comparative advantage determines the specialization of a person or a country.

Initially, *A* and *B* are unable to trade with each other. Both must be self-sufficient, relying solely on their own production of oranges and corn and meticulously consuming only what they yield to ensure their survival.

Table 1.3.4. Self-Sufficiency vs. Complete Specialization and Trade

		Self-Sufficiency (No Trade)	Complete Specialization and Trade		
		Column 1	**Column 2**	**Column 3**	**Column 4**
			Full production of specialization	Trade (40 orange bushels = 1 ton of corn)	Consumption
A	Oranges	500 (0.40*1250)	0		600 (what *A* receives: 40*15)
	Corn	30 (0.60*50)	50 (1*50)	15 (*A* exchanges to *B*)	35 (remaining corn for *A*: 50 - 15)
B	Oranges	300 (0.30*1000)	1000 (1*1000)	600 (*B* exchanges to *A*)	400 (remaining oranges for *B*: 1000 - 600)
	Corn	14 (0.70*20)	0		15 (what *B* receives: 600/40)
Total	Oranges	**800 (500+300)**	1000 (c/o *B*)	600	**1000 (600+400)**
	Corn	**44 (30+14)**	50 (c/o *A*)	15	**50 (35+15)**

Suppose *A* chooses to use 40% of the time producing oranges and 60% of the time producing corn. Meanwhile, suppose *B* chooses to use 30% of the time producing oranges and 70% of the time producing corn.

Table 1.3.4. presents an estimation of the tradable and non-tradeable quantities of oranges and corn between *A* and *B*. Column 1 of the table shows that *A* produces and consumes 500 orange bushels and 30 tons of corn, while *B* produces 300 orange bushels and 14 tons of corn. In this scenario of self-sufficiency, a total of 800 orange bushels and 44 tons of corn are produced.

Let's assume there are markets in which oranges and corn can be bought and sold, and in these markets, 40 orange bushels can be bought for the price of 1 ton of corn. If *A* specializes in growing corn, producing 50 tons of corn, while *B* specializes in oranges, producing 1,000 bushels of oranges, then the total volume of each crop under full product specialization (Column 2) is greater than the self-sufficiency scenario. This implies that an opportunity exists whereby they can sell a portion of their own crops and purchase a portion of the crops produced by other individuals.

For example, if *A* sells 15 tons of corn (Column 3) in order to purchase 600 bushels of oranges, *A* can now consume more oranges and more corn than before (Column 4). The table also shows that buying 15 tons of corn produced by *A* in return for 600 orange bushels similarly enables *B* to consume more of both crops than was possible in the absence of specialization and trade. This illustrates how engaging in trade can be beneficial for all.

Concept Check 1.3.	
Absolute advantage	the ability to produce a good using fewer inputs than another producer
Comparative advantage	the ability to produce a good at a lower opportunity cost than another producer
Specialization	an efficient production that encourages competitive advantage
Trade	exchange of goods or services

D. Economic Systems

An **economic system** or structure refers to the way in which production is organized and choices are made in an economy. Economic systems also identify the means by which households, firms, and governments make decisions relating to the three resource allocation questions: ***what*** needs to be produced, ***who*** should produce, and ***how*** the goods and services will be distributed.

There are three main economic systems:

1. **Market economy** (also known as laissez-faire or free market economy and capitalism): In this economic system, resources are allocated through the price mechanism, which is based on the forces of demand and supply. This means that households and firms interact as buyers and sellers and make decisions on how to allocate resources to satisfy their wants and needs. The government has little to no control over the process of resource allocation. In addition, productive resources and assets are owned by individuals and private firms.
2. **Command economy** (also known as a planned or centrally planned economy): Contrary to a market economy, in a planned economy, the government has a dominant role in making decisions related to resource allocation. In principle, all choices are made and controlled by the government in terms of what to produce, how to produce, and for whom to produce. In addition, the government has ownership of productive resources and property, meaning that the market has no real role in the allocation of resources.

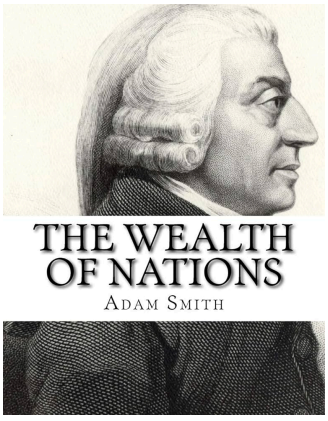
3. **Mixed economy:** In a mixed economic system, both the private sector (individuals and private firms) and the public sector (the government) have a role in allocating resources. Decisions consist of an interaction between individuals, private firms, labor, and the government. There is private ownership of assets as well as some public ownership.

Markets are Usually a Good Way to Organize Economic Activity

One of the monumental events in history happened during the late 1980s to early 1990s – the downfall of communism in the Soviet Union and Eastern Europe. In a communist country, the government acts as a central planner and has the power to make decisions on the production and distribution of goods and services. Communism anchors on the idea that the government organizes economic activities for the benefit of all.

Those countries that have abandoned communism as an economic system have shifted to a **market economy.** Instead of having a central planner (i.e., the government), firms and households make decisions on the production, distribution, and consumption activities in the economy. They interact and engage in a market, and their decisions are driven by prices and self-interest.

Unlike communism, a market economy does not explicitly consider the welfare of the society. Instead, market players (buyers and sellers) concern themselves with their own interests. One would expect that with this system, overall well-being would be sacrificed. However, evidence shows otherwise. Market economies sometimes seem to have a mechanism that promotes the welfare of all.



Adam Smith, known as the father of economics, documented his most well-known observation in his 1776 book, *An Inquiry into the Nature and Causes of the Wealth of Nations* – that is, **"an invisible hand"** orchestrates the interaction between households and firms in the market, which allows them to realize favorable market outcomes - *laissez-faire*.

The price of goods and services acts as the mechanism by which the "invisible hand" guides the market players' decisions. Buyers use price to decide on the quantity of the goods and services they will consume, while sellers use price to decide on the quantity of goods and services they will produce or sell. Market prices represent both the value and cost of a good

to society. Price adjustments in the market also prompt production and consumption adjustments, which, in many instances, lead to the maximization of societal welfare.

Government intervention, through the imposition of taxes or price controls, may hinder the "magic" of the invisible hand to direct market activities of households and firms. That is, government policies alter the "true" value of a good or service and distort the decisions of the market players. In such cases, the overall well-being of the society is reduced.

Going back to communism, the government dictates prices without taking into account consumer preferences and producers' costs. When this happens, it can lead to market failure. In turn, market failure hinders the natural functioning of the marketplace, where the "invisible hand" usually works its magic.

Governments Can Sometimes Improve Economic Outcomes

Is the "invisible hand" enough for markets to operate effectively? Although laissez-faire holds significant power to orchestrate the market, the government is still needed, not as a central planner but as a governing body, to enforce regulations and maintain essential institutions in a market economy.

One reason why government institutions exist in a market economy is to assign and enforce property rights to individuals for ownership and control of scarce resources. Without a governing body, an artist won't paint if they expect their artwork to be stolen; a medical clinic won't offer its healthcare services unless it is assured that patients will pay the medical fees; and a music company won't produce albums if too many potential customers stream at illegal sites. The effectiveness of property rights relies on a complex interplay between societal factors, legal frameworks, and enforcement mechanisms, including government-provided police and courts.

When it comes to advocating for efficiency or equality, the government intervenes by altering the distribution of resources that individuals would select on their own. Most policies target to either expand the economic pie or modify how the pie is allocated.

First Goal: Efficiency

It's not always the case that markets operate efficiently. There are instances where markets fail on their own, thereby not maximizing the size of the economic pie. When market failures occur, scarce resources are not managed properly, creating a shortage or surplus. One of the causes is **externality** – a situation in which market players fail to account for third-party benefits or costs in their decisions. To illustrate, the decision to manufacture cigarettes pollutes the air and can potentially cause health issues, even for individuals who don't smoke. In this case, unaccounted externalities can lead to market failure.

Market power, or the ability of a single person or firm to dictate market prices, also causes market failure. Take a sole electricity provider as an example. Without competition, this provider has the power to manipulate the market by restricting output and charging a higher price.

When externalities or market power exists, a well-designed government intervention can improve economic efficiency.

Second Goal: Equality

Efficient outcomes do not necessarily mean that there is equality. This is because a market economy compensates individuals according to what they can provide, which other individuals are willing to pay for. For example, the world's best tennis player may receive more income than the world's best frisbee player merely because individuals are willing to pay more to watch tennis than frisbee. The invisible hand does not guarantee that everyone receives the same rewards and advantages. In the presence of inequality, government policies may help achieve a more equitable allocation of economic well-being.

We cannot fully discredit the role of the government in a market economy. It can sometimes improve market outcomes depending on the circumstances and available information. Theoretically, the government can make economic activities more organized, efficient, and equitable through the enforcement of regulations and interventions.

The Standard of Living Depends on a Country's Production

Countries exhibit large variations in living standards. For example, in 2017, the average income in the U.S. was $60,000; in Germany, $51,000; in China, $17,000; and in Nigeria, $6,000. Given these differences, it can be expected that citizens from high-income countries have a better quality of life (i.e., ownership of more goods, healthier conditions, better education, etc.) than citizens from low-income countries.

Why do living standards among countries vary? The answer is mainly attributable to the country's productivity, which refers to the amount of goods and services produced by each unit of labor input. More productive workers are able to produce more goods and services than less productive workers in a given period of time. Countries with highly productive citizens benefit from a high standard of living, while countries with less productive citizens put up with a low standard of living. Collectively, it follows that the nation's productivity drives the nation's average income.

Improving national living standards often hinges on increasing the productivity of the populace. Government policies, therefore, frequently target enhancing worker output through supporting education, resource access, and technological adoption. These measures play a crucial role in equipping individuals with the skills and tools necessary to be competitive and productive within the labor market.

Prices Rise When the Government Prints Too Much Money

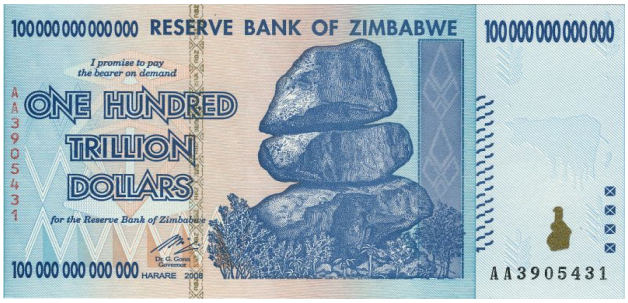
As a monetary policy tool, the Central Bank can choose to print money to increase money in circulation. However, if it is excessive, it **lowers** the **value** of money. How so? When people hold more money, more people compete in the demand for goods and services. As a result, firms may increase their prices (since

production can't match the demand in such a short period of time), which reduces the purchasing power of individuals. Money then loses its value.

When the government prints too much money, it can lead to **hyperinflation**, a state where there is a steep rise in the prices of goods and services. A high inflation rate poses a threat to the economy; thus, policymakers generally aim to maintain a single-digit inflation rate of around 2 – 4%.

During the 1920s, Germany experienced hyperinflation, which was largely due to the government printing banknotes to service payments to striking workers. In a span of two years, a daily newspaper that cost 0.30 marks in 1921 shot up to 70,000,000 marks in 1922.

In 2008, Zimbabwe recorded a staggering 79,600,000,000% inflation rate, mainly due to the government printing money in response to a series of economic shocks that needed to be addressed at that time.



In the U.S., there have not been extreme cases of hyperinflation similar to that of Germany or Zimbabwe. During the time of President Gerald Ford in the 1970s, inflation in the U.S. more than doubled when there was a rapid growth of the money supply in the economy. Notably, subsequent reductions in money supply growth during the 1980s contributed to bringing inflation back down to lower levels.

E. Property Rights and the Role of Incentives

People Respond to Incentives

An **incentive** is something that motivates or encourages an individual to take action, regardless of whether it is beneficial or detrimental to them. It can be said that rational people make decisions using *marginal analysis*, in which case these individuals usually respond to incentives.

Incentives play a pivotal role in comprehending how markets function. Consider the market for chocolates as an example. When the price of chocolate increases, consumers tend to buy less of it, while chocolate producers tend to allocate additional resources to increase chocolate production. Hence, the market price for chocolate works as an incentive to cause consumers to buy less and producers to manufacture more. Price movements help alter consumer behavior and allocate scarce resources.

There are two types of incentives: **extrinsic** and **intrinsic**. Extrinsic incentives involve financial rewards, peer recognition, fame, social status, and power of individuals. Meanwhile, intrinsic incentives are psychological in nature. That is, it is a feeling or pleasure one might get from conducting a task simply

because the task is interesting and enjoyable to that person. A combination of these incentives can motivate individuals to pursue beneficial and enjoyable activities. An individual's preferences and desires shape the degree to which they are influenced by incentives.

Policymakers and firms typically consider the implementation of incentives as a strategic approach to influence the behavior of individuals by altering their perceptions of benefits and costs. For example, the government may impose a tax on sugar to encourage people to cut down on sweets and shift to healthier alternatives. Firms may offer attractive salary packages and bonuses to incentivize potential employees into accepting employment.

Governments sometimes fail to recognize the profound impact that regulations and policy interventions can exert on individual incentives. These interventions may inadvertently give rise to unforeseen and adverse outcomes. An example from decades ago is the U.S. Congress' decision to enforce the installation of seat belts as a mandatory feature in newly manufactured cars. Despite Congress' good intentions, some drivers, under the misguided belief that seat belts alone would mitigate accident risks and decrease insurance premiums, started exhibiting more reckless behavior. Consequently, this surge in recklessness led to an escalation in motor vehicle accidents.

Property Rights and the Role of Incentives

Property rights are enforceable rules for the purpose of protecting the owner's exclusive control over an asset and the gains that come from using it. Property owners are bound by these commonly acknowledged rights: *right to use, right to income, right to transfer, and right to enforce*. These property rights serve as incentives for owners to transform their properties into profitable businesses that can boost economic activities and contribute to overall economic growth and development. Without this protection, owners would find it costly to operate businesses.

Concept Check 1.4.	
Incentive	anything that pushes an individual to act
Extrinsic incentive	comes from the individual's environment
Intrinsic incentive	comes from the elated feeling of enjoyment after completing a task
Property rights	enforceable rules of ownership

F. Marginal Analysis

Rational People Think at the Margin

In economics, we usually assume that people are rational decision-makers, which means that they can methodically and intentionally do their best to fulfill their established goals, given constraints. They use cost-benefit or marginal analysis as a tool for decision-making.

Decisions made in everyday life are not as clear-cut and usually come with ambiguity. During lunch, one does not ask, "Should I deprive myself of eating or should I replete myself with food?" More likely, the question faced is, "Should I take that extra slice of cake?" Additionally, when faced with a work deadline, we are forced to make a decision between dedicating time to our professional responsibilities or indulging in leisure activities.

When rational people make a decision, they consider the plan of action and the additional benefit or the additional cost that would result from undertaking such action. In economics, the term "additional" is referred to as "marginal." When rational people make decisions, they compare their marginal benefits and marginal costs.

Example 1:

Should *M* purchase and consume another cookie?

Individual *M* was craving cookies and came across a store that sells cookies, which costs $4 per piece. If *M* could put a personal monetary value on that cookie at that moment, *M* would value it at $10.

For the first cookie, *M* was willing to pay $10 when its price was $4. In this case, the marginal benefit is $6, and the marginal cost is $4. Given that the marginal benefit of the cookie exceeds its marginal cost, *M* bought one cookie and ate it right away.

After eating one cookie, *M's* initial craving was satisfied, but *M* still wanted more. However, at this time, *M's* willingness to pay for an additional cookie decreased, given that *M's* craving for a second cookie was less than the first one. For the second cookie, *M's* willingness to pay was $9, while the price remained at $4. Since the marginal benefit still exceeded the marginal cost, *M* bought another cookie.

M could still buy additional cookies, provided that for the last cookie, *M's* marginal benefit should be greater than or equal to its price (marginal cost). Otherwise, buying another cookie would be a waste because it will no longer satisfy *M*.

Table 1.6.1. shows how *M* uses marginal analysis by comparing marginal benefit and marginal cost per cookie consumption.

Table 1.6.1. M's Marginal Analysis

	1st	2nd	3rd	4th
Marginal Benefit (MB) (how *M* values each cookie)	$6	$5	$4	$3
Marginal Cost (MC) (Price per cookie)	$4	$4	$4	$4
Marginal Analysis	MB > MC	MB > MC	MB = MC	MB < MC
Should *M* buy?	Yes	Yes	Yes	No

Example 2:

Should Bank XYZ launch a new advertising campaign?

Bank XYZ, a global bank, plans to launch a new advertising campaign in their U.S. market.

Bank XYZ projects a marginal (incremental) revenue amounting to $13 million. However, Bank XYZ expects to incur a marginal (incremental) cost, which can be broken down into ad-related expenses and losses to the Foreign Operations Unit, amounting to $4 million and $8 million, respectively.

Using marginal analysis, the Bank's marginal (incremental) revenues can cover the marginal (incremental) cost. As a result, XYZ should proceed with the launching of a new advertising campaign.

Table 1.6.2. shows a summary of Bank XYZ's accounts pre- and post-advertising campaign launch.

Table 1.6.2. Bank XYZ's Accounts Summary

	Pre-Advertising Campaign (A)	Post-Advertising Campaign (B)	Incremental (Marginal) Changes (B-A)
Total Revenues	$19,000,000	$32,000,000	$13,000,000
Variable Cost			
TV Airtime	6,000,000	9,000,000	3,000,000
Ad development labor services	2,000,000	3,000,000	1,000,000
Total Variable Cost	(8,000,000)	(12,000,000)	(4,000,000)
Direct Fixed Cost	(2,000,000)	(2,000,000)	0
Indirect Fixed Cost	(10,000,000)	(10,000,000)	0
Ad Campaign Losses			(8,000,000)
Net Incremental Change			$1,000,000

Concept Check 1.5.	
Marginal benefit (MB)	the additional gain from a current state
Marginal cost (MC)	the additional cost from a current state
Marginal change	the additional adjustments from a current state
Marginal analysis	comparing marginal benefit and marginal cost; a tool used to make decisions regarding alternatives. That is, choosing one alternative relative to another: MB should be greater than or equal to MC.

Chapter 1 Review Questions

1. **Economics is best defined as the study of**
    A. how societies allocate their limited resources
    B. how businesses maximize their profits
    C. how to accurately anticipate inflation, unemployment, and growth
    D. how the government can reduce the negative effects of acting from self-interest

2. **What is the opportunity cost of attending a concert?**
    A. The concert ticket price
    B. The concert ticket price plus the cost of snacks purchased at the concert venue
    C. The total cash layout required to attend the concert and the value of the time spent
    D. None, as long as the concert is fun and worthy of the time spent on it

3. **Which of the following is accurate regarding marginal change?**
    A. It is not crucial for public policy.
    B. It gradually modifies a current plan.
    C. It always leads to an inefficient outcome.
    D. It has no significant impact on incentives.

4. **Which of the following results from the fact that people respond to incentives?**
    A. Policymakers use punishments or rewards to change outcomes.
    B. Policies can have unforeseen consequences.
    C. A trade-off is created between equality and efficiency.
    D. All of the above

5. **A nation benefits from international trade when**
    A. its revenue from selling abroad exceeds its expenses from purchasing abroad
    B. the well-being of its economic trading partners decreases
    C. all nations produce what they specialize in
    D. Residents of the country do not lose their jobs because of trade

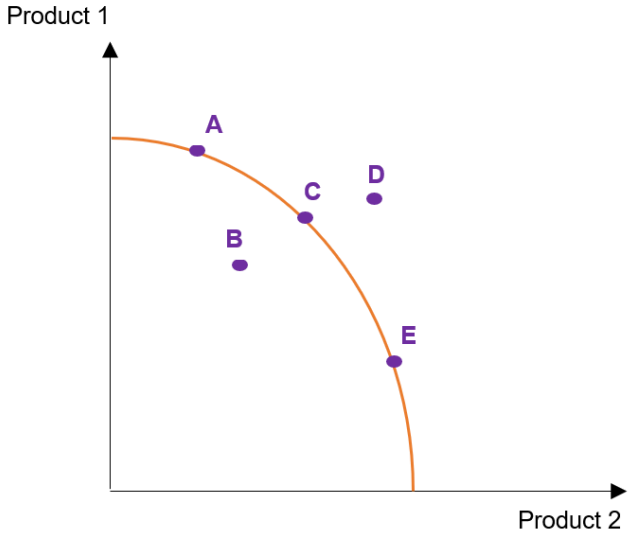
6. **What does Adam Smith's "invisible hand" refer to?**
    A. The questionable business tactics used by companies to make money off of customers.
    B. The unintended, positive consequence of individuals pursuing their own self-interest, which can benefit society as a whole.
    C. Government intervention that helps people and societies even when not requested.
    D. How costs associated with unregulated markets are transferred to individuals who were not directly involved in those markets.

7. **Why might a government intervene in a market economy?**
    A. To enforce property rights
    B. To correct a market failure caused by externalities
    C. To achieve an equal distribution of income
    D. All of the above

8. **What is a main factor that contributes to the disparities in average living standards across different nations?**
    A. Poor nations are abused by rich nations.
    B. Some central banks print more money.
    C. Some nations have better labor laws.
    D. Some nations have relatively more productive workers.

9. **What is the most likely explanation behind hyperinflation?**
    A. The central bank printed excessive amounts of money.
    B. Labor unions negotiated for excessively high wages.
    C. The government imposed high rates of taxation.
    D. Firms abused market power to charge high prices.

10. Referring to the PPC Curve below, all are feasible combinations of products 1 and 2, except:



A. A, C, E
B. D
C. A
D. B

Chapter 1 Review Answers

1. A
2. C
3. B
4. D
5. C
6. B
7. D
8. D
9. A
10. B

Chapter 2.1: The Nature and Functions of Product Markets – *Market Equilibrium*

Chapter Overview

This chapter aims to explain and discuss product markets by analyzing the diverse market structures and the critical role competition plays in shaping them. This chapter will also unpack the term demand, so that you will gain an understanding of consumer preferences, income, and even expectations that influence their choices. Furthermore, this chapter will outline the determinants driving supply, including production costs, technology, and input prices. Finally, this chapter will discuss how governments intervene through price and quantity controls, analyzing their potential benefits, drawbacks, and unintended consequences.

Learning Objectives

By the end of this chapter, you should be able to:

- Identify and compare different market structures, understanding their key features like the number of buyers and sellers, product differentiation, and barriers to entry.
- Analyze how factors like price, income, substitutes, and complements influence consumer demand and its responsiveness to price changes (elasticity).
- Explain how factors like input costs, technology, and government regulations affect producer supply and its responsiveness to price changes (elasticity).
- Apply the concept of market equilibrium, where supply and demand meet, and analyze how changes in market forces can disrupt and re-establish this balance.
- Critically evaluate the effectiveness and potential drawbacks of government interventions in markets through price controls or quantity controls.

Introduction

When the COVID-19 pandemic hit the world in 2020, prices of food, clothing, cleaning supplies, and basically any other necessity rose. Similarly, during the winter season, the prices of coats and scarves also show an increase. When a new phone model is released, the price of the old model declines. How are these circumstances similar? All of them show the dynamics of supply and demand.

Chapter 2.1 establishes the theory of demand and supply, the interaction between buyers and sellers, determination of prices in a market economy, and the price mechanism for allocation of limited resources.

A. Markets and Competition

Basically, a **market** is characterized by **a group of buyers (consumers) and sellers (producers)** for a specific good or service. A market exists for practically all goods and services. Markets include shops, supermarkets, shopping malls, restaurants, and even online markets such as Amazon, eBay, etc. Think of a market as a place where buyers and sellers interact.

The primary driver of demand and supply is to foster and promote competition, especially between buyers and sellers. However, the degree of competition depends on the homogeneity of the goods and services offered, as well as the number of buyers and sellers. If there are many buyers and sellers and the product sold is homogeneous, then the market is said to be perfectly competitive. In this case, all the market players have limited (or zero) control over price and quantity. They just accept the price dictated by the market; thus, they are price-takers, and everyone has the same information.

Not all markets exhibit perfect competition. The extreme opposite of a perfectly competitive market is a **monopoly**. In a monopoly market, there is only one seller offering a unique product or service, for example, electricity. Monopolists have market power and can dictate the price in the market; hence, they are price-makers. However, in the discussions for this section, we assume a perfectly competitive market.

To understand how markets work, we study the behavior of the market participants (buyers and sellers). We will then analyze how these buyers and sellers interact to determine the price and quantity of the goods and services offered in the market. To facilitate a simple discussion in the succeeding sub-sections, we will use the market for cookies as a reference, and goods to include the market for both goods and services.

B. Demand and its Determinants

A **buyer** is someone who is **1) willing and 2) able to purchase a good**, of which the **amount** is referred to as the **quantity demanded**. Demand for a good exists when these two conditions are satisfied. If one or both of these conditions are not satisfied, then no demand exists.

The most inherent **determinant** of demand is the **price of the good**. For example, if the market price of one cookie is $3, then you would purchase 6 cookies. If the price of the cookie increased to $5, then you would purchase less of it and buy a cheaper alternative instead. If, on the other hand, the price of the

cookie decreased to $1, then you would buy more. This **inverse relationship between the price of the good and quantity demanded** is what we call the **'law of demand'** in economics. All other things being equal (*ceteris paribus*), when the price of the good increases, the quantity demanded decreases, and vice-versa.

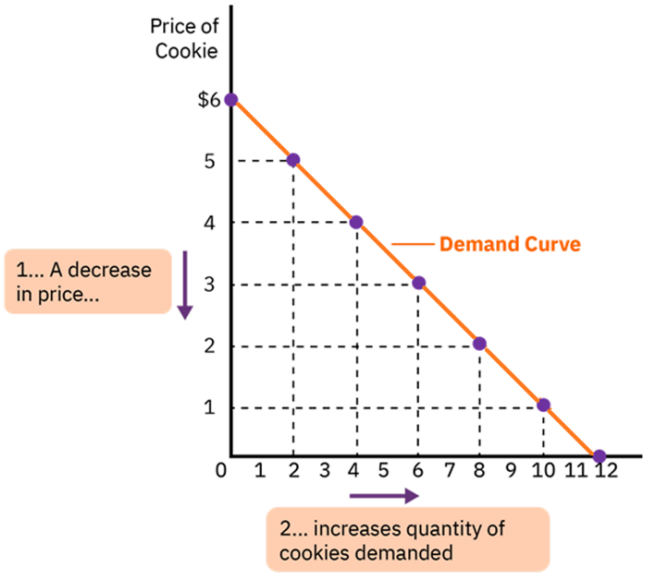
To illustrate further, individual *C*, a cookie lover, has revealed their willingness to pay for cookies at different price levels (see Table 2.1.1). If cookies are free, *C* buys 12. At $1, they buy 10 cookies. As the price goes up, they buy fewer and fewer cookies. When the price is $6, *C* is no longer willing to buy a cookie. Table 2.1.1 depicts a **demand schedule**, which shows the inverse relationship between the price of a good and the quantity demanded, holding all other things constant.

The graphical representation of the demand schedule shows a **downward-sloping demand curve,** which demonstrates the 'law of demand.' Generally, the price of the cookie is shown on the y-axis (vertical axis), and the quantity demanded for the cookie is shown on the x-axis (horizontal axis). The price and quantity of cookies shown in *C's* demand schedule are the combination of the associated quantity demanded (x) and its price (y) plotted in the graph.

Table 2.1.1 C's Demand Schedule

Price per Cookie	Quantity Demanded
$0	12 pcs
1	10
2	8
3	6
4	4
5	2
6	0

Figure 2.1.1 C's Demand Curve



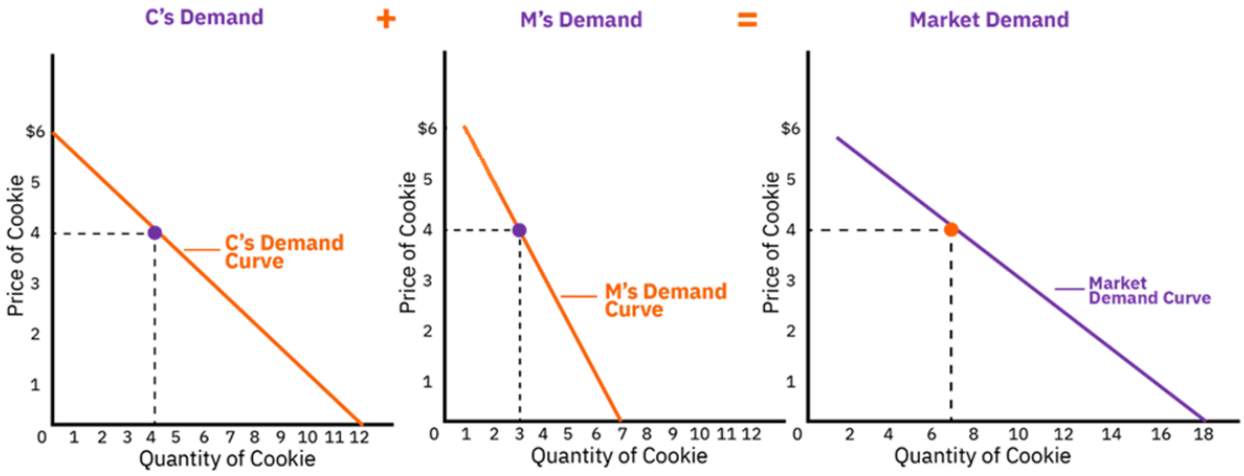
In the market for cookies, *C* is not the only buyer. Suppose there is another buyer named *M*. *M* has their own demand schedule, which depicts their demand curve. To analyze how markets work, we sum up **all the individual demands for a certain good or service** to derive the **market demand.** As shown in Table 2.1.2, *C* and *M* have their respective demand schedules. When *C* and *M's* demand schedules are combined, we can determine the market demand for cookies. If the cookie is free, the market demand will be 12 + 7 = 19 cookies. Inversely, if the cookie is $6, then the market demand will be 0 + 1 = 1 cookie.

Table 2.1.2. Market Demand as the Sum of Individual Demands

Price of a Cookie	Individual *C*	Individual *M*	Market
$0	12 +	7 =	19 pcs
1	10	6	16
2	8	5	13
3	6	4	10
4	4	3	7
5	2	2	4
6	0	1	1

Once we derive the market demand schedule, we can then plot the combinations of quantity demanded and price to illustrate the market demand curve. Because we are interested in analyzing how markets operate, we frequently use the market demand curve. This market demand curve shows how the total quantity demanded of a good varies at different price levels, holding all other things constant.

Figure 2.1.2. Market Demand as the Sum of Individual Demands



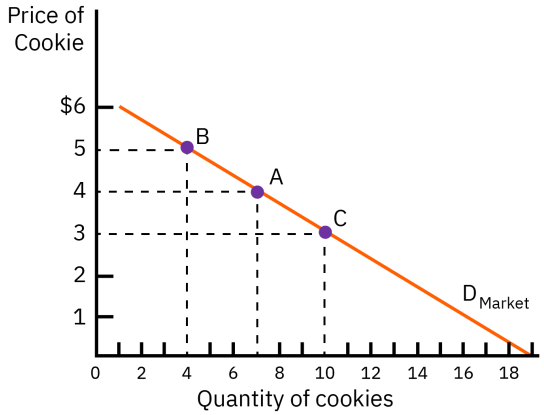
Concept Check 2.1.	
Quantity demanded	the amount of a good that buyers are willing and able to buy
Law of demand	all other things being equal (ceteris paribus), the quantity demanded of a good decreases when the price of the good increases
Demand schedule	a table that shows the relationship between the price of a good and the quantity demanded
Demand curve	a graph demonstrating the relationship between the price of a good and the quantity demanded
Market demand	sum of individual demands
Market demand curve	a demand curve that shows the total quantity demanded at different price levels

Movements Along the Demand Curve

Ceteris paribus (all other things being equal): **when there is a change in the demand of a good due to a change in price, it is referred to as the change in quantity demanded.** These changes can be shown as a movement along the demand curve. Suppose that market demand is initially at point A in Figure 2.1.3. an increase in the price per cookie from $4 to $6 reduces quantity demanded from 7 to 5 cookies. This is reflected by a movement up the demand curve to reach point B. Conversely, a drop in price from $4 to $3 increases the quantity demanded from 7 to 10 cookies. This is illustrated by a movement down the demand curve to reach point C.

Figure 2.1.3.

Market Demand



**Note that the price of the good is different from the price of a related good, which we will discuss later on.*

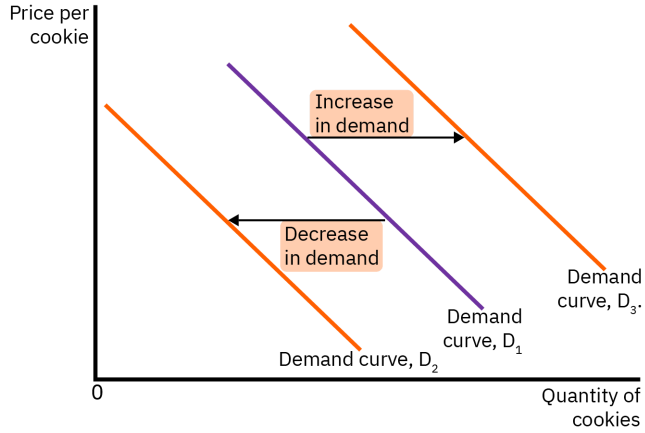
Shifts in the Demand Curve

Because the market demand curve holds other things constant, it need not be stable over time. **Other determinants can alter the quantity demanded at any given price, which causes the demand curve to shift.** If the U.S. Department of Health and Human Services releases a report of increasing incidents of diabetes, this would lower the demand for cookies. Buyers, out of fear of developing diabetes, would now want to consume fewer cookies at any given price; hence, the demand curve for cookies would shift to the left.

Figure 2.1.4. shows how the demand curve may shift to the right or to the left, depending on determinants that influence the behavior of buyers to purchase goods or services.

In this example, the diabetes scare shifts the demand curve to the left (D_1 to D_3), which shows a decrease in demand. Any change that increases the quantity demanded at every price level shifts the demand curve to the right (D_1 to D_2), which shows an increase in demand.

Figure 2.1.4.



In addition to the price of the good, there are several other determinants that can shift the demand curve. These determinants that shift the demand curve are discussed below:

- **Income.** Suppose your contract for your part-time job has ended, and you have lost a source of income. Given that you now have less income to spend, would you continue to buy the same amount of cookies? Most likely, you would opt to buy less cookies. Therefore, with a lower income, you tend to consume less since you have less income to spend.

  When there is a decrease in demand for a good due to a decrease in income, the good is classified as a **normal good**. Conversely, if the demand for a good increases when income decreases, it is referred to as an **inferior good**. An example of an inferior good could be pre-packaged meals. In the event of a decline in income, individuals may opt to purchase food packed from a convenience store rather than dining out at a restaurant.

- **Price of Related Goods.** Suppose that the price of brownies decreases. According to the law of demand, you will buy more brownies. Given the similarity between cookies and brownies, they can be considered related goods. Now with this sudden price decrease in brownies, you will most likely purchase fewer cookies since both cookies and brownies are similar goods. When there is a decrease in the price of one good (in this case, brownies), the demand for another good (in this case, cookies) decreases as well. These two goods (brownies and cookies) are

called ***substitutes***. Substitutes are often goods that can replace each other; for example, physical books and e-books, eyeglasses and contact lenses, and tea and coffee.

Cookies are usually consumed with milk. Therefore, you tend to also buy milk when you buy cookies. Suppose that the price of the milk decreases; then, we can expect that the demand for the milk will increase, as well as the demand for cookies. When a decrease in the price of one good (in this case, milk) increases the demand for another good (in this case, cookies), the two goods are called ***complements***. Complements are often goods that are used together, such as sneakers and socks, printers and ink, and clocks and batteries.

- **Tastes.** You buy something because you like it. If you like sweets, then you will probably consume cookies. If your doctor says you have to avoid sweets, then you will limit your consumption of cookies. Your taste or preference influences the way you consume goods and services. Tastes and preferences stem from historical and psychological factors that go beyond economics. These tastes and preferences aid us with our consumption behavior.

- **Expectations.** Your future perspective affects your purchasing decisions in the present. If you expect that the price of cookies will increase next week, you may demand more of it now and keep stock at home. If you expect to get a raise in your job next month, you may choose to consume more cookies now. That is, expectations of the future affect our consumption decisions today.

- **Number of Buyers.** If the number of buyers in the market increases, then the quantity demanded for cookies would be higher at each price level, raising the total market demand. For example, if Mark decides to buy cookies, he will join Carol and Martin in the market for cookies, and as a result, the quantity demanded for cookies increases.

Concept Check 2.2.	
Normal good	other things being equal, a good for which an increase in income leads to an increase in demand and vice-versa
Inferior good	other things being equal, a good for which an increase in income leads to a decrease in demand and vice-versa
Substitutes	two goods for which an increase in the price of one (A) leads to an increase in the demand of the other (B)
Complements	two goods for which an increase in the price of one (C) leads to a decrease in the demand for the other (D)

To summarize, the demand curve shows what happens to the quantity demanded of a good as its price changes, holding all other determinants that affect buyers equally. When one of these determinants varies, the quantity demanded at each price level varies and results in a shift of the demand curve.

Remember that only the price of the good itself will cause a movement along the demand curve. All other determinants (income, price of related goods, tastes, expectations, number of buyers) that can influence the demand for a good, will cause a shift in the demand curve. Also, take note that these other determinants are not found in both the x- and y-axis.

Here are some **possible movements and/or shifts** that can happen in the demand for cookies.

Table 2.1.3.

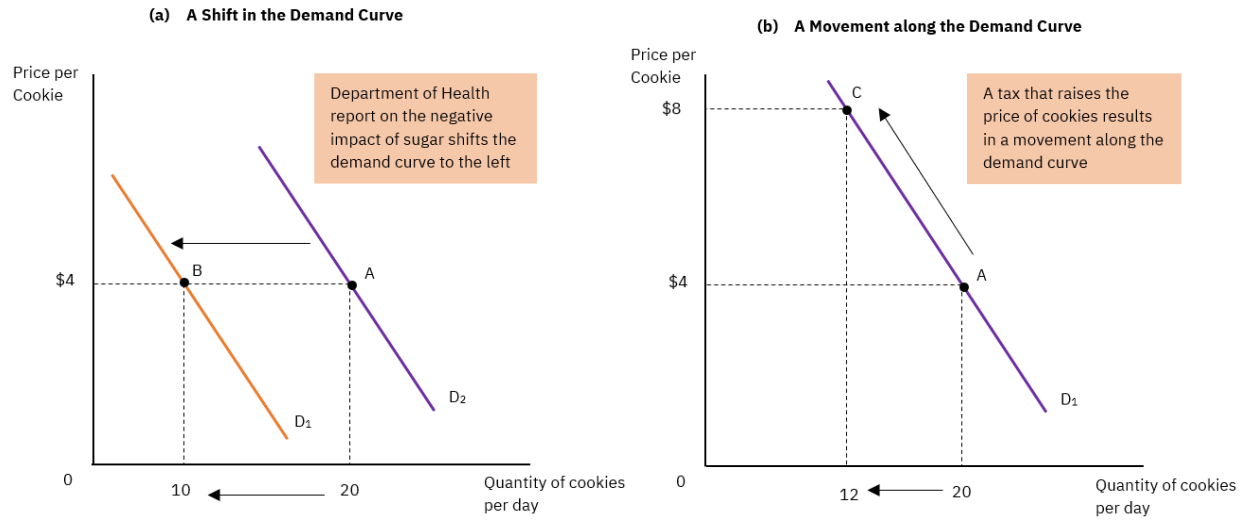
Factor/ Variable	Quantity Demanded	Movement/ Shift
Increase in the price of cookies	Decrease	Movement (downwards)
Decrease in the price of cookies	Increase	Movement (upwards)
Cookies as a normal good		
Increase in income	Increase	Shift to the right
Decrease in income	Decrease	Shift to the left
Cookies as an inferior good		
Increase in income	Decrease	Shift to the left
Decrease in income	Increase	Shift to the right
Cookies and Brownies are substitutes		
Increase in the price of brownies	Increase	Shift to the right
Decrease in the price of brownies	Decrease	Shift to the left
Cookies and milk are complements		
Increase in the price of milk	Decrease	Shift to the left
Decrease in the price of milk	Increase	Shift to the right
You have a sweet tooth	Increase	Shift to the right
You are on a diet	Decrease	Shift to the left
You expect its price to increase next week	Increase (present)	Shift to the right
You expect its price to decrease next week	Decrease (present)	Shift to the left
Individual *F* joins *C* and *M* as buyers	Increase	Shift to the right

To **illustrate a shift and a movement graphically**, let us use the following scenarios:

(a) The Department of Health releases a report on the negative impact of sugar on our bodies. This may convince consumers to consume fewer cookies; therefore, the demand curve shifts to the left (from D_1 to D_2). At a price of $4 per cookie, the quantity demanded falls from 20 to 10 cookies per day, as shown in the shift from Point A to Point B.

(b) If a tax on sugar raises the price of cookies, the demand curve does not shift. Instead, there will be a movement along the demand curve from Point A to C. When the price goes up to $8, the quantity demanded falls from 20 to 12 cookies.

Figure 2.1.5.



C. Supply and its Determinants

A **seller** is someone who is **1) willing and 2) able to sell a good,** of which the **amount** is referred to as the **quantity supplied**. Supply for a good exists when these two conditions are satisfied. If the seller does not satisfy both or one of the two, then no supply exists.

The most significant **determinant** of supply is the **price of the good**. When the price of cookies is high, sellers can generate profits, incentivizing them to increase production by investing in more resources, such as additional ovens and hiring extra staff. Conversely, when cookie prices are low, the incentive to produce diminishes due to lower profit margins. If prices fall too low, sellers may even cease production altogether. This **direct correlation between price and quantity supplied** is referred to as the **'law of supply'** in economics. All other things being equal (ceteris paribus), a price increase leads to an increase in quantity supplied, and vice-versa.

To illustrate further, Individual *E*, a baker, has revealed their willingness to sell cookies at different price levels each month (see Table 2.1.4.). If cookies are free or if the price of cookies is $1, *E* is not willing to bake and sell cookies. As the price goes up, he is more willing to sell and bake more and more cookies, such that when the price is $6, *E* will supply 5 cookies. Table 2.1.4. depicts a supply schedule, which shows the direct relationship between the price of a good and quantity supplied, holding all other things constant.

The graphical representation of the supply schedule (Figure 2.1.6.) is an upward-sloping demand curve, which is reflective of the 'law of supply'. Conventionally, the price of a cookie is on the y-axis (vertical axis), and the quantity demanded for a cookie is on the x-axis (horizontal axis). The numbers from Table 2.1.4. are the combinations of quantity supplied **(x)** and price **(y)** plotted in the graph.

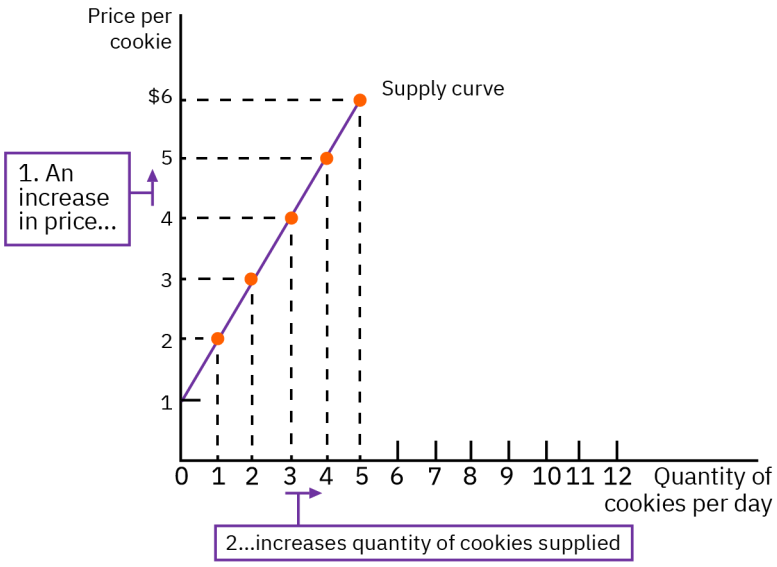
Table 2.1.4.

***E's* Supply Schedule**

Price per Cookie	Quantity Supplied
$0	0 pcs
$1	0
$2	1
$3	2
$4	3
$5	4
$6	5

Figure 2.1.6.

***E's* Supply Curve**



In the market for cookies, Individual *E* is not the only seller. Suppose there is another seller named Individual *R*. *R* has their own supply schedule, which depicts their individual supply curve. To analyze how markets work, we have to know the market supply by summing up all the quantities supplied per seller for a certain good or service. As shown in Table 2.1.5., *E* and *R* have their respective supply schedules that, when combined, make up the market supply. If the cookie is free, the market supply will be 0 cookies, while if the cookie is $6, the market demand will be 13 cookies.

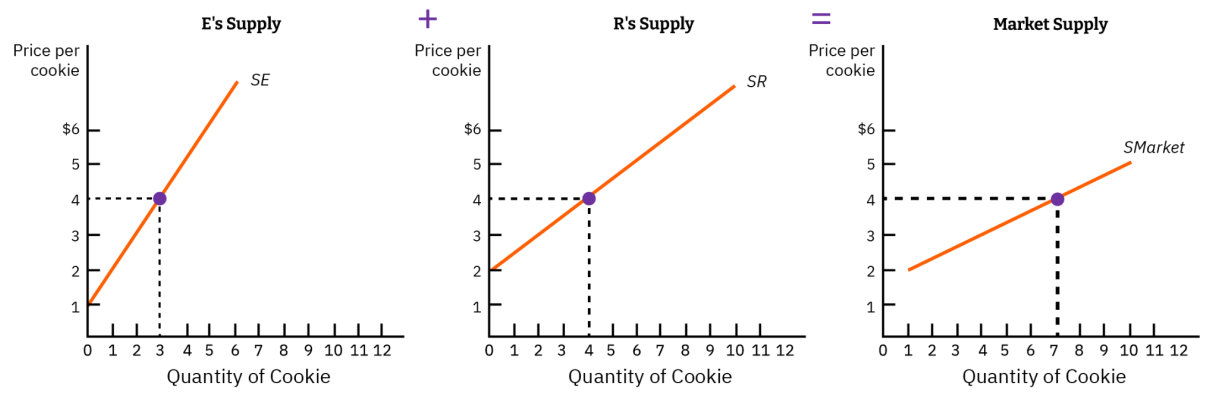
Once we derive the market supply schedule, we can then plot the combinations of quantity supplied and price to illustrate the market supply curve seen in Figure 2.1.7. Because we are interested in analyzing how markets operate, we frequently use the market supply curve. It shows how the total quantity supplied of a good varies at different price levels, holding all other things constant.

Table 2.1.5.

Market Supply as the Sum of Individual Supplies

Price of Cookie	Individual *E*	Individual *R*	Market
$0	0+	0 =	0 pcs
1	0	0	0
2	1	0	1
3	2	2	4
4	3	4	7
5	4	6	10
6	5	8	13

Figure 2.1.7.

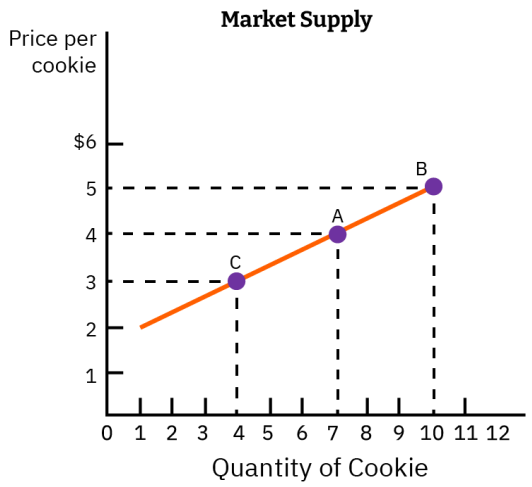


Concept Check 2.3.	
Quantity supplied	the amount of a good that sellers are willing and able to sell
Law of supply	all other things being equal (ceteris paribus), the quantity supplied of a good increases when the price of the good increases
Supply schedule	a table that shows the relationship between the price of a good and the quantity supplied
Supply curve	a graph of the relationship between the price of a good and the quantity supplied
Market supply	sum of individual supply
Market supply curve	a supply curve that shows the total quantity supplied at different price levels

Movements along the Supply Curve

Ceteris paribus (all things equal), a **change in the price of the good causes a movement along the supply curve**. Let's say that our reference point in Figure 2.1.8. is at point A (7 cookies, $4). If the price of the cookie increases to $5, the point will move toward point B (10 cookies, $5). If the price of a cookie goes down to $3, the point will move toward point C (4 cookies, $3).

Figure 2.1.8.



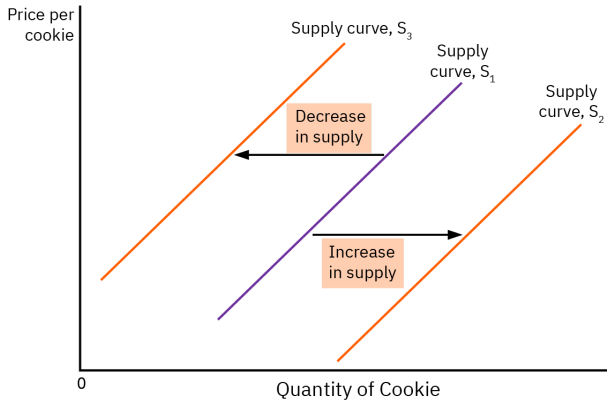
Shifts in the Supply Curve

Because the market supply curve holds other things in a constant state, it does not need to be stable over time. **Other determinants can alter the quantity supplied at any given price, which causes the supply curve to shift.** If the price of flour, an input necessary for baking cookies, decreases, sellers can purchase more of it and bake more cookies. In effect, because of the decrease in price of the input, flour, cookies are now cheaper to produce and therefore, more profitable for the sellers. As a result, the supply of cookies increases: at any given price, sellers are now willing to produce more cookies, causing the supply curve to shift.

Figure 2.1.9. on the right shows how the supply curve may shift to the right or to the left, depending on the factor that influences the behavior of sellers to produce goods or services.

In the example above, the price of flour (input) shifts the supply curve to the right (S_1 to S_2), which denotes an increase in cookie supply. Any change that decreases the quantity supplied at every price level shifts the supply curve to the left (S_1 to S_3), which denotes a decrease in supply.

Figure 2.1.9.



Except for the price of the good, there are several determinants that can shift the supply curve. Here are some of the **key determinants that cause the supply curve to shift:**

- **Input Prices.** The production of cookies involves the use of various ingredients, such as flour, sugar, and chocolate, in addition to the utilization of ovens and skilled bakers. In the event that the cost of any of these inputs, such as flour, experiences an increase, the production of cookies becomes more costly, potentially resulting in a reduction in the quantity supplied by the seller. We can, therefore, say that the price of inputs and quantity supplied are negatively related. Sellers typically seek lower input costs to enhance production efficiency and increase revenue from the sale of goods.
- **Technology.** Production of goods relies heavily on technology. If there is an improvement in technology (i.e., newer models, updated operating systems, better features), production becomes more efficient; therefore, sellers are able to produce and supply more. In our example, if Individual *E* upgrades to a bigger and better oven, then he will be able to produce and bake more cookies.
- **Expectations.** Your future perspective affects your production decisions in the present. If you expect that the price of cookies will increase next week, you may take stock of your current production in storage and supply fewer goods to the market today.
- **Number of Sellers.** An increase in the number of sellers in a market, such as the entry of a new competitor like Individual *A* joining Individual *E* and Individual *R*, would lead to a higher quantity of cookies supplied at each price point. This would translate to an upward shift in the total market supply of cookies.

To summarize, the supply curve shows what happens to the quantity of a good supplied as its price changes, holding all other determinants that affect sellers as equal. When one of these determinants varies, the quantity supplied at each price level varies and results in a shift of the supply curve.

Remember that only the price of the good itself will cause a movement along the supply curve. All other determinants (price of inputs, technology, expectations, and number of sellers) that can influence the supply of a good will cause a shift in the supply curve.

Here are some possible movements and/or shifts that can happen in the supply of cookies.

Table 2.1.6.

Factor/ Variable	Quantity Supplied	Movement/ Shift
Increase in the price of cookies	Increase	Movement (upwards)
Decrease in the price of cookies	Decrease	Movement (downwards)
Increase in the price of flour (input)	Decrease	Shift to the left
Decrease in the price of flour (input)	Increase	Shift to the right
Upgrade to a better oven	Increase	Shift to the right
Deterioration of the oven	Decrease	Shift to the left
You expect its price to increase next week	Decrease (present)	Shift to the left
You expect its price to decrease next week	Increase (present)	Shift to the right
Individual *A* joins *E* and *R* as sellers	Increase	Shift to the right

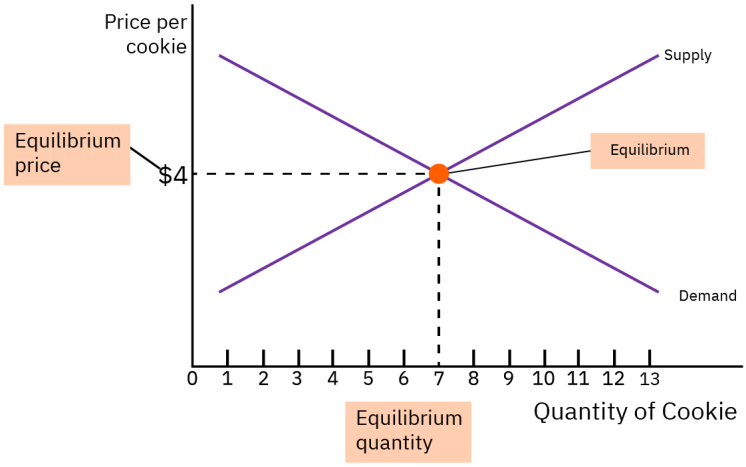
D. Market Equilibrium and Dynamics

Market Equilibrium

After we have determined the demand for a good and the supply of the good, we can then combine the demand of the good and the supply of the good and analyze how buyers and sellers interact to determine the price and quantity of the good offered in a market.

The figure below illustrates the market demand and market supply curves in one graph. **The curves intersect at one point, which is called the market's equilibrium.** The intersection of demand and supply determines the equilibrium price (y) and equilibrium quantity (x). In our example, the equilibrium price is $4 per cookie, and the equilibrium quantity is 7 cookies.

Figure 2.1.10.



At the equilibrium price of $4, the quantity demanded is equal to the quantity supplied. Therefore, the quantity that buyers are willing and able to purchase is exactly the same as the quantity that sellers are willing and able to sell. The equilibrium price is sometimes referred to as the **market-clearing price** since, at this price level, all the market participants have been satisfied: buyers have purchased the number of goods they want to purchase, while sellers have sold all the units of goods they want to sell.

The interactions of the buyers and sellers naturally gravitate toward the market equilibrium. To understand how, let us discuss two scenarios when ***market disequilibrium*** or imbalance occurs:
(a) there is excess supply, and (b) there is excess demand.

(a) Excess Supply

In this scenario, if the price of a cookie is set at $5 (above market equilibrium), buyers are willing to buy 4 cookies, but sellers are willing to sell 10 cookies, creating a **surplus** of 6 cookies. Here, **quantity supplied is greater than quantity demanded**.

Sellers do not want excess supply. To attract buyers, they will **decrease the price**. Buyers will then react by increasing the quantity demanded, which reduces the quantity supplied. There will be movements along the supply and demand curves due to the price decrease. The price of the cookie continues to decrease until the market clears or reaches the equilibrium.

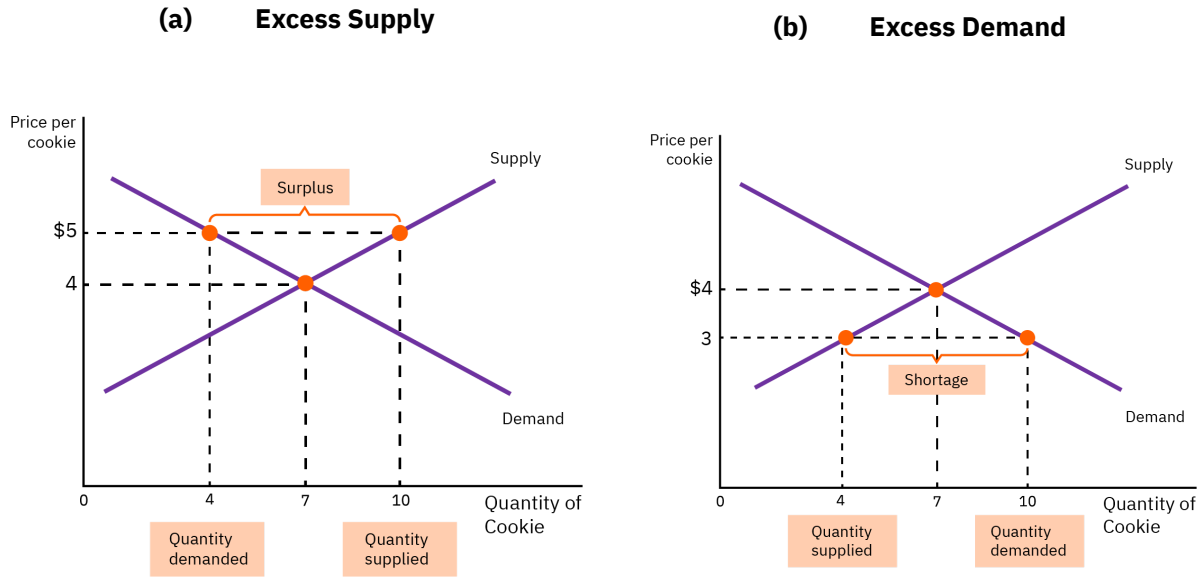
(b) Excess Demand

In this scenario, if the price of a cookie is set at $3 (below market equilibrium), buyers are willing to buy 10 cookies, but sellers are only willing to sell 4 cookies, creating a **shortage** of cookies. Here, **quantity supplied is less than quantity demanded**.

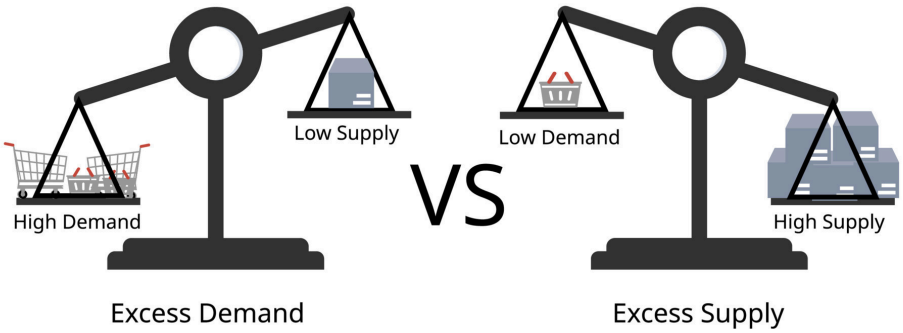
Once the sellers notice that there are several buyers willing to buy the cookies, they will increase the supply and **raise the price**. Some of these buyers will not buy any cookies at the higher price. Consequently, the cookie demand quantity decreases. The buyers that are still willing to buy at the higher price will have their demand for cookies match the new quantity of cookies supplied; however,

there will be movements along the supply and demand curves due to the price increase. The price of cookies continues to increase until the market clears or reaches the equilibrium.

Figure 2.1.11.



In most competitive markets, shortages and surpluses typically occur temporarily. Through the dynamic interaction of buyers and sellers, the market will eventually return to its equilibrium point. The speed of this adjustment varies depending on the nature of the market and the rate at which prices fluctuate. This economic principle is known as the **law of supply and demand**, whereby the price of a good adjusts to balance the quantity demanded with the quantity supplied.



Concept Check 2.4.	
Equilibrium	a situation in which the market price equates the quantity demanded and quantity supplied
Equilibrium price	the price that equates the quantity demanded and the quantity supplied
Equilibrium quantity	the quantity supplied at the equilibrium price
Surplus	a situation in which the quantity supplied is more than the quantity demanded
Shortage	a situation in which quantity supplied is less than the quantity demanded
Law of demand and supply	the market price of a good that is determined by the inverse relationship between supply and demand

Calculating Equilibrium Price and Equilibrium Quantity

Suppose we have the following:

Supply Equation: $Q_S = 3P - 5$ and Demand Equation: $Q_D = -3P + 19$

To get the equilibrium price, we equate both equations since at market equilibrium $Q_S = Q_D$

$$3P - 5 = -3P + 19$$
$$3P + 3P = 19 + 5$$
$$6P = 24$$
$$P_{EQUILIBRIUM} = 4$$

We then substitute $P_{EQUILIBRIUM}$ to both the supply and demand equations to get the equilibrium quantity. Always make sure that you get the same values for Q_S and Q_D given the resulting $P_{EQUILIBRIUM}$. Otherwise, re-check your computations.

Supply Equation:

$$Q_S = 3P - 5$$
$$Q_S = 3(4) - 5$$
$$Q_S = 12 - 5$$
$$Q_S = 7$$

Demand Equation:

$$Q_D = -3P + 19$$
$$Q_D = -3(4) + 19$$
$$Q_D = -12 + 19$$
$$Q_D = 7$$

After all the calculations, we arrive at $P_{EQUILIBRIUM} = 4$ and $Q_{EQUILIBRIUM} = 7$.

Equilibrium Dynamics: Towards a New Market Equilibrium

In Sections 3 and 4, recall that certain determinants influence the supply of and demand for a good or service, causing a movement or shift in the supply and demand curves. The **market equilibrium changes when an event occurs; hence, shifting the supply curve or the demand curve or both, leading to a new equilibrium price and quantity.**

To analyze these shifts, we follow these steps:

1. Decide if the event shifts the supply curve, demand curve or both.
2. Decide the direction of the shift, to the left or to the right.
3. Use the demand-and-supply graph to see how the shift adjusts to the new equilibrium price and quantity.

Let us analyze the market for cookies under different events and circumstances, leading to a change in market equilibrium.

Example 1: A Change in the Market Equilibrium Due to a Shift in Demand

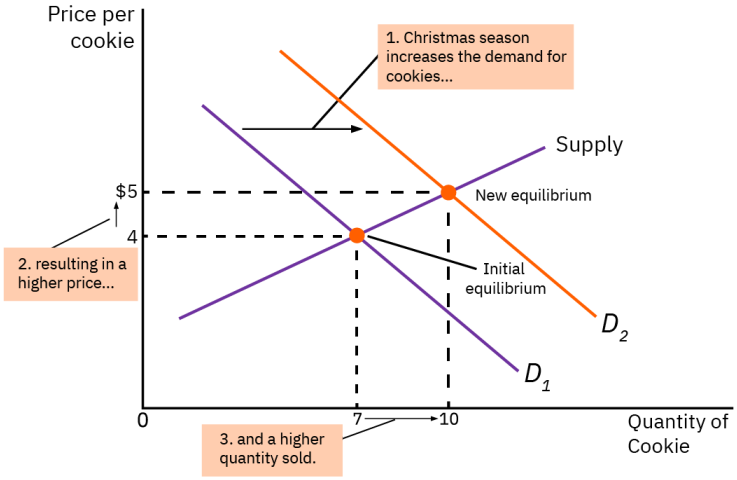
Suppose that it is the Christmas Season. How does this event affect the market for cookies?

Following the three steps above:

1. Since it is a time of giving during the Christmas season, people are more willing to buy cookies as a gift for loved ones. This alters the amount of cookies that people want to purchase at any given price level. The supply curve is unchanged because the Christmas season does not directly affect the firms that sell cookies.

2. Because the Christmas season makes people want to purchase more cookies, the demand curve shifts to the right, from D_1 to D_2, as shown in the right figure. This shift indicates that at each price level, the quantity demanded for cookies is higher than before.

Figure 2.1.12.



3. At the initial equilibrium price of $4, there is now excess demand for cookies, causing a shortage of cookies. This shortage prompts firms to increase the price. As the figure above shows, the increase in demand causes the equilibrium price to increase to $5 and the equilibrium quantity from 7 to 10 cookies. Overall, the **Christmas season** raises both the price of cookies and the quantity of cookies sold.

Example 2: A Change in the Market Equilibrium Due to a Shift in Supply

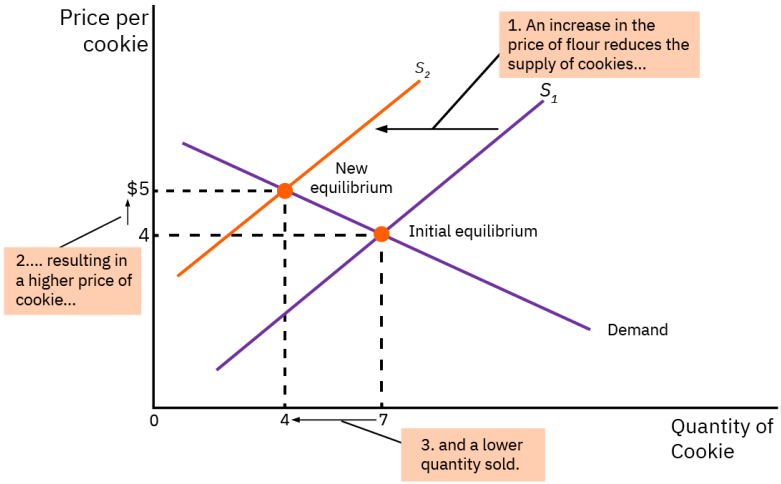
Suppose there is a snowstorm that negatively affects the production of wheat and causes the price of flour to increase. How does this event affect the market for cookies?

Following the three steps above:

1. Since flour is an input for producing cookies, any changes in its price affect the supply curve. In this case, flour becomes more expensive and costly for firms. Sellers, as a result, decrease the amount of cookies they produce and sell at any given price level. The demand curve remains the same (does not shift) since the **cost of inputs** does not directly impact the consumption behavior of the buyers.

2. The supply curve shifts to the left, because at each price level, the total amount of cookies that sellers are willing and able to sell decreases. As shown in the figure to the right, the supply curve shifts from S_1 to S_2.

Figure 2.1.13.



3. At the initial equilibrium price of $4, there is now excess demand for cookies, causing a shortage of cookies. The shortage prompts firms to increase the price. As the figure above shows, the decrease in supply raises the equilibrium price to $5 and decreases the equilibrium quantity from 7 to 4 cookies. Overall, due to the price of the flour increasing, the equilibrium price of cookies increased, and the equilibrium quantity decreased.

Example 3: Shifts in both the Supply and Demand Curves

Suppose during the Christmas season, there is a snowstorm. How do these events affect the market for cookies?

Following the three steps above:

1. The Christmas season affects the demand curve since it changes the amount of cookies that buyers want to buy at any given price level. Simultaneously, the snowstorm affects the price of flour, causing the supply of cookies to change. This change alters the amount of cookies that sellers want to sell at any given price level.

2. The demand curve shifts to the right, as seen in Example 1, and the supply curve shifts to the left, as seen in Example 2.

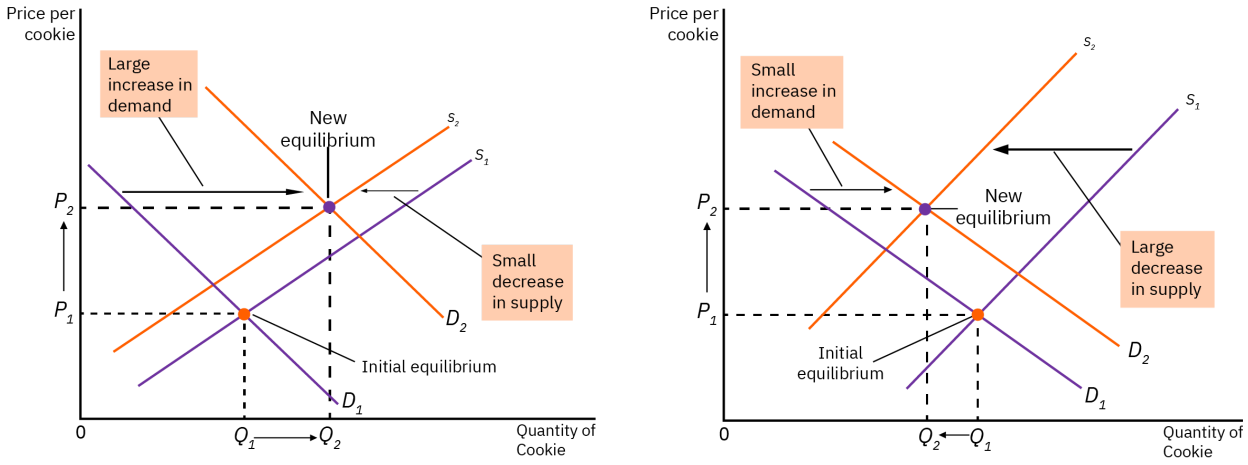
3. There are two possible outcomes that can occur depending on the relative size of the demand and supply shifts. In both cases, the equilibrium price rises due to a shortage. However, the change in equilibrium quantity is ambiguous (that is, it could go either way) as follows:

    (a) Increase in demand is greater than the decrease in supply, hence the equilibrium quantity increases.

(b) Increase in demand is less than the decrease in supply, hence the equilibrium quantity decreases.

Figure 2.1.14.

(a) Increase in demand > decrease in supply **(b) Increase in demand < decrease in supply**



So far, we have presented three examples of how to use demand and supply curves to analyze equilibrium dynamics. When an event shifts the demand curve, the supply curve, or both, we can use the demand and supply model as a tool to predict what happens to the equilibrium price and quantity sold. Table 2.1.7 below shows the predicted outcome for any combination of shifts in the two curves.

Table 2.1.7.

	No Change in Supply	Increase in Supply	Decrease in Supply
No Change in Demand	same price same quantity	price decreases quantity increases	price increases quantity decreases
Increase in Demand	price increases quantity increases	ambiguous price quantity increases	price increases ambiguous quantity
Decrease in Demand	price decreases quantity decreases	price decreases ambiguous quantity	ambiguous price quantity decreases

To ensure that you understand how to analyze shifts and changes in the market equilibrium, practice by simulating events, shifts and changes in a demand and supply diagram.

E. Price Controls

It is well understood that buyers and sellers often have conflicting interests in a market setting. Buyers typically seek lower prices, while sellers aim for higher prices. For instance, in the context of the cookie market, some buyers may express dissatisfaction with the equilibrium price of $3 per cookie as being too high, while some sellers may find it insufficient for achieving profitability. In response to such price distortions, governmental intervention may be warranted. However, despite the government's objective of market stabilization, such interventions can inadvertently lead to inefficiencies, wastage, and economic losses. These interventions, known as **price controls**, are the mechanisms through which governments regulate market prices.

There are two types of **price controls**: a **price ceiling** that favors buyers and a **price floor** that favors sellers.

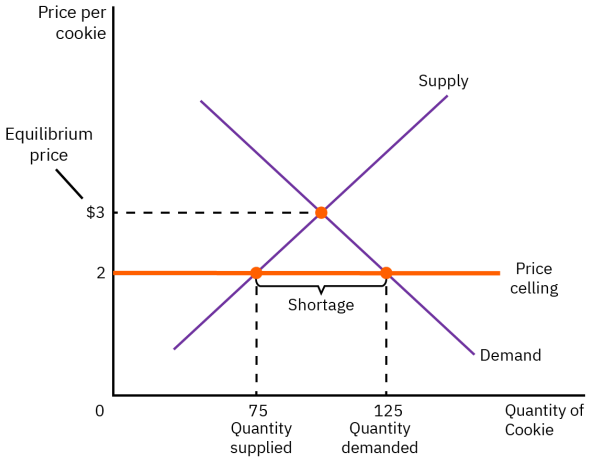
Price Ceiling

This is the **highest possible price that sellers can charge for their** goods. Since the price ceiling is set by the government, it is considered the legal maximum price. Charging above this 'ceiling' is not allowed. If the government imposes a price ceiling, the government is therefore protecting the consumers; thus, the buyers should be happy.

Graphically, this price ceiling is depicted by a horizontal line that passes through the imposed price amount. In our example, the imposed price ceiling is $2. It is less than the equilibrium price of $3, which consumers find expensive. Sellers can charge below the price ceiling but not above it.

Note that imposing a price ceiling can lead to a **shortage** as a **consequence**. At $2, the quantity demanded exceeds the quantity supplied by 50 cookies. This occurs because fewer sellers are willing to supply cookies at the price of $2, while buyers have a higher demand at this price point.

Figure 2.1.15.



In the event of a shortage, a **rationing mechanism** may be implemented to allocate the limited resources. Price rationing occurs when the supply of a good is restricted, leading to an increase in its price. The price increase serves to reduce demand distributing the available goods to those buyers who are willing and able to pay the higher price. For example, a price rationing mechanism can be initiated by buyers willing to wait in line to purchase cookies on a first-come, first-serve basis. While waiting in line allows for fair allocation, it represents an indirect cost since time is a valuable resource. Other types of rationing mechanisms exist, such as those implemented by sellers who ration based on their personal preferences, which may be viewed as biased or inefficient.

Even if a price ceiling is imposed with good intent, it produces unanticipated consequences such as increasing the opportunity cost of waiting in line, or displacing some buyers who would have wanted to buy cookies when there is no longer a supply available.

Price Ceiling Application: Rent Control

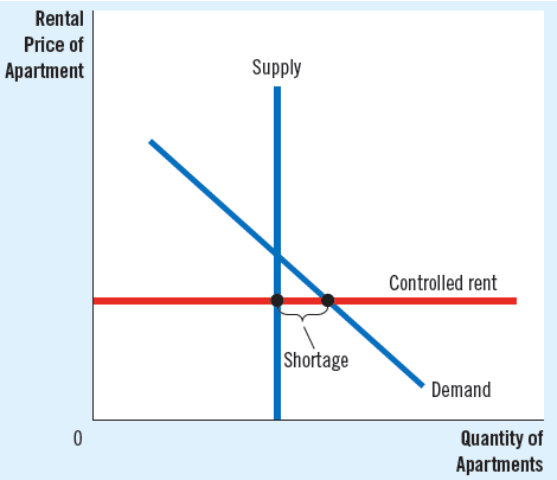
In order to assist those with limited financial means, the government may impose rent control to make housing cheaper. The unfavorable effects of rent control may not be noticeable initially.

In the short-run, landlords have less flexibility to increase the number of units for rent; therefore, the supply of rental units is fixed (shown as a vertical line in Panel a in Figure 2.1.16.). In the short-run, potential tenants take their time to decide whether to rent or not. Hence, they have an inelastic demand (steeper) in the short-run. As seen in Panel (a), when rent control is imposed, a (narrow) shortage develops.

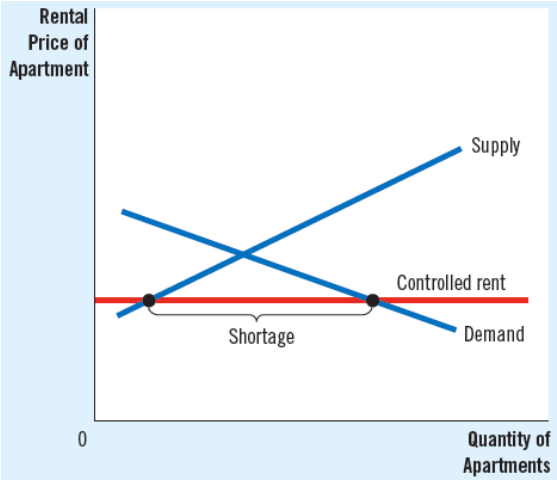
In the long-run, both landlords and potential tenants adjust to the market conditions. On the one hand, landlords are unmotivated to rent their rental units. On the other hand, potential tenants may have already made a decision to rent, given the cheaper price. Because of these changes, the supply and demand curves are now flatter, illustrating a more elastic supply and demand. As seen in Panel (b), a wider shortage occurs.

Figure 2.1.16.

(a) Rent Control in the Short-Run (supply and demand are inelastic)



(b) Rent Control in the Long-Run (supply and demand are elastic)



Price Floor

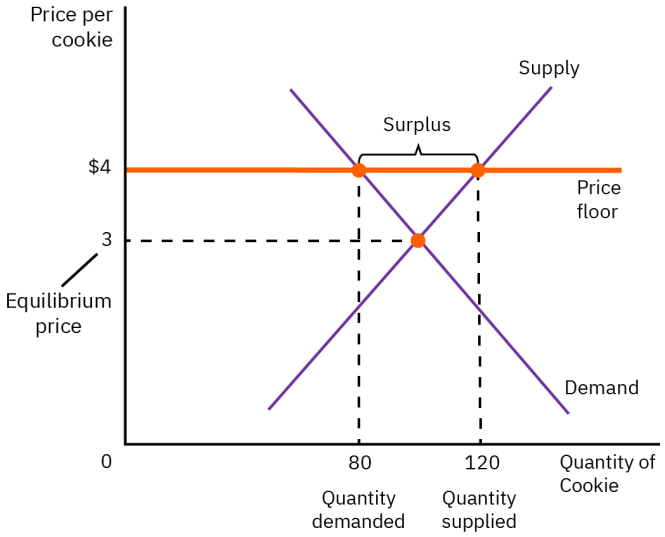
This is the **lowest possible price that sellers can charge for their** good. Since this price floor is set by the government, it is considered a legal minimum price. Charging below this 'floor' is not encouraged. If the government imposes a price floor, this price floor protects the producers; thus, sellers should be happy.

Graphically, the price floor is depicted by a horizontal line that passes through the imposed price floor amount, which in our example is $4. This price floor is more than the equilibrium price of $3, the price that sellers find low. Sellers can charge above the price floor but not below it.

Notice that the **consequence** of a price floor is a **surplus**. At $4, quantity supplied exceeds quantity demanded by 40 cookies. More sellers are willing to supply cookies at $4, but less buyers want to buy cookies at that price.

When a surplus occurs, a **rationing mechanism** may also inevitably occur.

Figure 2.1.17.



A price rationing mechanism occurs when the demand for the good is limited, which causes the good price to decrease, thereby increasing demand and allocating the available goods to those sellers who are willing and able to sell at the lower price.

Even if a price floor is imposed with good intent, it produces **unanticipated consequences** such as higher opportunity cost of looking for buyers or displacing some sellers who would have wanted to sell cookies when no one wants to buy them.

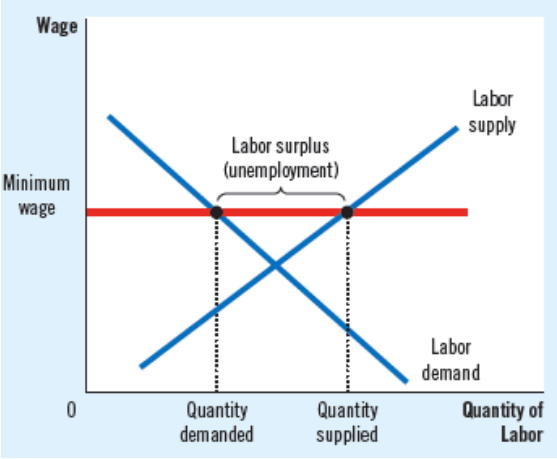
Price Floor Application: Minimum Wage

In a labor market, workers supply labor, and employers demand labor. Workers may find the equilibrium wage (price of labor) low; therefore, they demand a higher wage. To protect and support the workers, the government may impose a minimum wage, a type of price floor.

Graphically, imposing a minimum wage causes a labor surplus. Employers find hiring laborers expensive; therefore, they will demand less labor. However, with the higher wage, workers will be more willing to supply labor. With contrasting interests, the labor market is in disequilibrium, and there is a surplus of labor as a result.

A consequence of a minimum wage is unemployment.

Figure 2.1.18.



Even though the rationing mechanism distorts the market economy by causing either a shortage or a surplus, there are instances when the rationing mechanism will aid in eliminating inequality, especially during times of crisis.

F. Quantity Controls

Instead of directly controlling the price to alter market outcomes, the government may control the quantity of a good or service by enforcing an upper limit on supply. This can be in the form of licenses, production quotas, or import restrictions. Controlling quantity creates a forced 'scarcity' that, as a consequence, may lead to increased prices.

Consider a scenario where the government seeks to regulate cookie production due to concerns about the health implications of high sugar content. In a small town, the equilibrium price of a cookie is $4, with buyers and sellers willing to trade 7,000 cookies (the equilibrium quantity). If the government imposes a quota of 4,000 cookies, this production restriction creates a shortage. At this new quantity, the supply price falls to $3, while the demand price remains at $5, reflecting buyers' continued willingness to pay $5. Since the demand price is higher than the supply price, existing sellers are incentivized to sell at the prevailing market price of $5.

Quantity control, in essence, displaces buyers and sellers in the market who would have bought and sold at the market equilibrium quantity. This quantity control creates inefficiency due to missed opportunities; that is, goods that could have been produced and sold. If no quota was imposed, sellers would be able to sell more at a higher price, and buyers would be able to buy more at a lower price. Furthermore, quantity control may also incentivize people to evade or break the law by creating 'underground' markets.

Chapter 2.1 Review Questions

1. A market is best defined as:

A. A group of stores lined up on the same street
B. A place where auctions take place
C. A group of buyers and sellers interacting to demand and supply a good or service
D. A venue where the largest supplier of a product offers its goods

2. In a perfectly competitive market,

A. products are unique and differentiated.
B. firms are price takers.
C. sellers frequently raise their prices to generate higher revenues.
D. only one seller exists.

3. Which product is more likely to have a perfectly competitive market?

A. Tomatoes
B. Handmade crafts
C. Electricity
D. Luxury cars

4. All of the following cause a shift in the demand curve for waffles EXCEPT:

A. The price of pancakes
B. The price of waffles
C. The price of flour, an ingredient of waffles
D. The income of waffle consumers

5. Which of the following shifts the demand curve for hamburgers to the right?

A. An increase in the price of pizzas, a substitute for hamburgers
B. An increase in the price of soda, a complement to hamburgers
C. An increase in the number of people leaving the country
D. A decrease in the price of hamburgers

6. Suppose that rice is an inferior good. This means that its demand curve shifts to the _____ when _____ rises.

A. Right; the price of rice
B. Right; consumers' income
C. Left; the price of rice
D. Left; consumers' income

7. Which of the following moves the hotdog market up along a given supply curve?

A. An increase in the price of hotdogs
B. An increase in the price of soda, a complement to hotdogs
C. A decrease in the price of mustard, an input to hotdogs
D. A kitchen fire that destroys a popular hotdog joint

8. Which of the following shifts the supply curve of pancakes to the right?

A. An increase in the price of pancakes
B. An increase in the price of maple syrups, a complement to pancakes
C. A decrease in the price of eggs, an input to pancakes
D. A kitchen fire that destroys a popular pancake joint

9. Physical books and ebooks are substitutes. If the price of physical books increases, what happens in the market for ebooks?

A. The supply curve shifts to the left
B. The supply curve shifts to the right
C. The demand curve shifts to the left
D. The demand curve shifts to the right

10. The discovery of a large new reserve of gold will shift the _____ curve of jewelry, leading to a _____ equilibrium price.

A. Supply; higher
B. Supply; lower
C. Demand; higher
D. Demand; lower

Chapter 2.1. Review Quiz Answers

1. C
2. B
3. A
4. B
5. A
6. D
7. A
8. C
9. D
10. B

Chapter 2.2: The Nature and Functions of Product Markets – *Elasticity*

Chapter Overview

This chapter aims to explore the concept of elasticity and its crucial role in understanding markets. The chapter will outline the various complexities of price elasticity of demand, uncovering how consumers react to price changes for specific goods and services. Within this chapter you will learn to measure consumer price sensitivity, identifying determinants like availability of substitutes and necessities that influence their choices. Furthermore, this chapter will explain the income elasticity of demand, understanding how changes in income impact buying patterns. Finally, this chapter will analyze the elasticity of supply, outlining the determinants that influence producers' willingness to offer goods and services.

Learning Objectives

By the end of this chapter you will be able to:

- Understand elasticity, a measure of how responsive quantity demanded or supplied is to changes in price, and its importance in analyzing market behavior and predicting responses.
- Calculate price elasticity of demand, revealing how much demand changes due to a price shift.
- Relate income elasticity of demand to product categories, distinguishing necessities, luxuries, and income-neutral goods.
- Identify and analyze cross-price elasticity, exploring how the price change of one good affects demand for another.
- Apply elasticity of supply, understanding how changes in factors like input costs affect the quantity businesses are willing to offer.

Introduction

There are a lot of events that can prompt an increase in the price of airline tickets in the United States. Events would include fuel prices in the global market, a ‘revenge travel’ trend after lockdowns during the pandemic, or a tax on sales passed by Congress. How would U.S. travelers respond to the higher airline tickets?

According to the law of demand, all other things being equal (ceteris paribus), consumers would travel less because of the increase in airline ticket prices. Knowing the direction of the effect (increase or decrease) is important, but measuring the magnitude of how much the consumption would change is also of equivalent importance. To determine the magnitude or level of responsiveness, we study the

concept called *elasticity,* which measures how much buyers and sellers respond to changes in market conditions.

A. Price Elasticity of Demand

From the previous section, we have discussed how the determinants of demand (price, income, and price of related goods) influence the consumption behavior of buyers. We can determine the effect of quantity demanded qualitatively (direction) but not quantitatively (magnitude or size of the change). We can measure the change in consumer behavior in response to a change in the price of a good or service. To measure the response or **magnitude of price change in demand**, we use the concept of **elasticity**.

Price Elasticity of Demand and its Determinants

The **price elasticity of demand** measures **how much the quantity demanded responds to a change in price**. We can say that demand is price **elastic** if the quantity demanded responds substantially to a price change. On the other hand, demand is price **inelastic** if the quantity demanded responds minimally to price changes.

The price elasticity of demand for any good determines how willing the buyers are to purchase more or less of the good as its price decreases or increases. Here are some common determinants of price elasticity of demand:

- **Availability of Close Substitutes.** A good that has close substitutes is likely to have a demand that is price elastic because consumers can easily substitute one good for another. For instance, coffee can be easily substituted for tea or vice-versa. A small increase in the price of coffee (while the price of tea is constant) causes the quantity of coffee sold to decrease since people can switch to tea. However, if the good is gasoline, which has no close substitutes, we can expect that the demand is price inelastic or less elastic than the demand for coffee. A small increase in the price of gasoline minimally decreases the quantity demanded for it.

- **Necessities versus Luxuries.** If consumers require necessities such as drinking water or maintenance medicines, even if their prices rise, the decrease in quantity demanded is only minimal (if not zero). Hence, the price elasticity of demand for these necessities is inelastic. However, if consumers are in need of luxury items, such as a Rolex watch or a yacht, even if the prices of these luxury items rise, the decrease in quantity demanded is substantial since consumers can postpone their purchasing decision until prices stabilize. Therefore, the price elasticity of demand for these luxury items is elastic. Evaluating whether a good is a necessity or a luxury depends on the consumer's preferences and circumstances.

- **Definition of the Market.** We can define the market as broad or narrow. Narrowly defined markets, such as the market for 'cookies,' tend to have a demand that is price elastic because it is easier to replace cookies with another type of baked goods. Broadly defined markets, such as the market for "food," have a demand that is price inelastic because no other category can replace food.

- **Time Horizon.** Goods tend to have a demand that is more price elastic over long time horizons. For example, when the price of gasoline increases, the quantity demanded minimally decreases in the short run. Eventually, however, when consumers have adjusted to the gasoline's new price, consumers tend to find alternatives such as switching to a more fuel-efficient car, opting for public transportation, or transferring to a nearer place walkable to their workplace. In the long run, the quantity demanded for gasoline decreases substantially.

a. Computing the Price Elasticity of Demand

We measure the price elasticity of demand using this **basic formula**:

Formula 2.2.1

$$Price\ elasticity\ of\ demand\ = \left|\frac{\%\Delta Qd}{\%\Delta P}\right| = \left|\frac{Percentage\ change\ in\ quantity\ demanded}{Percentage\ change\ in\ price}\right|$$

For example, suppose that a 15% increase in the price of a cookie causes the number of cookies purchased to decrease by 30%. Using the formula above, we can compute the price elasticity of demand as:

$$Price\ elasticity\ of\ demand\ = \left|\frac{-\ 30\%}{15\%}\right| = |-\ 2| = 2$$

Since the quantity demanded decreased, the sign of the change is negative. If the demand increases, on the other hand, then the change is positive. Mathematically, we will always get a negative value for price elasticity of demand. However, since we are concerned with the magnitude or size of the change, we will use the absolute value of the price elasticity of demand for interpretation purposes.

To interpret the answer above, the price elasticity of demand is 2, which means that the change in quantity demanded is twice as much as the change in price. We can, therefore, say that the consumers of cookies respond substantially to a price change, and their demand is price elastic.

Suppose the percentage changes in quantity demanded and price are not given; the price elasticity of demand can be determined with alternative formulas. To use these formulas, the values for the current and the previous quantity demand and price are usually given. For example, see Table 2.2.1. Below.

Table 2.2.1.

Price	Quantity Demanded
P_1 = \$4	Qd_1 = 120
P_2 = \$4.6	Qd_2 = 84

1) Expanded Form

The numerator is an expanded version of the percentage change in quantity demanded, and the denominator is an expanded version of the percentage change in price. According to the ***Expanded Form*** formula: The percentage change in quantity and price can be determined by subtracting the previous from the current, then dividing the difference by the previous value and multiplying the result by 100. Therefore, a 30 percent change (decrease) in quantity demanded divided by a 15 percent change (increase) in price determines the price elasticity of demand equaling 2.

$$Price\ elasticity\ of\ demand\ = \left|\frac{\frac{Qd_2-Qd_1}{Qd_1}}{\frac{P_2-P_1}{P_1}}\right| = \left|\frac{\frac{84-120}{120}}{\frac{4.6-4}{4}}\right| = \left|\frac{-0.30}{0.15}\right| = |-2| = 2$$

2) Midpoint Formula

After subtracting the previous from the current quantity demanded, this value is then divided by the average (midpoint) of the previous and current quantity demanded value. Then, subtracting the previous from the current price, this value is then divided by the average (midpoint) of the previous and current price values. Next, divide the estimated value for the quantity demanded by the estimated value for the price.

$$Price\ elasticity\ of\ demand\ = \left|\frac{\frac{Qd_2-Qd_1}{(Qd_2+Qd_1)/2}}{\frac{P_2-P_1}{(P_2+P_1)/2}}\right| = \left|\frac{\frac{84-120}{(84+120)/2}}{\frac{4.6-4}{(4.6+4)/2}}\right| = \left|\frac{-0.35}{0.14}\right| = |-2.5| = 2.5$$

The answer is slightly greater than the elasticities calculated using the basic and expanded formulas.

But just the same, the demand is still price elastic.

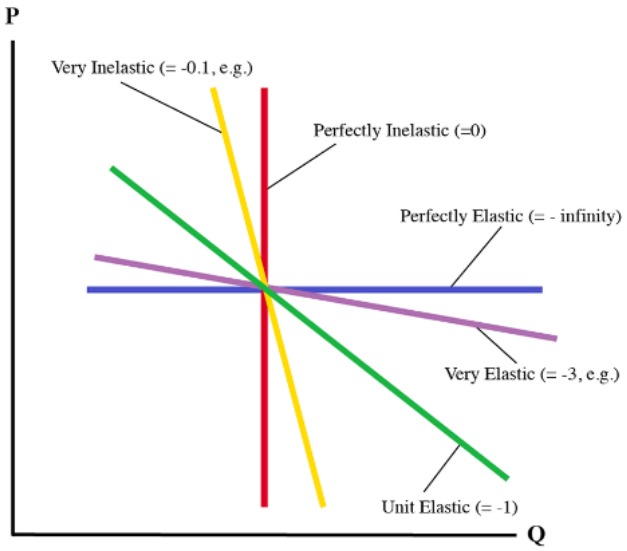
How do we interpret the price elasticity of demand, and how does it look graphically? Note the elasticity is closely related to the slope of the demand curve through a given point.

Table 2.2.1.

Price Elasticity of Demand	Demand Curve
if > 1, then demand is elastic	flatter passing through a given point
if < 1, then demand is inelastic	steeper passing through a given point
if = 1, then demand is unit-elastic	constant slope at any given point
if = 0, then demand is perfectly inelastic	vertical
if infinity, then demand is perfectly elastic	horizontal

See Figure 2.2.1 below for a graphical representation of Table 2.2.1 above.

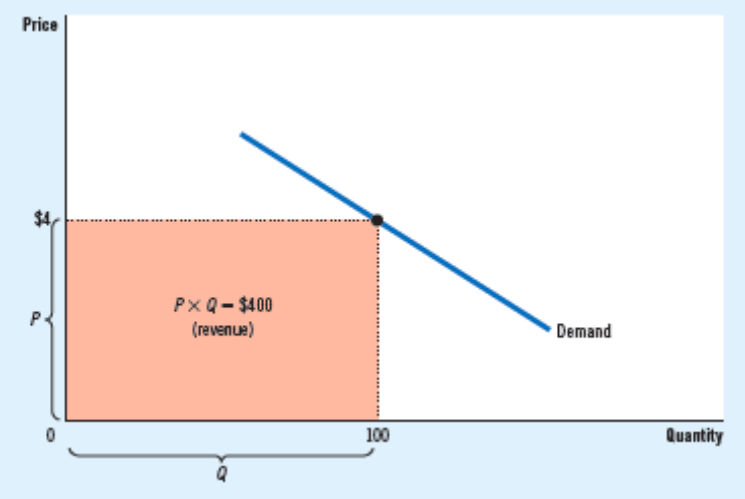
Figure 2.2.1.



b. Total Revenue and the Price Elasticity of Demand

Changes in quantity demanded due to a change in price affect total revenue. This revenue is obtained by multiplying the amount paid by buyers and accepted by sellers of a good. We calculate it using the formula: Price (P) x Quantity (Q). As shown in the figure below, the revenue is the area (box) under the demand curve that is bounded by the given price on the y-axis and by the corresponding quantity on the x-axis. Since P = $4 and Q = 100, then the total revenue at this point on the demand curve is $4 x 100 = $400.

Figure 2.2.2.



Total revenue changes as price and quantity demanded change. In other words, a change in total revenue is driven by the price elasticity of demand. Consider the following cases (refer to panel of figures below):

(a) Inelastic demand

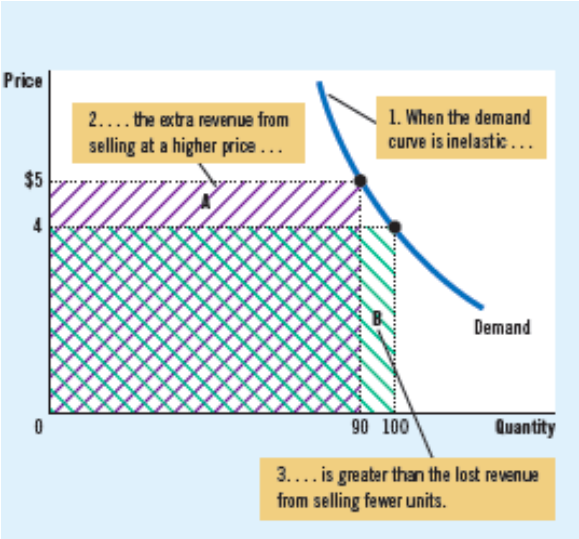
The demand curve looks steeper and is inelastic. This means that there is a minimal decrease in quantity demanded when the price increases. At the price of $4, the total revenue (box with green diagonal stripes) is $400, and at a higher price of $5, the total revenue (box with purple diagonal stripes) is $450. Even if there are losses (area B) because of reduced demand, the extra gains (area A) from the increased price of the good are more than enough to cover the losses. **Overall, it is a good move to increase the price when demand is inelastic because total revenue increases as well.**

(b) Elastic demand

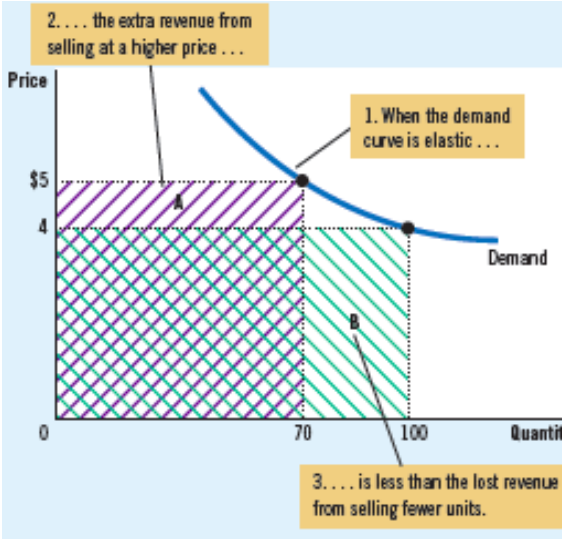
The demand curve looks flatter and is elastic. This means that there is a substantial decrease in quantity demanded when the price increases. At the price of $3, the total revenue (box with green diagonal stripes) is $400, and at a higher price of $5, the total revenue (box with purple diagonal stripes) is $350. The extra gains (area A) from increasing the price of the good are insufficient to cover the losses (area B) due to reduced demand. **Overall, it is not a good move to increase the price when demand is elastic because total revenue decreases.**

Figure 2.2.3.

(a) The Case of Inelastic Demand



(b) The Case of Elastic Demand



(c) Unit-Elastic

When demand is unit-elastic, **total revenue remains constant** when the price changes.

c. Total Revenue and Elasticity along a Linear Demand Curve

The slope of a linear demand curve is constant, but its elasticity is not.

The reason for this is that the slope is computed as the ratio of changes in the two variables: $\left|\frac{\Delta Qd}{\Delta P}\right|$

While elasticity is computed as the ratio of percentage changes in the two variables: $\left|\frac{\%\Delta Qd}{\%\Delta P}\right|$

The linear demand curve shows that the price elasticity of demand differs at each point on the demand curve. Given a demand schedule, we can compute the price elasticity of demand at each level of price and quantity demanded.

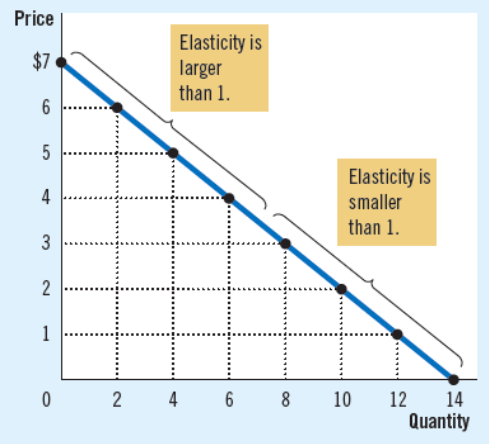
Table 2.2.2.

Price ($)	Quantity	Total Revenue ($)	$\%\Delta P$	$\%\Delta Qd$	Elasticity	Description
7	0	0				
6	2	12	15	200	13.0	Elastic
5	4	20	18	67	3.7	Elastic
4	6	24	22	40	1.8	Elastic
3	8	24	29	29	1.0	Unit Elastic
2	10	20	40	22	0.6	Inelastic
1	12	12	67	18	0.3	Inelastic
0	14	0	200	16	0.1	Inelastic

Notice that at points with a low price and high quantity, the demand curve is inelastic. At points with a high price and low quantity, the demand curve is elastic. This is illustrated graphically in Figure 2.2.4.

Total revenue 1) decreases when changes in price and quantity occur in the elastic region; 2) increases when changes in price and quantity occur in the inelastic region; and 3) remains the same in the unit-elastic region.

Figure 2.2.4.



B. Income Elasticity of Demand

The **income elasticity of demand (YED)** measures **how much the quantity demanded responds to a change in income**, using this formula:

Formula 2.2.2

$$Income\ elasticity\ of\ demand = \frac{\%\Delta Qd}{\%\Delta M} = \frac{Percentage\ change\ in\ quantity\ demanded}{Percentage\ change\ in\ income}$$

When the income elasticity is **positive**, consumption of the good increases. When income increases, the good is a **normal good**.

When the income elasticity is **negative**, consumption of the good decreases. When income increases, the good is an **inferior good**.

C. Cross-Price Elasticity of Demand

The **cross-price elasticity of demand (XED)** measures **how much the quantity demanded responds to a change in the price of a related good** using this formula:

Formula 2.2.3

$$Cross - price\ elasticity\ of\ demand\ = \frac{\%\Delta Qd_{good1}}{\%\Delta P_{good2}} = \frac{Percentage\ change\ in\ quantity\ demanded\ of\ good\ 1}{Percentage\ change\ in\ the\ price\ good\ 2}$$

When the cross-price elasticity of demand is **positive**, **good 1 and good 2 are substitutes**. For example, suppose good 1 is coffee, and good 2 is tea, then when the price of tea increases, the quantity demanded of coffee also increases because coffee is cheaper relative to tea. The price of good 2 and the quantity demanded of good 1 moves in the same direction.

When the cross-price elasticity of demand is **negative, good 1 and good 2 are complements**. For example, suppose good 1 is ink, and good 2 is a printer then, when the price of the printer increases, the quantity demanded of ink decreases because without buying a printer, the ink is not needed. The price of good 2 and the quantity demanded of good 1 move in the opposite direction.

D. Elasticity of Supply

The **price elasticity of supply** measures **how much the quantity supplied responds to a change in price.** We can say that supply is price elastic if the quantity supplied responds substantially to price changes, while supply is price inelastic if the quantity supplied responds minimally to price changes.

The price elasticity of supply for any good determines how willing the sellers are to produce and sell more or less of their goods as the prices of these goods decrease or increase. The price elasticity of supply depends on the:

- **Flexibility of sellers to change the amount of the good they produce.** The decision to produce more or less of a good depends on many determinants. These determinants include the number of producers, production capacity, production period, factor mobility, input costs, technology, etc.

For example, a land with a mountain view has an inelastic supply because it is not possible to produce more of it. That is, the mountain is not mobile. Manufactured goods, such as pencils, phones, bikes, and shoes, have a price elasticity of supply that is elastic since producers can produce more of these goods by operating their factories for longer than usual.

- **Time period being considered**. Supply is usually inelastic in the short-run and elastic in the long-run. This is because it takes time for sellers to adjust their supply in the short-term, given the size of their factories, available resources, etc.

Computing the Price Elasticity of Supply

We measure the price elasticity of supply using this **basic formula**:

Formula 2.2.4

$$Price\ elasticity\ of\ supply = \frac{\%\Delta Qs}{\%\Delta P} = \frac{Percentage\ change\ in\ quantity\ supplied}{Percentage\ change\ in\ price}$$

For example, suppose that a 10% increase in the price of milk per gallon causes gallons of milk to increase by 20%. Using the formula above, we can compute the price elasticity of supply as:

$$Price\ elasticity\ of\ supply = \frac{\%\Delta Qs}{\%\Delta P} = \frac{20\%}{10\%} = 2$$

Hence, the price elasticity of supply is 2. Therefore, milk producers respond twice as much as the change in price. We can, therefore, say milk producers respond substantially to a price change and their supply is price elastic.

Using the alternative formulas for Price Elasticity of Supply, given the values for price and quantity supplied:

Table 2.2.3.

Price	Quantity Supplied
P_1 = \$2.85	Qs_1 = 9,000 gallons
P_2 = \$3.15	Qs_2 = 11,000 gallons

1) Expanded Form

$$Price\ elasticity\ of\ supply = \frac{\frac{Qs_2 - Qs_1}{Qs_1}}{\frac{P_2 - P_1}{P_1}} = \frac{\frac{11{,}000 - 9{,}000}{9{,}000}}{\frac{3.15 - 2.85}{2.85}} = \frac{0.22}{0.10} = 2.2$$

The numerator is the expanded version of the percentage change in quantity supplied, and the denominator is the expanded version of the percentage change in price.

2) Midpoint Formula

Using the current and the previous periods for quantity and price, the price elasticity of supply is 2.

$$Price\ elasticity\ of\ supply = \frac{\frac{Qs_2 - Qs_1}{(Qs_2 + Qs_1)/2}}{\frac{P_2 - P_1}{(P_2 + P_1)/2}} = \frac{\frac{11{,}000 - 9{,}000}{(11{,}000 + 9{,}000)/2}}{\frac{3.15 - 2.85}{(3.15 + 2.85)/2}} = \frac{0.20}{0.10} = 2$$

This answer is slightly less than the elasticity computed using the expanded form, but just the same, the supply is still price elastic.

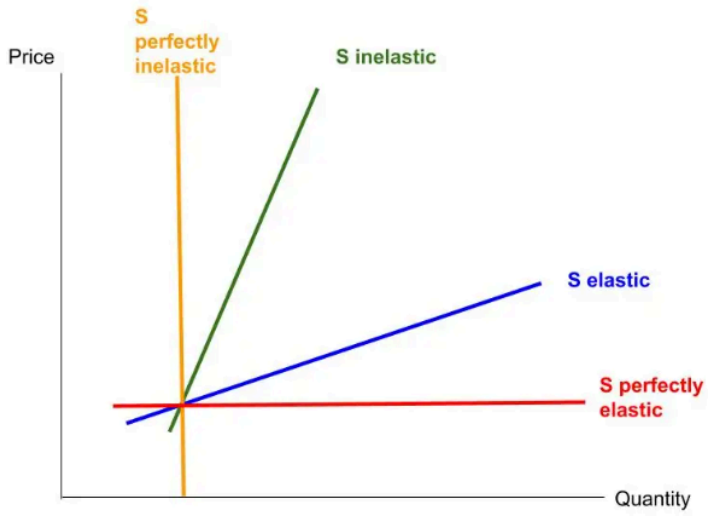
How do we interpret the price elasticity of supply, and how does it look graphically? Note the price elasticity of supply is closely related to the slope of the supply curve through a given point.

Table 2.2.4.

Price Elasticity of Supply	Supply Curve
if > 1, then supply is elastic	flatter passing through a given point
if < 1, then supply is inelastic	steeper passing through a given point
if = 1, then supply is unit-elastic	constant slope at any given point
if = 0, then supply is perfectly inelastic	vertical
if infinity, then supply is perfectly elastic	horizontal

See Figure 2.2.5 below for a graphical representation of Table 2.2.4 above.

Figure 2.2.5.



Concept Check 2.5.	
Elasticity	a measure of the responsiveness of quantity demanded or quantity supplied to a change in one of its determinants (price or income)
Price elasticity of demand	a measure of how much the quantity demanded of a good responds to a change in the price of that good
Income elasticity of demand	a measure of how much the quantity demanded of a good responds to a change in consumers' income
Cross-price elasticity of demand	a measure of how much the quantity demanded of one good responds to a change in the price of another good
Price elasticity of supply	a measure of how much the quantity supplied of a good responds to a change in the price of that good

Chapter 2.2 Review Questions

1. Price elasticity of demand tends to be small for

A. goods that are necessities, such as medicine.
B. goods that have many close substitutes.
C. goods whose market is narrowly defined.
D. the measurement of the long-run response.

2. When the _____ elasticity of demand is _____ than one, a rise in the price of a product results in a decrease in the total expenditure consumers allocate towards it.

A. Income; less
B. Income; greater
C. Price; less
D. Price; greater

3. A linear, downward-sloping demand curve indicates

A. Inelasticity
B. Unit elasticity
C. Elasticity
D. Inelasticity at some points and elasticity at others

4. The citizens of Boston spend a higher fraction of their income on clothes than the citizens of Chicago do. What could justify that?

A. Boston has lower clothes prices, and the price elasticity of demand is zero.
B. Boston has lower clothes prices, and the price elasticity of demand is 0.6.
C. Boston has lower income, and the income elasticity of demand is 0.6.
D. Boston has lower income, and the income elasticity of demand is 1.7.

5. The price of Good X rises from $20 to $30, and its quantity supplied rises from 120 to 150 units. The price elasticity of supply using the midpoint method is

A. ⅕
B. ½
C. 2
D. 5

6. The supply curve is vertical when the price elasticity of supply is

A. Greater than 1
B. Between 0 and 1
C. Zero
D. Infinity

7. A scenario in which firms can easily enter and exit a market over time indicates that, in the long run,

A. The demand curve becomes more elastic
B. The demand curve becomes less elastic
C. The supply curve becomes more elastic
D. The supply curve becomes less elastic

8. An increase in the supply of watermelons reduces the total revenue of watermelons if

A. Supply is inelastic
B. Supply is elastic
C. Demand is inelastic
D. Demand is elastic

9. **Given that the demand curve for oil is _____ elastic in the long term, OPEC's reduction in the supply of oil had a _____ impact on the price in the long run than it did in the short run.**

   A. Less; smaller
   B. Less; larger
   C. More; smaller
   D. More; larger

10. **Over time, technological breakthroughs have increased consumers' incomes and reduced the price of laptops. Both of these factors increase the amount consumers spend on laptops if the income elasticity of demand is greater than _____ and the price elasticity of demand is greater than _____.**

   a. Zero; zero
   b. Zero; one
   c. One; zero
   d. One; one

Chapter 2.2. Review Quiz Answers

1. A
2. D
3. D
4. C
5. B
6. C
7. C
8. C
9. C
10. B

Chapter 2.3: The Nature and Functions of Product Markets – *Markets and Welfare*

Chapter Overview

This chapter explores how markets impact welfare and efficiency. Within this chapter, we will analyze the concept of consumer surplus, the difference between what consumers pay and what they're willing to pay, revealing the value consumers gain from participating in markets. In addition to this, we will identify and explain topics such as producer surplus, the difference between what producers sell for and their production costs, highlighting the value producers capture in market transactions. Furthermore, this chapter will aim to unpack the concept of tax incidence, where the burden of a tax ultimately falls, and how it can differ from who initially pays it. Throughout this chapter you will gain further understanding of how markets affect welfare, the potential pitfalls of government intervention, and the complex interplay between economic efficiency and broader societal objectives.

Learning Objectives

By the end of this chapter you will be able to:

- Define and differentiate consumer surplus (benefit gained by consumers) and producer surplus (benefit gained by producers) in a market transaction.
- Analyze how government interventions, like taxes and subsidies, affect the distribution of consumer and producer surplus.
- Apply the concepts of consumer and producer surplus to evaluate real-world policy decisions and their impact on different stakeholder groups.
- Identify and analyze market failures, like externalities and monopolies, that can lead to inefficiencies and reduced societal welfare.
- Explore the complex relationship between economic efficiency, which focuses on maximizing total surplus, and broader societal objectives like equity and fairness.

Introduction

The ultimate goal in economics is to efficiently allocate scarce resources. In a free market economy, the ‘invisible hand’ orchestrates the interaction of market participants, and the price mechanism motivates the behavior of buyers to consume and sellers to produce goods and services. This leads to favorable market outcomes and maximization of economic well-being. To understand more about societal welfare, we discuss how consumers and producers benefit from market participation and how efficiency is achieved in a market economy in the context of a perfectly competitive market. We will further look into how societal welfare changes when the government participates in the market through policy interventions. Irrespective of their good intentions, do government policies actually enhance societal welfare? By the end of this section, we will be able to answer this question.

A. Consumer Surplus, Producer Surplus, and Market Efficiency

Consumer Surplus

How do buyers benefit when they participate in the market? What makes them purchase a good? Suppose that we are analyzing the market for stickers and there are four (4) buyers, namely, Individual *A*, Individual *B*, Individual *C*, and Individual *D*. Their preference for stickers varies. *A* and *B* are collectors, while *C* and *D* just find them appealing at times.

Each of these buyers has their own **willingness to pay (WTP)** for the specific sticker sold in the market. Willingness to pay is the **maximum amount that a buyer will pay for a good.** Since WTP is a subjective value, buyers who prefer the sticker more than the others will assign higher values for the good. Given that *A* and *B* are collectors, we can expect that their willingness to pay is higher than that of others. If the sticker in the market is something that *A* needs for their collection, then they would be more willing to pay for it than *B*.

Suppose the buyer's willingness to pay is the amount found in Table 2.3.1. If the market price of the sticker is $7, *A* and *B* will be purchasing a sticker. *C* is indifferent and may or may not purchase a sticker. *D* will not. At $7, *D* finds the sticker expensive and would rather use their money to buy something else that they value.

Among these buyers, *A* will be the most satisfied, since the sticker is only selling for $7 when they are willing to pay $10 for it.

Table 2.3.1.

Buyer	Willingness to Pay
Individual *A*	$10
Individual *B*	$8
Individual *C*	$7
Individual *D*	$5

We call the benefit that a buyer receives from purchasing a good **consumer surplus.** This consumer surplus is the **difference between the amount a buyer is willing to pay for the good and the amount the buyer actually pays for it**. In our example, *A* has a consumer surplus of $3 ($10 - $7) and *B*, $1 ($8 – $7). For as long as the buyer's willingness to pay is greater than the market price, the buyer will purchase the goods. If it is equal, the consumer is indifferent and may either decide to purchase the good or another good.

Consumer surplus is closely associated with the demand curve. **We can derive the demand schedule from the buyer's willingness to pay.** If the price is more than $10, neither Individual *A*, Individual *B*, Individual *C*, or Individual *D* will purchase stickers. When the price is between $8 and $10, only *A* will buy the sticker because she receives a consumer surplus at this price range. When the price is between $7 and $8, *B* joins *A* in the market and purchases a sticker, making the quantity demanded equal to 2.

When the price is between $5 and $7, *C* joins the market for stickers. When the price is $5 or less, *D* also joins the market for stickers, making the quantity demanded equal to 4.

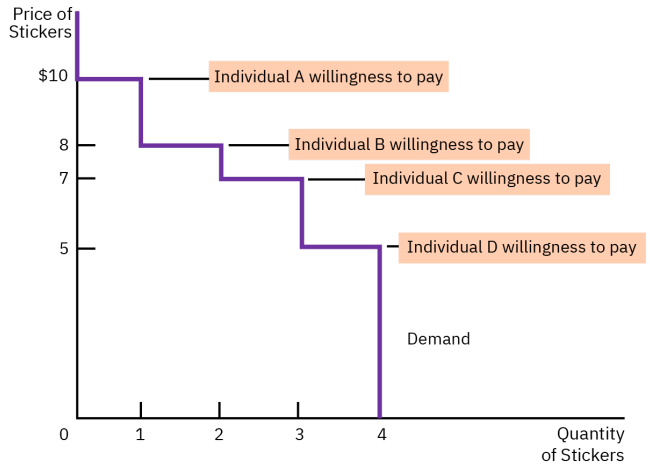
The demand curve looks like steps going down. At any quantity, the price given by the demand curve represents the marginal (additional) buyer's willingness to pay, who would be the one to exit the market first when the goods become more expensive. For example, at a quantity of 4 stickers, the demand curve has a height of $5, the price that *D* (marginal buyer) is willing to pay for the sticker. At a quantity of 3 stickers, the demand curve has a height of $7, the price that *C* (who is now the marginal buyer) is willing to pay.

Table 2.3.2.

Demand Schedule and Demand Curve

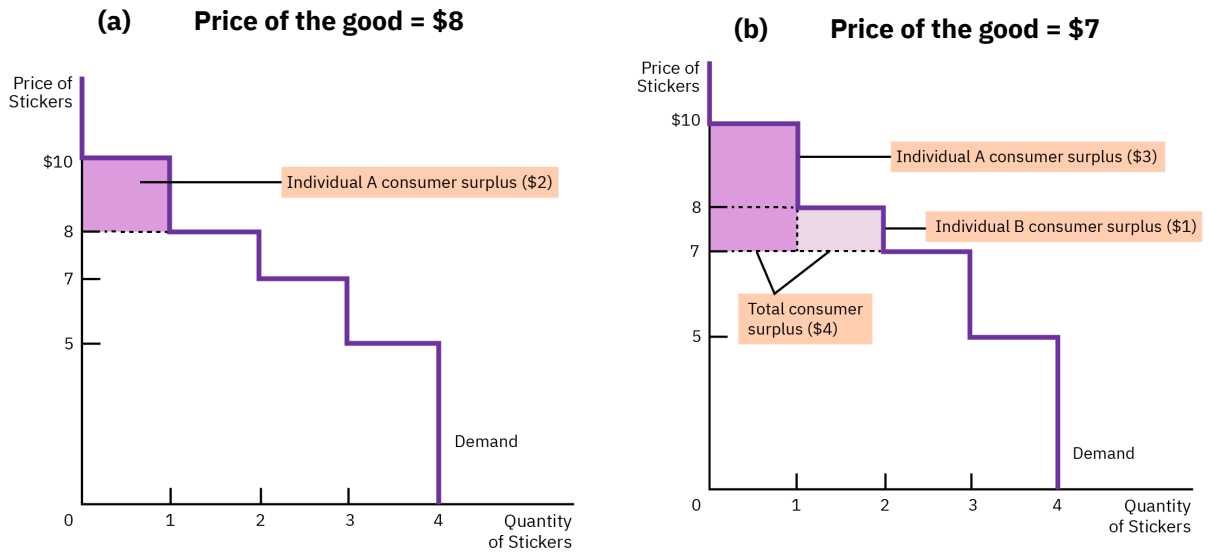
Price	Buyers	Quantity Demanded
More than $10	None	0
$8 to $10	Individual *A*	1
$7 to $8	Individual *A* Individual *B*	2
$5 to $7	Individual *A* Individual *B* Individual *C*	3
$5 and less	Individual *A* Individual *B* Individual *C* Individual *D*	4

Figure 2.3.1.



We can further use the demand curve to **measure consumer surplus.** Here are two scenarios:

Figure 2.3.2.



(a) Price of the good = $8

When the price of the sticker is $8 (or slightly above), the quantity demanded is 1 (Individual *A*). The consumer surplus is the area below the demand curve and above the price. Since it is a rectangle, the consumer surplus is simply computed as ***(WTP - Price) x Quantity Demanded***. In this case ($10 - $8) x (1) = $2.

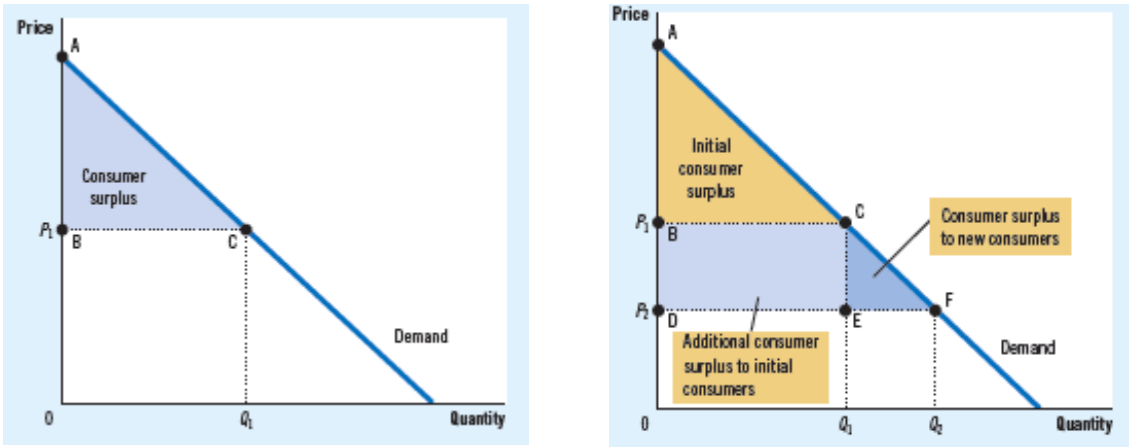
(b) Price of the good = $7

When the price of the sticker is $7 (or slightly above), the quantity demanded is 2 (Individual A and Individual B). The consumer surplus (CS) is now bigger and comprises Individual A's original and the additional consumer surplus and Individual B's consumer surplus. The total consumer surplus is now equal to $4 (Individual A = ($10 - $7)* 1 plus Individual B = ($8 - $7) * 1). Regardless of the price in the market, the consumer surplus is always the area below the demand curve and above the price. The consumer surplus gets bigger as more buyers participate in the market when the price decreases.

As the number of buyers grows, the influence of individual buyers becomes smaller. This smooths out the demand curve, making it change from a discrete (step-like pattern) to a linear form. In Panel (a) below, when the price is P_1, the quantity demanded is Q_1, and consumer surplus is the area of the triangle ABC. In Panel (b), the price declines to P_2, the quantity demanded increases to Q_2, and the consumer surplus now sums up to the area of the bigger triangle ADF. This new total consumer surplus now includes the additional consumer surplus of existing buyers (area BCED) and the consumer surplus of new entrants in the market (area CEF). Therefore, the total consumer surplus is the area ADF.

Figure 2.3.3.

(a) Consumer Surplus at Price P_1 **(b) Consumer Surplus at P_2**



In general, consumer surplus is used as a measure of economic well-being. If there is a surplus, consumers are satisfied. In designing policies or interventions, policymakers should consider consumer surplus in order to enhance consumer behavior. Note, however, that when the good is inherently bad (i.e., drugs), the government may disregard consumer surplus since the good is not beneficial to the consumer in the first place.

Producer Surplus

How do sellers benefit when they participate in the market? What makes them sell a good? Suppose that we are still analyzing the market for stickers and there are four (4) sellers, namely, Individual *E*, Individual *F*, Individual *G*, and Individual *H*. Their willingness to produce stickers depends on the associated cost of sticker production, which is the value of everything a seller must give up to produce that good.

Each seller has their own **willingness to accept (WTA)** for the specific sticker sold in the market. It is the **lowest cost or price that a seller will accept to produce and sell the goods.** Since sellers use different resources (i.e., labor, capital) to produce their goods, their cost varies. The higher the market price that the seller is willing to accept, the better for the seller. If the cost is more than the market price, sellers would rather use their resources to produce other goods.

Let's say producers' willingness to accept (cost) is the amount shown in Table 2.3.3. If the market price of the sticker is $7, *G* and *H* will be willing to sell and produce the sticker. At this price, *E* and *F* will find producing the good costly; therefore, they will not participate in the market.

Among them, *H* will be the most satisfied, since the sticker is selling for $7 when her cost is just $5.

Table 2.3.3.

Seller	Willingness to Accept (Cost)
Individual *E*	$9
Individual *F*	$8
Individual *G*	$6
Individual *H*	$5

We call the benefit that a seller receives from producing and selling a good a **producer surplus.** It is the **difference between the amount the buyers pay for the good and the seller's production cost (willingness to accept)**. In our example, Individual *H* has a producer surplus of $2 ($7 - $5) and Individual *G*, $1 ($7 - $6). For as long as the market price is greater than the seller's cost, the seller produces and sells the sticker (assuming that they are rational). If the market price in the seller's price is equal, then the producer is indifferent and may either decide to produce the good or another good.

Producer surplus is closely associated with the supply curve. **We can derive the supply schedule from the cost (willingness to accept) of the sellers.** If the price is less than $6, none of the sellers will produce stickers. When the price is $5 to $6, only Individual *H* will produce and sell because they receive a producer surplus at this price range. When the price is $6 to $8, *G* joins *H* in the market and produces a sticker, making the quantity supplied equal to 2. When the price is $8 to $9, Individual *F* joins the market for stickers. And, when the price is $9 or more, Individual *E* joins them, making the quantity supplied equal to 4.

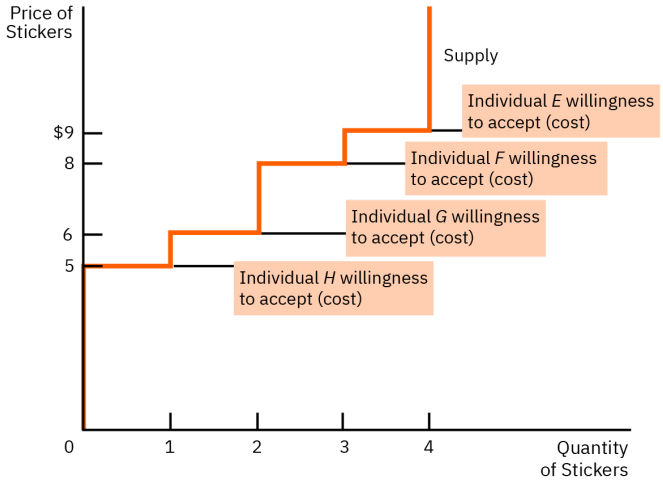
The supply curve looks like stairs going up (Figure 2.3.4.). At any quantity, the price given by the supply curve represents the willingness to accept the marginal (additional) seller, who is the one who will enter the market first when the sticker becomes more expensive. For example, at a quantity of 3 stickers, the supply curve has a minimum height of $8, the price that *F* (marginal seller) is willing to accept to produce and sell a sticker. At a quantity of 4 stickers, the supply curve has a minimum height of $9, the price that *E* (who is now the marginal seller) is willing to accept.

Table 2.3.4.

Supply Schedule and Supply Curve

Price	Sellers	Quantity Supplied
$9 or more	Individual *E* Individual *F* Individual *G* Individual *H*	4
$8 to $9	Individual *F* Individual *G* Individual *H*	3
$6 to 8	Individual *G* Individual *H*	2
$5 to $6	Individual *H*	1
Less than $5	None	0

Figure 2.3.4.



We can further use the supply curve to **measure producer surplus.** Here are two scenarios:

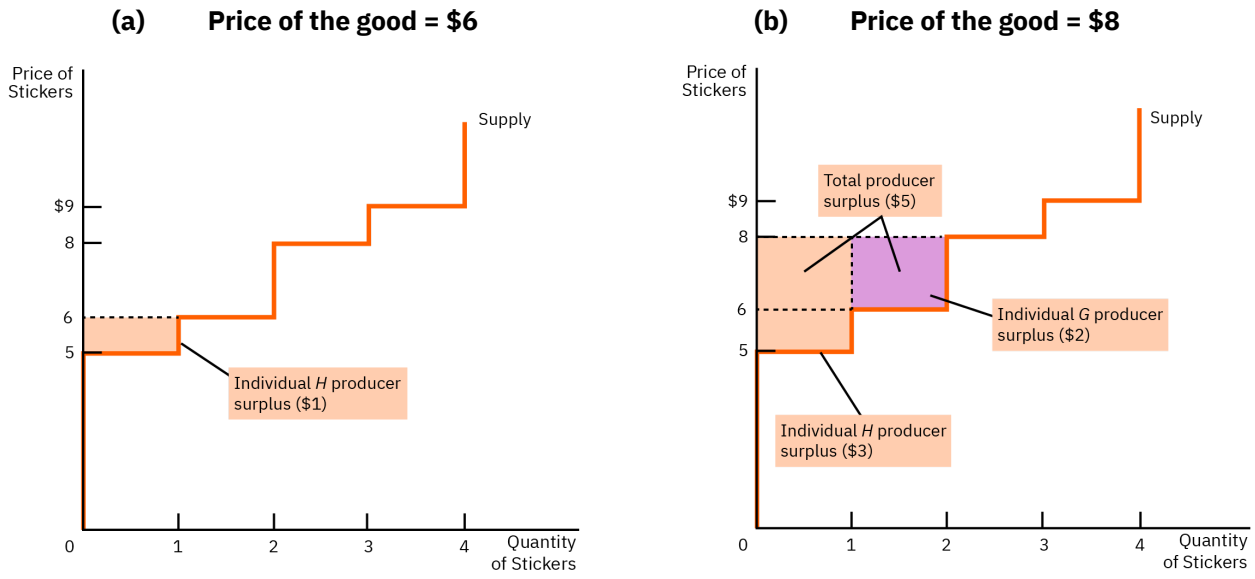
(a) Price of the good = $6

When the price of the sticker is $6 (or slightly less), the quantity supplied is 1 (Individual *H*). The producer surplus is the area above the supply curve and below the price. Since it is a rectangle, the producer surplus is simply computed as (Price - Cost) x Quantity Supplied. In this case ($6 - $5) x (1) = $1.

(b) Price of the good = $8

When the price of the sticker is $8 (or slightly less), the quantity supplied is 2 (Individual *G* and Individual *H*). The producer surplus (PS) is now bigger, which is composed of *H*'s original and additional producer surplus and *G*'s producer surplus. The total producer surplus is now equal to $5 (Individual *H* = ($8 - $5) * 1 plus Individual *G* = ($8 - $6) * 1).

Figure 2.3.5.

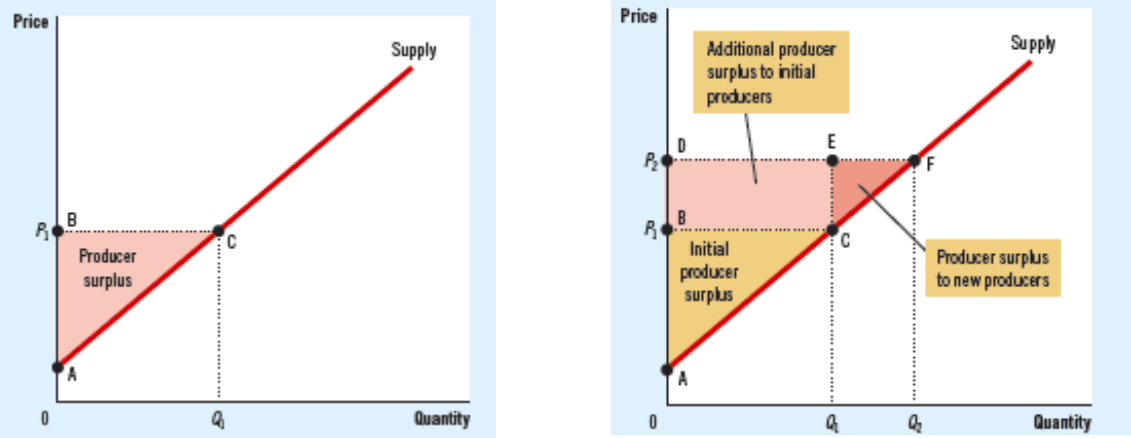


Regardless of the price in the market, the producer surplus is always the area above the supply curve and below the price. It gets bigger as more sellers participate in the market when the price increases.

When the number of sellers becomes larger, the entry and exit of marginal sellers are minimal so that the supply curve transforms from discrete (staircase) into a linear form. In Panel (a) below, when the price is P_1, the quantity supplied is Q_1, and producer surplus is the area of the triangle ABC. In Panel (b), the price increases to P_2, the quantity supplied increases to Q_2, and the producer surplus sums up to the area of the bigger triangle ADF. The total producer surplus now includes the additional producer surplus of existing buyers (area BCFD) and the producer surplus of new entrants in the market (area CEF).

Figure 2.3.6.

(a) Producer Surplus at Price P_1 **(b) Producer Surplus at P_2**



In general, producer surplus is used as a measure of economic well-being for sellers, just like how consumer surplus is for buyers. If there is a producer surplus, sellers are satisfied.

Market Efficiency

Efficiency is achieved when both the consumer surplus and producer surplus are maximized. Since both measure the economic well-being of buyers and sellers the **total surplus** (sum of consumer and producer surplus) measures the **society's economic well-being.**

To recap, we measure consumer surplus as:

- ***Consumer surplus*** *= Value to buyers (willingness to pay) - Amount paid by buyers (market price)*

In the same way, we measure producer surplus as:

- ***Producer surplus*** *= Amount received by sellers (market price)*

- Cost to Sellers (willingness to accept/sell)

Combining both measures, we derive the Total Surplus:

- ***Total surplus*** *= [Value to buyers - Amount paid by buyers] + [Amount received by sellers - cost to sellers]*

Since the amount paid by buyers is also the amount received by sellers (cancel each other out), we can then express total surplus in its simplest form as:

- ***Total surplus*** *= Value to buyers - Cost to sellers*

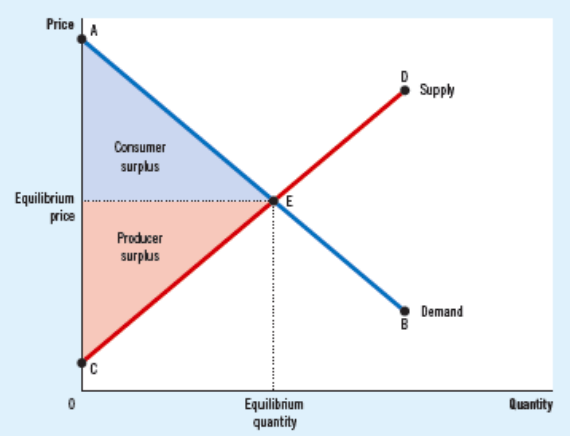
Total surplus is the difference between the value to buyers (willingness to pay) and cost to sellers of producing the good (willingness to accept). If total surplus is maximized, then resources are allocated efficiently.

At the market equilibrium, total surplus is maximized. In Panel (a) below, the total surplus is represented by triangle AEC, which is the total area below the demand curve (consumer surplus) and above the supply curve (producer surplus).

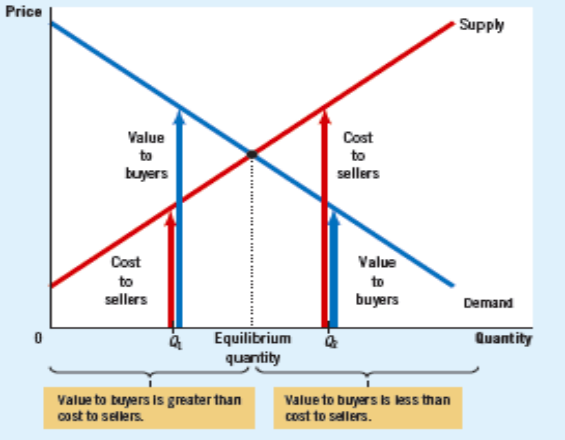
As seen in Panel (b) of Figure 2.3.7., Q_1 quantities are lower than the equilibrium quantity, and Q_1 is in the inefficient region. In this region, the value to marginal buyers is greater than the cost to the marginal seller. So, to increase society's well-being (total surplus), more goods should be sold in the market until the additional quantities reach equilibrium. Quantities higher than the equilibrium quantity (ex. Q_2) are also in the inefficient region. In this region, the value to marginal buyers is less than the cost to the marginal seller. To increase society's well-being (total surplus), fewer goods should be sold in the market until the quantities reach equilibrium.

Figure 2.3.7.

(a) Total Surplus



(b) Efficiency of the Equilibrium Quantity



To summarize, **the market equilibrium outcome is efficient, and total surplus (consumer and producer surplus) is maximized.** Quantities lower or higher than the equilibrium quantity create inefficiencies, which lower the society's economic well-being.

Concept Check 2.6.	
Willingness to pay	maximum amount that a buyer is willing to pay for the good
Consumer surplus	difference between the amount a buyer is willing to pay for the good and the amount the buyer actually pays for it
Cost (willingness to sell)	minimum amount that a seller is willing to accept to sell the good
Producer surplus	difference between the amount paid by the buyer and the seller's cost
Total surplus	sum of consumer surplus and producer surplus
Efficiency	resources are allocated in a manner that maximize the total surplus received by all members of a society

The succeeding sub-topics under this section discuss government policies and interventions that distort the market economy and lead to unintended consequences. These unintended consequences cause inefficiencies in the market in the form of shortages, surpluses, or suboptimal total surplus.

B. Tax Incidence and Deadweight Loss

The Government imposes taxes to generate funds to pay for public services, such as healthcare, education, and infrastructure. One type of tax is a sales tax, which is a tax levied on a good sold. There is no consensus between buyers and sellers regarding who should assume the tax burden. Buyers do not want to pay taxes because it will make their purchases more expensive. Sellers also do not want to pay taxes because it will depress their income.

We refer to the manner in which the tax burden is distributed among market participants (buyers and sellers) as **tax incidence**. We will answer the question, *"How is the tax burden distributed?"* using the tool we used in Sec 2.1, the demand and supply analysis framework. We will then follow the three-step process identified in equilibrium dynamics.

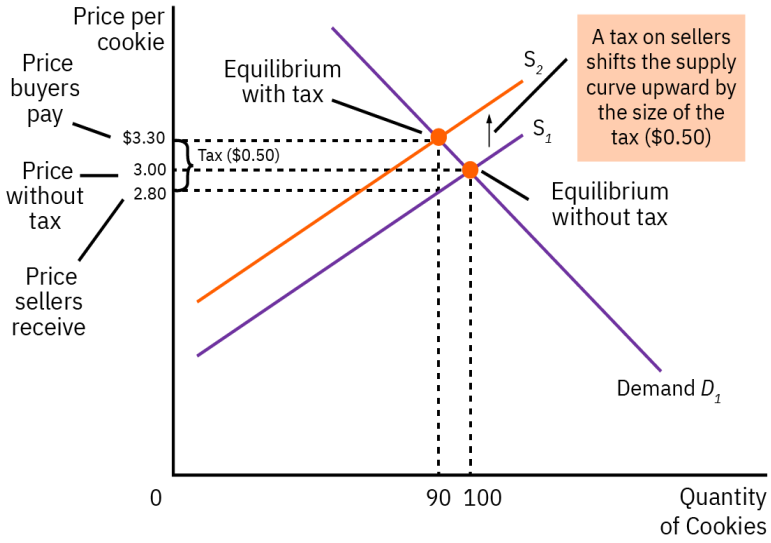
Sales Tax on Sellers

Suppose that the government imposes a $0.50 tax for each cookie the seller sold in the market, meaning that the tax is imposed on sellers. How does this tax imposition affect both the buyers and sellers of cookies?

1. The sellers are directly affected by the sales tax. We expect that demand remains the same at any given price level while supply changes because producing cookies becomes more costly. For this reason, there is no change in the demand curve. The supply curve, meanwhile, shifts.

2. We can consider a tax imposition as an additional cost to production; thus, it is a burden to sellers. Graphically, this decreases the quantity supplied at every price level and shifts the supply curve to the left (upward) from S_1 to S_2 by the amount of $0.50 (tax).

Figure 2.3.8.



3. The sales tax increases the equilibrium price from $3 to $3.30 and decreases the equilibrium quantity from 100 to 90 cookies. Overall, sellers sell less and buyers consume less, which leads to a shrinkage in the market for cookies.

Looking at Figure 2.3.8., we can answer the question "How is the tax burden distributed?" to both the buyer and the seller. With the sales tax, assuming that buyers are forced to pay an additional $0.30 ($3.30 - $3) for each cookie, then the seller pays the remaining balance of $0.20 ($0.50 tax - $0.30). In total, the sellers remit $0.50 to the government and only get to keep $2.80 for each cookie sold. In this case, both the buyers and sellers are worse off.

Based on our demand and supply analysis, we can conclude that:

(a) Taxes depress market activity because the quantity of the good sold decreases.

(b) Both the sellers and buyers shoulder the tax burden. That is, the buyers pay more and the sellers receive less.

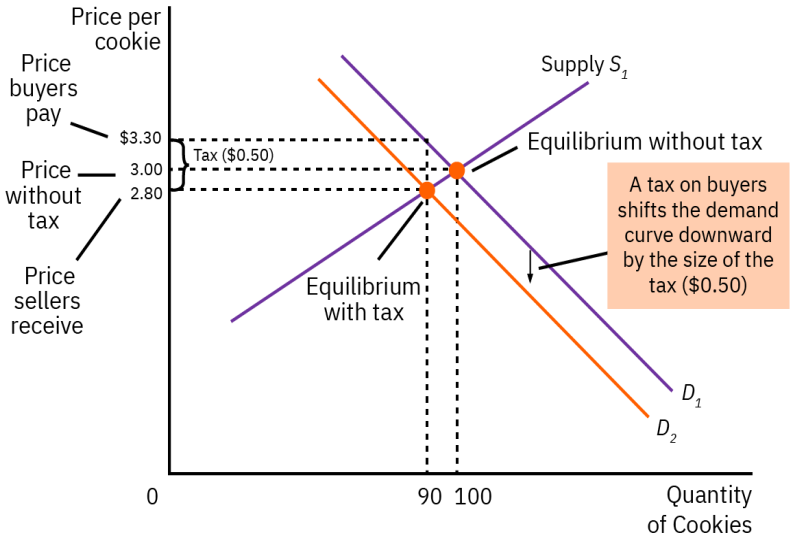
Sales Tax on Buyers

Suppose now that the government imposes the $0.50 tax for each cookie sold in the market on buyers instead. How does this tax imposition affect both the buyers and sellers of cookies?

1. The buyers are directly affected by the sales tax. We expect that supply remains the same at any given price level, while demand changes because consuming cookies becomes more expensive. For this reason, there is no change in the supply curve. In this instance, the demand curve shifts.

2. Graphically, this decreases the quantity demanded at every price level and shifts the demand curve to the left (downward) from D_1 to D_2 by the amount of $0.50 (tax).

Figure 2.3.9.



3. The sales tax decreases the equilibrium price from $3 to $2.80 and decreases the equilibrium quantity from 100 to 90 cookies. Overall, sellers sell less and buyers consume less, which leads to a shrinkage in the market for cookies.

Looking at Figure 2.3.9., the answer to the question, "How is the tax burden distributed?" is still the same for both the buyer and the seller. If we continue to assume that sellers receive a lower price of $2.80. The $0.20 reduction can be attributed to the seller's share of the tax. Then, the balance of $0.30 is shouldered by the buyers, which is an additional cost to them. Overall, this leads to a shrinkage in the market for cookies.

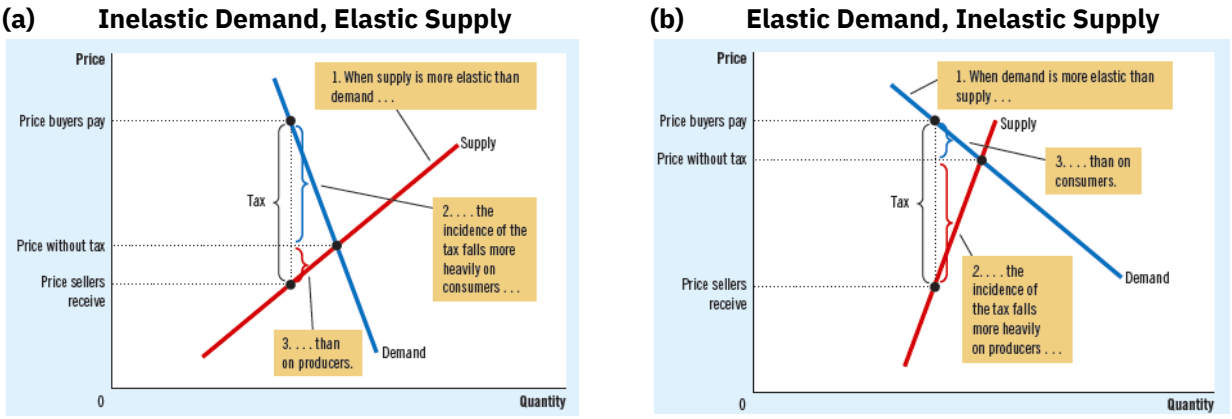
Tax Incidence: Both Buyers and Sellers

Whether the tax is imposed on the sellers or buyers, the result is the same. The difference only lies in who remits the tax to the government. If it is levied to the sellers, then the sellers pay the government and if it is levied to the buyers, then the buyers pay the government.

The tax incidence, however, depends on the elasticity of demand or supply. Most of the time, the tax burden is not shared equally. If the demand is inelastic and supply is elastic, then the buyers have a greater share of the tax paid to the government. If the demand is elastic and supply is inelastic, the sellers have a greater share of the tax paid to the government.

As seen in the figures below, the distribution of tax burden is depicted in the wedge between the price buyers pay and the price that sellers receive. We no longer show the shift because regardless of which curve shifts, the resulting wedge is the same.

Figure 2.3.10.

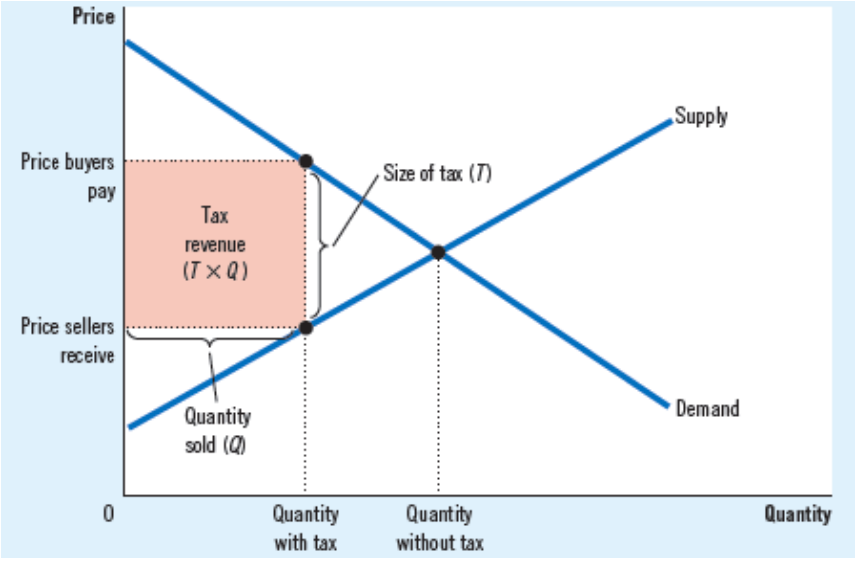


Taxation and Deadweight Loss

By now, we already know that when a tax on a good is imposed, the buyers and sellers share the burden. Whether the supply curve shifts to the left (upward) or the demand curve shifts to the left (downward), the resulting outcome is the same. To illustrate the effect of tax, we will no longer show either shift for simplicity of discussion. Just keep in mind that regardless of who is responsible for paying the tax, a wedge between what the price buyers pay and the price sellers receive is created, and that the quantity sold with tax is less than the quantity sold without tax.

With tax, an additional market participant joins - the government. They generate revenue to pay for public services; therefore, the benefit from taxation accrues to the beneficiaries of the service. The tax revenue is computed as size of tax, *T* multiplied by the quantity sold, *Q*. As seen in the figure below, the tax revenue is the shaded rectangle in which the height is *T* and the width is *Q*.

Figure 2.3.11.



From our discussion of market efficiency, economic welfare can be measured by the total surplus generated in the market. This total surplus is maximized at market equilibrium. The benefits received by buyers and sellers from participating in the market are the consumer surplus and the producer surplus. Given this, how does a tax affect welfare? To answer this question, an explanation consisting of three phases will be provided, namely: without tax, welfare with a tax, and changes in welfare (refer to Table 2.3.5. and Figure 2.3.12. below).

Without Tax

At the market equilibrium (Q_1, P_1), the outcome is efficient; therefore, total surplus is maximized. Recall that, on the one hand, consumer surplus is the area below the demand curve and above the equilibrium price, and its value is A + B + C. On the other hand, the producer surplus is the area above the supply curve and below the equilibrium price, and its value is D + E + F. Combining both the consumer and the producer surplus, we get a total surplus of A + B + C + D + E + F. Note that since there is no tax, no revenue is collected by the government.

Welfare with a Tax

Suppose a tax is imposed, buyers pay more at P_B, reducing consumer surplus to A, and sellers receive less at P_S, reducing producer surplus to F. With tax collected, the quantity sold decreases from Q_1 to Q_2, and the government generates revenue of B + D. Portions of the consumer surplus and producer surplus are transferred to the tax revenue that will accrue to the direct beneficiaries of public services. The total surplus amounts to A + B + D + F.

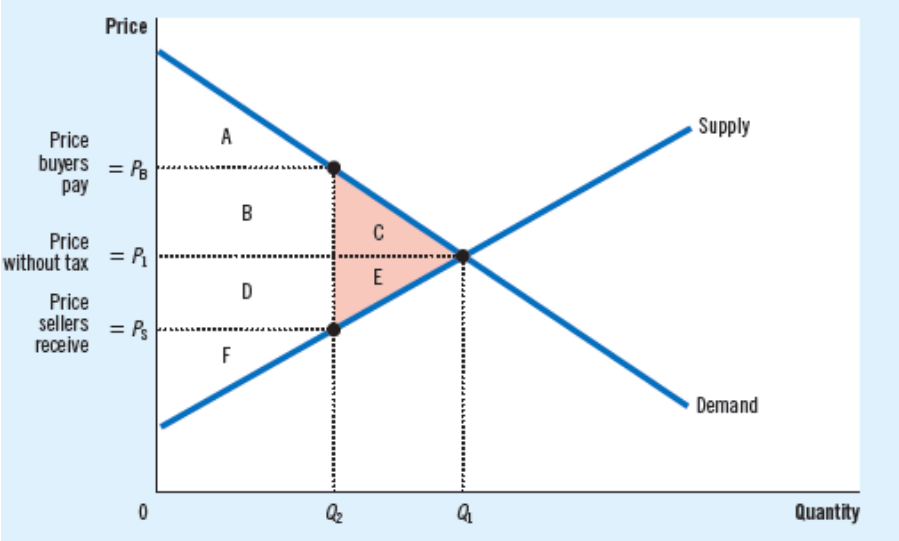
Changes in Welfare

By comparing welfare before and after the tax imposition, we can see how this affects welfare. Consumer surplus decreases by the area B + C and producer surplus by D + E. Tax revenues increase by B + D, which are transferred benefits from consumers and producers to the beneficiaries of the services funded by the tax revenue. With these changes, total surplus shrinks by the area C + E. This represents losses to both buyers and sellers, which could not be covered by the tax revenue. In economics, this reduction in total surplus due to a policy or intervention (in this case, a tax) is referred to as the **deadweight loss**.

Table 2.3.5.

	Without Tax	With Tax	Change
Consumer Surplus	A + B + C	A	-(B + C)
Producer Surplus	D + E + F	F	-(D + E)
Tax Revenue	zero	B + D	+(B + D)
Total Surplus	A + B + C + D + E + F	A + B + D + F	-(C + E)

Figure 2.3.12.



When the government levies a tax, it increases the price buyers pay and decreases the price sellers receive. This disincentivizes buyers to consume and sellers to produce, resulting in a market failure or an inefficient allocation of resources.

Concept Check 2.7	
Price ceiling	the highest possible price that sellers can charge for their good or service
Rent control	a type of price ceiling imposed in the housing market that protects potential tenants
Price floor	the lowest possible price that sellers can charge for their good or service
Minimum wage	a type of price floor imposed in the labor market that protects workers
Quantity control	maximum limit on the quantity of a good that can be bought or sold
Tax incidence	manner in which the tax burden is distributed between buyers and sellers
Deadweight loss	the fall in total surplus that results from a market distortion, such as tax

Chapter 2.3 Review Questions

1. **Individual *A*, Individual *B*, and Individual *C* each want a burger. *A* is willing to pay $10, *B* is willing to pay $7, and *C* is willing to pay $4. The market price is $5. Consumer surplus equals:**
   A. $5
   B. $7
   C. $21
   D. $26

2. **If the price of a burger falls to $4, the consumer surplus of Individual *A*, Individual *B*, and Individual *C* increases by:**
   A. $9
   B. $2
   C. $1
   D. $25

3. **Beer has a downward-sloping demand curve. When the price of beer is $3, its quantity demanded is 100. What happens to consumer surplus if price falls to $2?**
   A. It falls by less than $100.
   B. It falls to zero.
   C. It rises by less than $100.
   D. It rises by more than $100.

4. **Individual *D*, Individual *E*, and Individual *F* are available to work as tennis coaches for the summer. The opportunity cost of tennis coaching is $200 for *D*, $400 for *E*, and $600 for *F*. The tennis club is hiring coaches at a price of $500. Producer surplus equals:**
   A. $200
   B. $300
   C. $400
   D. $500

5. **Individual *G* has been working full-time as a tutor for $300 a week. When the market price of tutors rises to $400, *Individual H* becomes a tutor as well. How much does producer surplus rise as a result of this price increase?**
   A. By less than $100
   B. Between $100 and $200
   C. Between $200 and $300
   D. By more than $300

6. **The supply curve for a product is Qs = 2P, and the market price is $8. What is producer surplus? (Hint: Graph the supply curve and recall the formula for the area of a triangle)**
   A. $8
   B. $20
   C. $64
   D. $200

7. **Individual *J* values their time at $60 an hour. They spend 2 hours giving Individual *K* a piano lesson. *K* was willing to pay as much as $300 for the piano lesson, but they negotiated a price of $200. In this transaction:**
   A. Consumer surplus is $20 larger than producer surplus
   B. Consumer surplus is $40 larger than producer surplus
   C. Producer surplus is $20 larger than consumer surplus
   D. Producer surplus is $40 larger than consumer surplus

8. **What is maximized through an efficient allocation of resources?**
   A. Consumer surplus
   B. Producer surplus
   C. Consumer surplus plus producer surplus
   D. Consumer surplus minus producer surplus

9. **At market equilibrium, buyers have the _____ willingness to pay and the sellers have the _____ costs.**
   A. Highest; highest
   B. Highest; lowest
   C. Lowest; highest
   D. Lowest; lowest

10. **Producing a quantity beyond the supply and demand equilibrium is inefficient because:**
   A. The marginal buyer's willingness to pay is negative.
   B. The marginal buyer's willingness to pay is zero.
   C. The marginal buyer's willingness to pay is positive but lower than the marginal seller's cost.
   D. The marginal buyer's willingness to pay is positive and higher than the marginal seller's cost.

Chapter 2.3 Review Quiz Answers

1. B
2. B
3. A
4. C
5. B
6. C
7. A
8. C
9. B
10. C

Chapter 2.4: The Nature and Functions of Product Markets – *Theory of Consumer Choice*

Chapter Overview

This chapter aims to analyze the layers of market behavior by delving into the fascinating Theory of Consumer Choice. In this chapter we will explore the concept of utility, a measure of satisfaction derived from consuming goods and services. Throughout this chapter we will discuss how consumers, driven by a desire to maximize their utility, navigate the market landscape. Furthermore, this chapter aims to outline how changes in income and prices trigger income and substitution effects, revealing the impact on consumers when they are faced with shifting market conditions. Finally, we'll bridge the gap between individual choices and market trends, learning how to derive individual and market demand curves from the underlying preferences and decisions of consumers. These concepts will allow you to gain a deeper understanding of why consumers behave the way they do, unlocking the secrets behind market demand and equip you with a powerful lens to analyze consumer behavior in a variety of economic contexts.

Learning Objectives

By the end of this chapter you will be able to:

- Understand the concept of utility, a measure of satisfaction derived from consuming goods and services, and its role in driving consumer choices.
- Analyze consumer equilibrium, the point where consumers achieve maximum satisfaction (utility) within their budget constraint.
- Apply the concepts of income and substitution effects to predict how changes in price and income influence consumer choices.
- Identify and derive individual and market demand curves, which represent the relationship between price and the quantity demanded by consumers.
- Critically evaluate the limitations of the Theory of Consumer Choice, recognizing its assumptions and potential shortcomings in real-world applications.

Introduction

We have limited income for our unlimited needs and wants. The question now is, “How do we allocate our income to satisfy our desires to consume goods and services?” In this section, we will look beyond the law of demand, examine how consumers value goods and services, and determine what causes consumers to make choices in light of budget constraints and preferences. In this section, we will examine the theory of consumer choice and we will delve deeper into how consumers, faced with trade-offs, decide and respond to changes in their environment.

A. Utility

Our goal in life is to satisfy our desires and be happy. In economics, satisfaction is referred to as **utility**. If you are a rational decision-maker, then you will allocate your budget that allows you to maximize your utility. The unit of measurement economists use to measure satisfaction is called "**utils**." Utils is a subjective value and represents your willingness to pay for a good or service.

Total Utility and Marginal Utility

The overall satisfaction we get from consuming goods and services is called **total utility**. Suppose you want to consume cookies. For every additional cookie you consume, you gain an additional util, which is called **marginal utility**. If you sum marginal utility per cookie consumed, you will get total utility. Mathematically, we use this formula to get marginal utility:

Formula 2.4.1

$$Marginal\ Utility\ (MU) = \frac{\Delta Total\ Utility\ (TU)}{\Delta Quantity\ (Q)} = \frac{TU_Q - TU_{Q-1}}{Q_Q - Q_{Q-1}}$$

Using Table 2.4.1. and Formula 2.4.1, the marginal utility obtained from consuming the third cookie is 6:

$$Marginal\ Utility\ (MU) = \frac{\Delta Total\ Utility\ (TU)}{\Delta Quantity\ (Q)} = \frac{TU_Q - TU_{Q-1}}{Q_Q - Q_{Q-1}} = \frac{24-18}{3-2} = 6$$

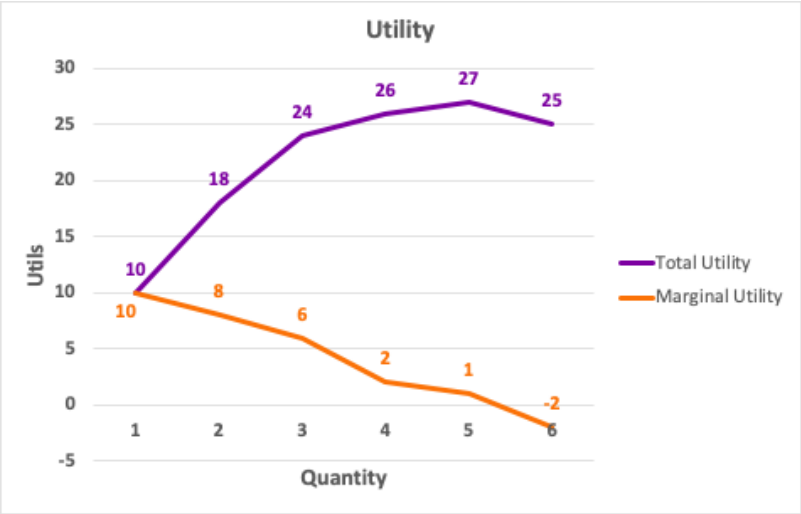
To explain further, let us see how consumption decisions are made. For your first cookie, your total utility and marginal utility are the same, with a value of 10 utils. A positive marginal util means that your additional consumption satisfies you. Since you crave more cookies, you consume your second cookie, which gives you an additional 8 utils (marginal utility) and a total utility of 18 utils. This continues until your craving for cookies is satisfied. After consuming your fifth cookie, you contemplate whether to consume one more or not. You decide to take another cookie even though you are already full. With the sixth cookie, you lose 2 utils, thereby decreasing your total utility from 27 utils to 25 utils.

Looking at the graph below, total utility increases for as long as marginal utility is positive. In our example, consuming 5 cookies gives you the highest satisfaction. When you consume 6 cookies, your marginal utility becomes negative, and total utility decreases. This implies that a consumer has a satiation point. Once you reach this threshold, overall satisfaction declines. To maximize total utility, a rational decision-maker will only consume 5 cookies.

Table 2.4.1.

Quantity	Total Utility	Marginal Utility
1	10	10
2	18	8
3	24	6
4	26	2
5	27	1
6	25	-2

Figure 2.4.1.



Furthermore, you may also notice that as you consume additional cookies, the additional satisfaction (marginal utility) you derive from each cookie decreases. The first cookie you consume will provide you with the greatest satisfaction, and subsequent cookies will provide increasingly less satisfaction even though your total satisfaction (cumulative utility) continues to increase. This is referred to as the **law of diminishing marginal utility**. For this reason, we can say that total utility is increasing at a diminishing rate.

B. Utility Maximization

Equalizing Marginal Utility Per Dollar

The choices we make in consuming goods and services are guided by our income limitations and the pricing of available products. Determinants such as income and prices are taken into consideration when maximizing utility. For the purpose of this discussion, we will focus on the consumption of two goods, X and Y, while recognizing that the principles of utility maximization are still applicable even when considering multiple goods.

Suppose the two goods are pizza ($2 per slice) and a mini cupcake ($1), and your income is $8. Considering these factors, how should you allocate your income in order to consume pizza slices and mini cupcakes? In other words, how many slices of pizza and mini cupcakes should you buy in order to satisfy your craving? We assume that consumers prefer more to less, so they are most satisfied when their income is fully utilized.

Utility maximization is a strategy in which consumers exhaust their income to purchase a combination of goods that give them the highest level of satisfaction. To determine this optimal combination, we

determine the **marginal utility (MU) per dollar** spent for every additional unit consumed for each good. We calculate MU/$ by dividing the marginal utility by the price of the good. The MU/$ represents the additional satisfaction we get from an additional unit of the good, given its price. The higher the MU/$, the more satisfaction we get.

Tables 2.4.1. and 2.4.2. show the total utility, marginal utility, and marginal utility per dollar for a slice of pizza and a mini cupcake. We use this information to rank the MU/$ and allocate the income between the two goods.

Table 2.4.1.

Pizza (P_x = $2 per slice)

Q_x	TU	MU	**MU/P_x**
1	**200**	**200**	**100**
2	390	190	**95**
3	570	180	**90**
4	740	170	**85**
5	900	160	**80**
6	1030	130	**65**
7	1130	100	**50**

Table 2.4.2.

Mini Cupcake (P_y = $1)

Q_y	TU	MU	**MU/P_y**
1	200	200	**200**
2	380	180	**180**
3	540	160	**160**
4	680	140	**140**
5	800	120	**120**
6	**900**	**100**	**100**
7	980	80	**80**

Suppose your income is $8. You choose each good one at a time based on your corresponding MU/$ until none of your income remains.

Your choices and the running balance of your income are presented in Table 2.4.3.

- The good with the highest MU/$ at 200 is a mini cupcake and is your first purchase. It is worth $1, therefore you still have $7 to spend.
- The second purchase is again a mini cupcake with MU/$ = 180, leaving you with $6 to spend.
- After your fifth purchase, you still have $3 to spend. At this point, having an additional slice of pizza or a mini cupcake gives you the same MU/$=100; therefore, you are indifferent.

- Given your indifference, your sixth and seventh purchases can interchange. That is, you can have a slice of pizza before a mini cupcake or vice versa. At this point, your income will be exhausted.
- We know that you have maximized your utility when these two conditions are met:
    - Full utilization of income
    - MU/$ for the last consumption of each good are the same.
- The optimal combination of goods, given your income is 6 mini cupcakes and 1 pizza slice.

Table 2.4.3. summarizes your choice, MU/$, Income Remaining, and your marginal and total utilities.

Table 2.4.3.

Choice	MU/$	Expenditure	Income Remaining	MU	TU
mini cupcake	200	1	7	200	200
mini cupcake	180	1	6	180	380
mini cupcake	160	1	5	160	540
mini cupcake	140	1	4	140	680
mini cupcake	120	1	3	120	800
mini cupcake	100	1	2	100	900
pizza	100	2	0	200	1100

To summarize, utility maximization is achieved when:

1) income (M) is exhausted:

Formula 2.4.2

$$M = P_x Q_x + P_y Q_y$$

In our example, \$8 = (\$2)(1 pizza slice) + (\$1)(6 mini cupcakes)

And

2) the last dollar spent on each good provides equal marginal utility per dollar:

Formula 2.4.3

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

if $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$ then consume more of x until their marginal utilities per dollar equalize;

if $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$ then consume more of y until their marginal utilities per dollar equalize.

In our example, we started with $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$; that is, we first consumed 6 mini cupcakes then we reached $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$ and consumed a slice of pizza. With our last consumption of each good, given the remaining income, we achieved $\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = 100$

Concept Check 2.8.	
Total utility	overall satisfaction an individual gets from consuming goods and services
Marginal utility	additional satisfaction that an individual gets from consuming an additional unit of a good or service; exhibits an inverse relationship between quantity consumed and utility
Law of diminishing marginal utility	as consumers consume additional units of a good, the additional satisfaction (marginal utility) derived from each unit decreases

C. Consumer Equilibrium: A Different Lens for Utility Maximization

Budget Constraint

By now, we know that one of the consumers' considerations for consumption decisions is their income or budget. This consumption decision is represented by a **budget constraint**, which shows the affordable consumption bundles for the consumers. The **budget line** shows all the possible combinations of good X and good Y that a consumer can buy, given their income and the prices for good X and good Y (see Table 2.4.4.).

Suppose you have an income of $1,000 to spend on sandwiches (good X) and cans of soda (good Y). If you spend all your income on sandwiches, priced at $10 each, then you consume 100 sandwiches and no soda (bundle A). If, instead, you spend all your income to buy sodas priced $2 per can, then you consume 0 sandwiches and 500 cans of soda (bundle B). In between these two extremes, you can choose any bundle worth $1,000 among several other bundles, such as 50 sandwiches and 250 cans of soda (bundle B). Any bundle below the budget line is affordable but is worth less than $1,000, while any bundle above the budget line is unaffordable.

The budget line is represented by: $M = P_x Q_x + P_y Q_y$

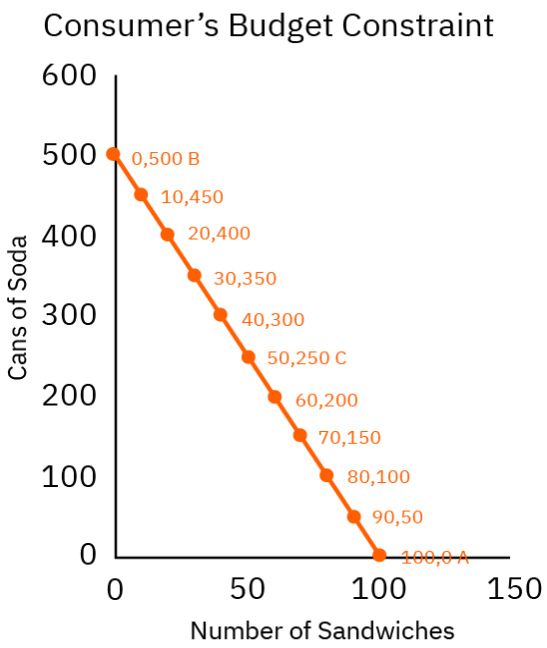
Rearranging this equation, we get the slope of the budget line, which is basically the relative **price ratio** of the two goods, $\frac{P_x}{P_y} = \frac{\$10}{\$2}$ (we drop the minus sign for interpretation purposes).

This means that a sandwich costs five times as much as a can of soda. Hence, when you choose a sandwich, you are sacrificing 5 cans of soda.

Table 2.4.4.

Sandwich (X)	Soda (Y)	Spending on Sandwich	Spending on Soda	Total Spending
100	0	$1,000	$0	$1,000
90	50	900	100	1,000
80	100	800	200	,1000
70	150	700	300	1,000
60	200	600	400	,1000
50	250	500	500	1,000
40	300	400	600	1,000
30	350	300	700	1,000
20	400	200	800	1,000
10	450	100	900	1,000
0	500	0	1000	1,000

Figure 2.4.2.



Parallel and Rotational Shifts in Budget Line

If the consumer's income or the prices of the goods change, the budget line shifts.

(a) Suppose your income increases from $1,000 to $2,000, while prices of soda and sandwiches remain the same. Since you have more income to spend, you consume more of both goods. This results in an outward parallel shift (no change in slope) of the budget line, as seen in Panel (a) Figure 2.4.3.

(b) Suppose the price of a soda decreases from $2 to $1 while your income and the price of a sandwich remain the same. If you spend all your income to buy sandwiches, nothing will change and you still consume 100 sandwiches. If you spend all your income to buy sodas, you double your consumption because of the price decrease. When you combine both sandwiches and sodas into your consumption bundle, you consume more soda and the same number of sandwiches as before. This results in an outward rotational shift (with a change in the slope) from the x-intercept, as seen in Panel (b) Figure 2.4.3.

(c) Suppose the price of a sandwich decreases from $10 to $5, while your income and the price of a soda remain the same. If you spend all your income to buy soda, nothing will change and you will still consume 500 cans of soda. If you spend all your income to buy sandwiches, you will double your consumption because of the price decrease. When you combine both sandwiches and sodas into your consumption bundle, you consume more sandwiches and the same amount of sodas as before. This results in an outward rotational shift (with a change in the slope) from the y-intercept, as seen in Panel (c) Figure 2.4.3.

Figure 2.4.3.

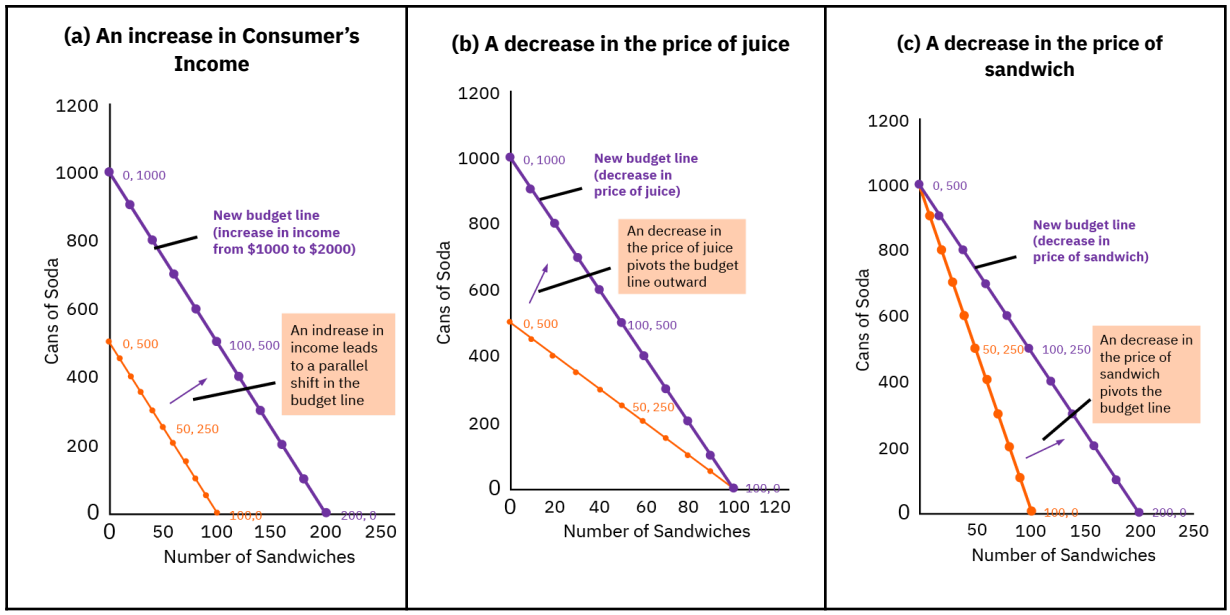


Table 2.4.5. presents a summary of the expected shifts in the budget line when income or the price of the goods change/s:

Table 2.4.5.

Change (all other things constant)	Expected Shift in the Budget Line
Increase in income	Outward parallel shift
Decrease in income	Inward parallel shift
Increase in the price of good X (horizontal axis)	Inward rotational shift from the x-intercept
Decrease in the price of good X (horizontal axis)	Outward rotational shift from the x-intercept
Increase in the price good Y (vertical axis)	Inward rotational shift from the y-intercept
Decrease in the price of good Y (vertical axis)	Outward rotational shift from the y-intercept

Consumer Preferences

Besides budget consideration, consumers determine what they want based on their preferences for the goods or services. Among several bundles of goods available to them, consumers can select the bundle that best matches their tastes. However, they can also be indifferent between two bundles that match their tastes equally. This is represented by an **indifference curve,** which shows different bundles of a good or service that make the consumers equally satisfied.

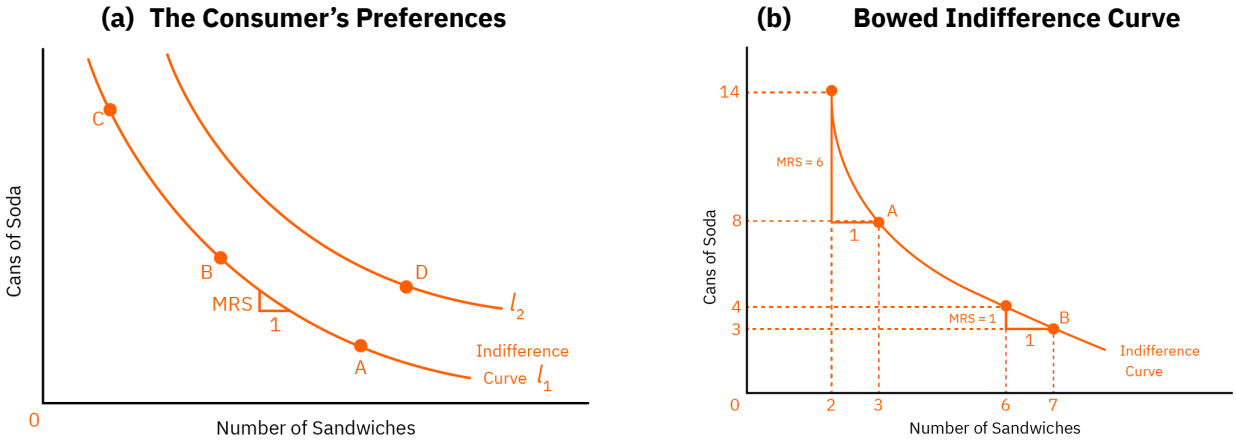
Panel (a) Figure 2.4.4. shows two of the several possible indifference curves ($\mathbf{I}_1$ and $\mathbf{I}_2$) that a consumer may have. All bundles at $\mathbf{I}_1$, such as A, B, and C, give the same level of satisfaction or utility to the consumer. Moving from one bundle to another entails a trade-off. As the consumer consumes more of good X (sandwich), they consume less of good Y (soda) and vice-versa.

Consumers are assumed to prefer more to less; therefore, bundle D (and any other bundle) that belongs to a higher indifference curve (in this case, $\mathbf{I}_2$) is always preferred. Even though bundle D has less cans of soda than bundle C, D is still preferred because the number of sandwiches consumed at this point more than compensates for the fewer cans of soda consumed.

Since the indifference curve is nonlinear and convex (bowed inward as shown in Panel (b) below), its slope varies per bundle. The slope at any point on an indifference curve measures the rate at which the consumer is willing to substitute one good for the other. This trade-off is called the **marginal rate of substitution (MRS)**. It is also basically the ratio of the marginal utilities of the two goods, $\frac{MU_x}{MU_y}$ (we drop the minus sign for interpretation purposes).

To be able to consume an additional sandwich at bundle A, the consumer has to give up 6 cans of soda, while at bundle B, the consumer has to give up 1 can of soda. Notice that the MRS decreases at a decreasing rate, which is consistent with the law of diminishing marginal utility. This is also known as the diminishing marginal rate of substitution.

Figure 2.4.4.



Optimization: Consumer Equilibrium

By now, we know two things:

1) Consumers are constrained by their income, which is represented by a budget line.

2) Consumers have preferences, which are represented by an indifference curve.

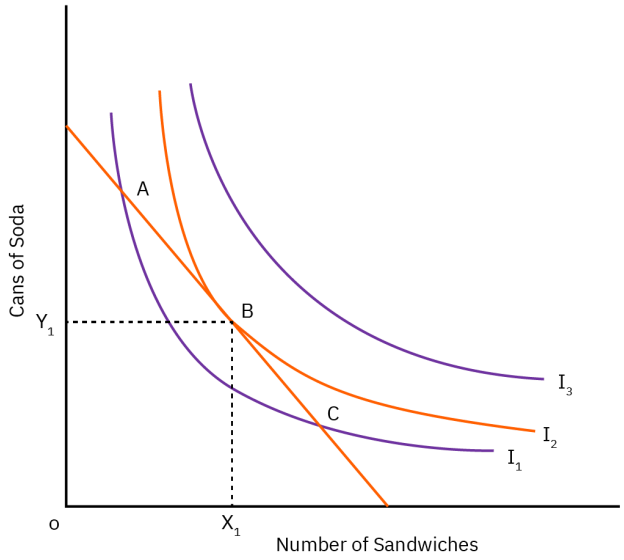
Combining the budget line and the indifference curve in one graph allows us to determine the optimal combination of goods among all the bundles available. Let us examine Figure 2.4.5.

The consumers prefer any bundle on the highest indifference curve, $\mathbf{I_3}$, but it is unaffordable.

The consumers can afford bundles A, B, and C, but bundles A and C will give less satisfaction since these bundles are on a lower indifference curve, $\mathbf{I_1}$.

The optimal combination, therefore, is bundle B since this bundle is on the highest possible indifference curve ($\mathbf{I_2}$), given the budget line. Bundle B is the only point on $\mathbf{IC_2}$ that is tangent to the budget line.

Figure 2.4.5.



We say that **consumer equilibrium** is achieved at the point where the budget line is tangent to the highest possible indifference curve, which determines the optimal bundle that maximizes consumer satisfaction.

At the optimal bundle, the slope of the budget line (relative price of the goods) and the slope of the indifference curve (marginal rate of substitution) is equal to: $\frac{P_x}{P_y} = \frac{MU_x}{MU_y}$

Arranging this algebraically, we get the same utility maximization condition established earlier in

Formula 2.4.3 in Section 2: $\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$ and at bundle A: $\frac{MU_x}{P_x} > \frac{MU_y}{P_y}$

Therefore, sacrificing cans of soda to consume more sandwiches will give more satisfaction to the consumer until this satisfaction is maximized at bundle B, and at bundle C: $\frac{MU_x}{P_x} < \frac{MU_y}{P_y}$

Fewer sandwiches and more cans of soda consumed will give more satisfaction to the consumer until the satisfaction is maximized at bundle B.

Concept Check 2.9.	
Budget constraint	shows all the affordable bundles of the consumer
Budget line	shows all the affordable bundles of the consumer when income is fully utilized
Price ratio	slope of the budget line
Indifference curve	shows different bundles of consumption that makes a consumer equally satisfied
Marginal rate of substitution (MRS)	slope of the indifference curve
Consumer equilibrium	achieved at the point of tangency between the budget line and the optimal indifference curve, which determines the best bundle for the consumer

D. Income and Substitution Effects

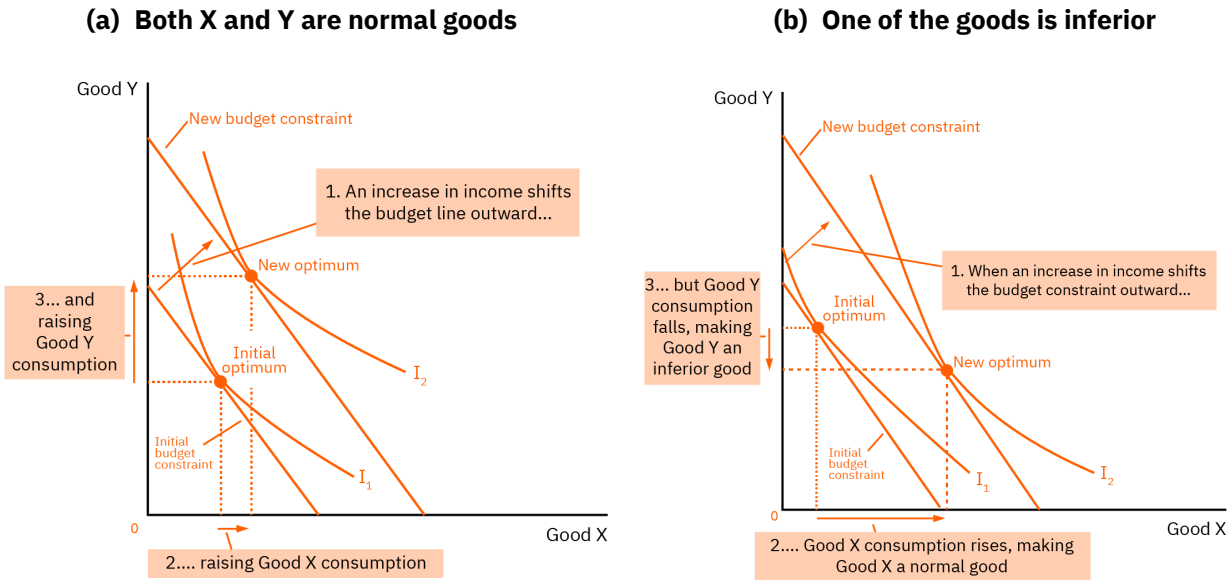
The consumer equilibrium changes when income changes and/or price of good X or Y changes. Combinations of these events cause a parallel or rotational shift in the budget line. This, in turn, prompts a change in consumer preferences, which also causes the indifference curve to shift.

Income Changes and Consumer Choice

When the consumer's income increases, an outward parallel shift occurs. The slope of the budget line remains the same because the prices of the goods remain constant. Since the consumer has more income to spend, they can buy more goods. If both goods are normal (see Panel a) in Figure 2.4.6., then more of good X and good Y will be purchased.

If X is inferior, then fewer of X and more of Y will be purchased, and if Y is inferior, then more of X and less of Y will be purchased (see Panel b) in Figure 2.4.6. When income changes and whether the good is a normal good or an inferior good determines the position of the new optimum bundle that belongs to the new indifference curve and tangent to the new budget line.

Figure 2.4.6.



Try for yourself: How does a decrease in the consumer's income affect the consumer's choice? What will happen to the budget line? What is the new optimum bundle if both goods X and Y are normal? If good X is inferior?

When the price of soda decreases and the price of a sandwich remains constant, the budget line rotates outward from the x-intercept. The slope of the budget line changes and becomes steeper. Since soda becomes relatively cheaper than sandwiches, the consumer may choose a new optimum bundle that belongs to a higher indifference curve ($\mathbf{I_2}$), which has more cans of soda and fewer sandwiches.

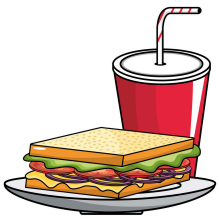
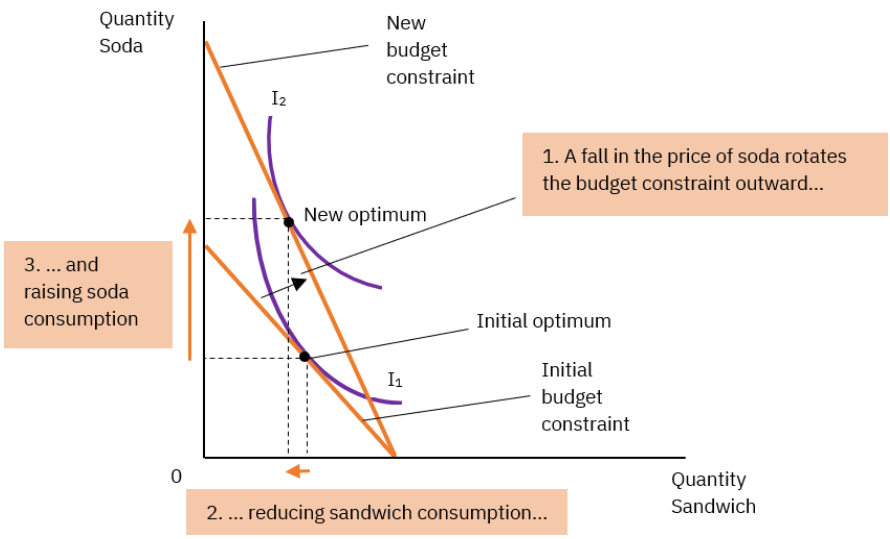


Figure 2.4.7.



Try for yourself to observe the effects of: 1) an increase in the price of soda; 2) an increase in the price of a sandwich; 3) a decrease in the price of a sandwich, and how each affects consumer choice. Consider what will happen to the budget line and determine the new optimum bundle.

Income and Substitution Effects

The effect of a price change can be broken down into two effects: an income effect and a substitution effect. In our example above, a decrease in the price of soda may elicit the following responses from the consumer:

- Because the consumer has a greater purchasing power and feels richer than before, they can purchase more sandwiches and cans of soda (income effect).
- Relative to a sandwich, soda is cheaper; therefore, they should buy fewer sandwiches and more cans of soda (substitution effect).

Certainly, the consumer buys more cans of soda. However, given the contrasting responses for sandwich consumption, the consumer's decision depends on the net impact of the income and substitution effects. It is possible that the consumer can either buy more or fewer sandwiches. As a result, sandwich consumption is ambiguous.

We can use the indifference curves to illustrate the income and substitution effects. The **income effect** is the change in consumption that results when a price change moves the consumer to a higher or lower indifference curve, while the **substitution effect** is the change in consumption that results when a price change moves the consumer *along* a given indifference curve to a point with a new marginal rate of substitution.

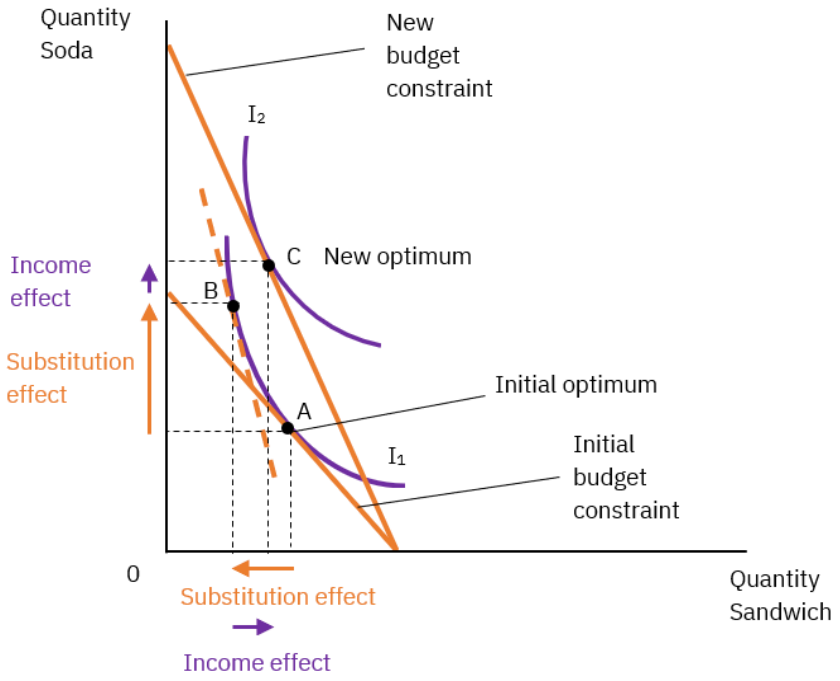
When the price of soda decreases, the consumer moves from optimum bundle A to C.

This is achieved in two steps:

1) The consumer moves along I_1, from bundle A to B, where the MRS at B is steeper due to the new relative price of soda and sandwiches (broken line represents a transitory budget line)

2) The consumer shifts to a higher indifference curve, I_2, from bundle B to C, where the new budget line is parallel to the transitory budget line and the MRS are the same.

Figure 2.4.8.



Notice bundle A to B is on the same indifference curve as the original consumption bundle B, and bundle A to B is located where the budget line is parallel to the new budget line that is tangent to the initial indifference curve. This transitory (broken-line) budget line is trying to hold income fixed so we can separate the substitution effect. Bundle B represents the consumer's satisfaction if faced with the new price. This substitution effect is the difference between the original consumption bundle A and the transitory consumption bundle B.

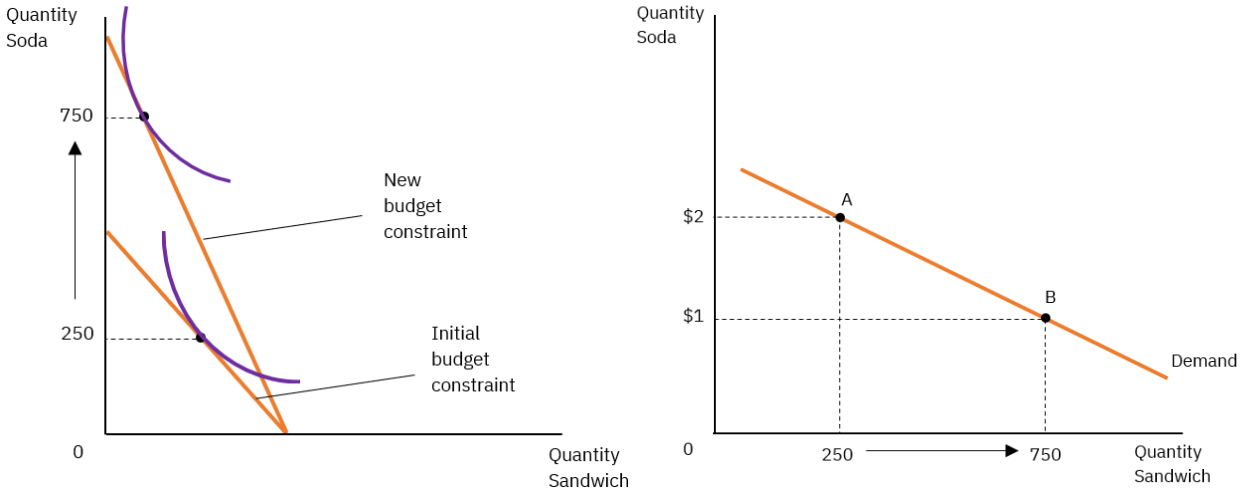
Suppose the price of sandwiches increases but the consumer's income has not increased or has even decreased, they are then not able to buy as many sandwiches as they were before. We could say that the consumer has become less affluent (that is, their income has changed). This change in income **(the income effect)** is the difference between the transitory budget line at bundle B and bundle C.

E. Deriving the Individual and Market Demand Curves

The demand curve for any good reflects the consumption decisions of consumers. Hence, the demand curve illustrates the quantity demanded for a good at any given price. We can say that a consumer's demand curve is a summary of the optimal decisions that arise from their budget constraint and indifference curves.

Consider the demand for soda. As seen in Panel (a) Figure 2.4.8., when the price of a soda decreases from $2 to $1, the consumer's budget line rotates outward from the x-intercept. Owing to both the income and substitution effects, the consumer purchases more soda, from 250 to 750 cans. As seen in Panel (b) Figure 2.4.8., the demand curve can be derived from the consumer's desire for more soda. In other words, the theory of consumer choice serves as the fundamental principle for the consumer's demand curve.

Figure 2.4.9.



Concept Check 2.10.	
Income effect	change in consumption that results when a price change moves the consumer to a higher or lower indifference curve
Substitution effect	change in consumption that results when a price change moves the consumer along a given indifference curve to a point with a new marginal rate of substitution
Market demand	sum of individual demands
Market demand curve	a demand curve that shows the total quantity demanded at different price levels

Chapter 2.4 Review Questions Questions

1. A painter eats 3 cookies while working on a painting. The marginal utility of the first cookie is 12 utils, the second cookie is 10 utils, and the third cookie is 7 utils. Which of the statements is accurate in this case?

A. The painter would not eat any more cookies.
B. The painter should have stopped eating cookies after the second one.
C. The total utility this painter received from eating cookies is 29 utils.
D. The total utility decreases after the first cookie because of diminishing marginal utility.

2. The first banana yields Individual *C* 12 units of utility, and the second yields them an additional 8 units of utility. Their total utility from three bananas is 25 units of utility. The marginal utility of the third banana is:

A. 25 units of utility
B. 5 units of utility
C. 4 units of utility
D. 45 total utils

3. The theory of consumer choice assumes that:

A. Total utility increases at an increasing rate.
B. Consumers act rationally to maximize their satisfaction.
C. Consumers possess unlimited financial resources.
D. Consumers are unaware of the marginal utility they derive from successive units of different products.

4. Suppose that MUx/Px > MUy/Py. This means that, to maximize utility, consumers spending all their income should:

A. Buy less of X only if its price rises.
B. Buy more of Y only if its price rises.
C. Buy more of Y and less of X.
D. Buy more of X and less of Y.

For questions 5 and 6, use Table 2.4.6. below, which shows the marginal utility (additional satisfaction) that a consumer derives from consuming successive quantities of products M and N.

Table 2.4.6.

Units of M	MU_M	Units of N	MU_N
1	58	1	32
2	48	2	28
3	32	3	24
4	24	4	20
5	20	5	12
6	16	6	10
7	8	7	4

5. Refer to the previous table. If the consumer has an income of $52 and the price of M is $8, and the price of N is $4, then the consumer will maximize their utility by purchasing:

A. 2 units of M and 7 units of N
B. 5 units of M and 5 units of N
C. 4 units of M and 5 units of N
D. 6 units of M and 3 units of N

6. If the consumer's income rises to $84 and the products' prices remain unchanged, the consumer maximizes utility by purchasing:

A. 2 units of M and 7 units of N
B. 5 units of M and 5 units of N
C. 4 units of M and 5 units of N
D. 7 units of M and 7 units of N

7. *Individual L* buys milk and cookies, both of which are normal goods. When the price of milk rises, the income effect induces *L* to buy ____ milk and ____ cookies.

A. More; more
B. More; less
C. Less; more
D. Less; less

8. **Individual *H* buys a donut for $10 and a cup of coffee for $3. Their income is $100. Their budget constraint will shift inward if:**

   A. The price of a donut rises to $11.
   B. The price of a coffee falls to $2.
   C. Their income rises to $170.
   D. The price of donuts, the price of coffee, and their income all rise by 50 percent

9. ***Individual I* also buys a donut for $10 and a cup of coffee for $3. Their income is $200. Their budget constraint will experience a parallel outward shift if:**

   A. The price of a donut falls to $8, the price of coffee falls to $2, and their income falls to $150.
   B. The price of a donut rises to $15, the price of coffee rises to $4, and their income remains unchanged.
   C. The price of a donut rises to $18, the price of coffee rises to $1.5, and their income decreases to $180.
   D. The price of a donut falls to $9.5, the price of coffee falls to $2, and their income rises to $210.

10. **Individual *O* and Individual *P* are both optimizing consumers in the markets for coats and vests, where they pay $100 for a coat and $50 for a vest. *O* buys 8 coats and 4 vests, while *P* buys 6 coats and 12 vests. It can be concluded that *O*'s marginal rate of substitution is ____ vests per coat, while *P*'s is _____.**

   A. 2; 1
   B. 2; 2
   C. 4; 1
   D. 4; 2

Chapter 2.4. Review Quiz Answers

1. C
2. B
3. B
4. D
5. C
6. D
7. D
8. A
9. D
10. B

Chapter 2.5: The Nature and Functions of Product Markets – *Production and Costs*

Overview

This chapter outlines the fundamentals of production and costs within product markets. The chapter will explore the concept of production functions, differentiating between short-run and long-run scenarios. We then delve into various measures of costs, including fixed, variable, total, and average costs. This chapter further analyzes the relationship between marginal product and diminishing returns, highlighting their impact on marginal cost. Lastly, we will compare and contrast cost behavior in the short run and long run, emphasizing the concept of long-run cost minimization and the optimal input combination for achieving it.

Objectives

By the end of this chapter you will be able to:

- Explain the concept of production functions and differentiate between short-run and long-run production scenarios.
- Describe various measures of costs, including fixed, variable, total, and average costs.
- Analyze the relationship between marginal product and diminishing returns, and explain their impact on marginal cost.
- Compare and contrast cost behavior in the short run and long run.
- Identify the long-run cost-minimizing input combination and discuss its significance for firms.

Introduction

One of the main activities in an economy is the production of goods and services. Consumers are able to purchase these goods and services, while firms produce and sell these goods and services in the market. Firms can be large, with several shareholders, workers, warehouses, branches, and factories. Alternatively, firms can be small, with few owners (or sole owner), workers, and capital resources. Regardless of the size, firms are in business to earn profits. Recall, producers (sellers) behave and decide according to the law of supply. When the price increases, firms are more willing to produce and sell a larger quantity of a good. The firms' main consideration for participating in the market is the cost they incur. They will only produce and sell if the market price of the good is sufficient to cover the cost of production. In this section, we will discuss the different types of costs and how they relate to each other.

A. Production Functions: Short and Long-Run

The **production process** involves transforming inputs into outputs. Firms incur costs by purchasing raw materials, machines, labor, technology, and other resources to produce goods and services. We will be analyzing the link between a firm's production process and its total cost, using a hypothetical firm, *The Cupcake Factory*, as an example.

For our analysis, we assume that in the short-run, the size of the factory is fixed, and the size of labor (number of workers) is variable. The firm may take a long time to build or expand to a larger factory, but they may also be able to instantly hire workers. In the long-run, however, both variables (factory and labor) can vary. For our discussion, we will first describe the production costs and the decisions that *The Cupcake Factory* faces in the short-run, then we will look at how these costs and decisions evolve in the long-run.

The Production Function

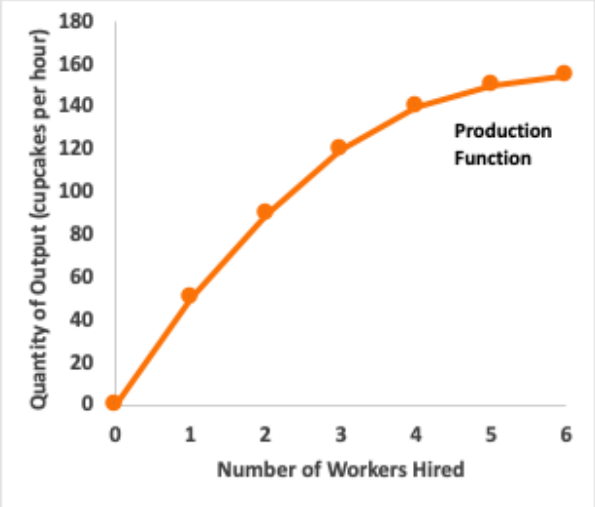
Table: 2.5.1. Production Function and Total Costs: The Cupcake Factory

(1) Number of Workers	(2) Quantity of cupcakes (output)	(3) Marginal Product of Labor	(4) Cost of Factory	(5) Cost of Workers	(6) Total Cost of Inputs (cost of factory + cost of workers)
0	0	-	$30	$0	$30
1	50	50	30	10	40
2	90	40	30	20	50
3	120	30	30	30	60
4	140	20	30	40	70
5	150	10	30	50	80
6	155	5	30	60	90

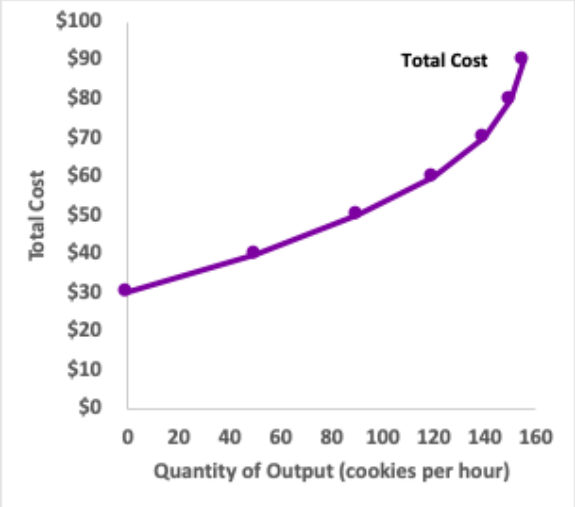
Table 2.5.1. illustrates how the quantity of cupcakes produced per hour at *The Cupcake Factory* depends on the number of workers hired. Looking at columns (1) and (2), without any workers, the factory produces no cupcakes. With 1 worker, 50 cupcakes are produced. With 2 workers, 90 cupcakes are produced, and so on. The relationship between the quantity of inputs (workers) and the quantity of output (cupcakes) is referred to as the production function. This is illustrated in Panel (a) of Figure 2.5.1. The vertical axis (y-axis) shows the quantity of cupcakes produced, while the horizontal axis (x-axis) shows the number of workers hired.

Figure: 2.5.1. The Cupcake Factory's Production Function and Total-Cost Curve

(a) Production Function



(b) Total-Cost Curve



Column (3) of Table 2.5.1. depicts the marginal product of a worker, which is the change (Δ) in the quantity of output due to a change (Δ) in the quantity of input used. For example, if *The Cupcake Factory* hires an additional worker, from 1 to 2, their total output is 90 cupcakes.

Since we know that worker 1 can produce 50 cupcakes on their own, the marginal product of worker 2 must then be 40 cupcakes. Mathematically, we solve for marginal product using this formula:

Formula 2.5.1

$$Marginal\ Product\ of\ Labor = \frac{\Delta Q_{Output}}{\Delta Q_{Labor(L)}} = \frac{Q_{Output\ (L)} - Q_{Output\ (L-1)}}{Q_{Labor(L)} - Q_{Labor(L-1)}}$$

Applying this to our example:

$$Marginal\ Product\ of\ Labor = \frac{\Delta Q_{Output}}{\Delta Q_{Labor(L)}} = \frac{Q_{Output\ (L)} - Q_{Output\ (L-1)}}{Q_{Labor(L)} - Q_{Labor(L-1)}} = \frac{90-50}{2-1} = 40$$

If *The Cupcake Factory* hires an additional worker, from 2 to 3, the marginal product of this worker 3 is 30 cupcakes:

$$Marginal\ Product\ of\ Labor = \frac{\Delta Q_{Output}}{\Delta Q_{Labor(L)}} = \frac{Q_{Output\ (L)} - Q_{Output\ (L-1)}}{Q_{Labor(L)} - Q_{Labor(L-1)}} = \frac{120-90}{3-2} = 30$$

Observing the trend, as *The Cupcake Factory* hires more workers, the marginal product for each additional worker decreases. Why did this occur? According to economics production theory, if more variable inputs (labor) are used with a certain amount of fixed input (factory), then the overall output might increase, but at a decreasing rate. This theory is called **diminishing marginal product.** Given fixed capital, the first worker has full access to the kitchen equipment; therefore, is the most productive and able to produce 50 cupcakes.

As additional workers are hired, the first worker loses their exclusive privilege to the kitchen and has to share the use of the kitchen equipment with other workers. When Worker 2 joins Worker 1, they can still comfortably work together, but the additional number of cupcakes produced by Worker 2 is less than what Worker 1 could have produced alone. When the kitchen becomes overcrowded, the workers cannot freely move around. The workers have to wait for their turn to use the kitchen equipment. As this happens, the production of the additional worker is less than the production of the previous worker hired.

The diminishing marginal product can be seen in the production function shown in Panel (a) of Figure 2.5.1. If we measure the slope of the production function, we will notice that the slope increases but at a diminishing rate. As a result, the production function becomes flatter as the marginal product of labor decreases. Recall, the marginal product of labor is the slope of the production function, which can be defined as the additional output that is produced when an additional unit of labor is added to the existing factors of production.

Total-Cost Curve

Columns (4), (5), and (6) in Table 2.5.1. present *The Cupcake Factory's* cost of producing cupcakes. The cost to rent or own the factory is fixed at $30 per hour. This cost does not change whether she produces cookies or not. Each worker is paid $10 per hour. Notice the cost per worker changes depending on the number of workers hired.

For example, if the factory hires 1 worker, the total cost is $40 to produce 50 cupcakes. If they hire 2 workers, the total cost is $50 to produce 90 cupcakes, and so on. The relationship between the quantity produced [(Column (2)] and total cost [(Column (6)] is illustrated in Panel (b) Figure 2.5.1. This relationship graphically derives the **total-cost curve**. The vertical axis (y-axis) shows total cost, while the horizontal axis (x-axis) shows the quantity of output produced. Unlike the production function, the

total-cost curve gets steeper as production increases since producing an additional cupcake requires more labor, which is very costly.

Concept Check 2.11.	
Production process	transforming inputs into final goods and services for consumption
Production function	the relationship between the quantity of inputs used to produce a good and the quantity of output of that good
Diminishing marginal product	if more variable input is used with a certain amount of fixed input, then the overall output might increase, but at a decreasing rate
Total-cost curve	graphical representation of the relationship between the quantity produced and total cost

B. Various Measures of Costs

From a firm's total cost data, we can generate various related measures of cost that are essential in production and pricing decisions. To understand how these measures are generated, we consider the cost of another hypothetical firm, *The Tea House*. Table 2.5.2. shows the various costs incurred whilst operating this business.

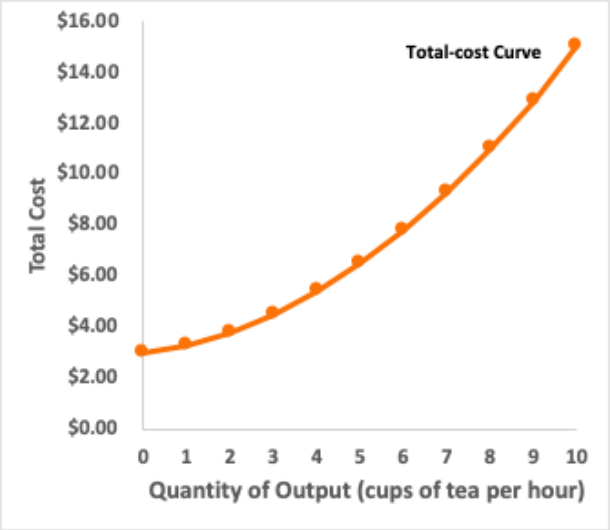
Table 2.5.2. The Various Measures of Cost: The Tea House

(1) Output (cups of tea per hour)	(2) Total Cost	(3) Fixed Cost	(4) Variable Cost	(5) Average Fixed Cost	(6) Average Variable Cost	(7) Average Total Cost	(8) Marginal Cost
0	$3.00	$3.00	$0.00	-	-	-	-
1	3.30	3.00	0.30	$3.00	$0.30	$3.30	$0.30
2	3.80	3.00	0.80	1.50	0.40	1.90	0.50
3	4.50	3.00	1.50	1.00	0.50	1.50	0.70
4	5.40	3.00	2.40	0.75	0.60	1.35	0.90
5	6.50	3.00	3.50	0.60	0.70	1.30	1.10
6	7.80	3.00	4.80	0.50	0.80	1.30	1.30
7	9.30	3.00	6.30	0.43	0.90	1.33	1.50
8	11.00	3.00	8.00	0.38	1.00	1.38	1.70
9	12.90	3.00	9.90	0.33	1.10	1.43	1.90
10	15.00	3.00	12.00	0.30	1.20	1.50	2.10

Column (1) in Table 2.5.2. presents the possible number of cups of tea that *The Tea House* can produce, ranging from 0 to 10 cups per hour. Column (2) presents the business's total cost of producing tea.

Figure 2.5.2. illustrates *The Tea House*'s total-cost curve. Similar to *The Cupcake Factory's* total-cost curve, the horizontal axis (x-axis) shows the quantity of tea, and the vertical axis (y-axis) shows the total cost. The curve gets steeper as the quantity of tea produced increases.

Figure: 2.5.2.



(a) Fixed and Variable Costs

Total cost can be broken down into fixed and variable costs. **Fixed costs** do not change when the quantity of output changes. For instance, the rent that *The Tea House* pays for their tea house is a fixed cost because its value remains constant regardless of whether he produces tea or not. In the same way, if they hire a full-time assistant to pay the tea house bills and help with other administrative tasks, the assistant's wage is a fixed cost regardless of whether tea is produced or not. Column (3) in Table 2.5.2. list the business's fixed cost of $3.00.

Variable costs change as the firm varies the quantity of output it produces. For example, the costs of tea bags, herbs, honey, and paper cups depend on the quantity of tea that the business intends to produce and sell. Similarly, if *The Tea House* hires more workers to make more cups of tea, then the wages of the additional workers are considered variable costs. Column (4) in Table 2.5.2. depicts the variable cost incurred as the quantity of the tea produced increases. If the tea house produces nothing, the variable cost is nothing. If the tea house produces 1 cup of tea, then the variable cost is $0.30. If the tea house produces 2 cups of tea, then the variable cost is $0.80, and so on.

A firm's total cost is the sum of the fixed costs plus the variable costs. In Table 2.5.2., total cost in column (2) equals fixed cost in column (3) plus variable cost in column (4).

(b) Average and Marginal Cost

One of the decisions that *The Tea House* needs to make is how much to produce. In doing so, they should consider how output affects the production costs. Hence, they need answers to the following questions:

1. How much does it cost to make a typical cup of tea?

2. How much does it cost to increase production of tea by 1 cup?

The first question above refers to the average cost. We divide the tea house's total costs by the quantity of output it produces. For instance, if *The Tea House* produces 2 cups of tea per hour, its total cost is $3.80, and the average cost (or cost of a typical cup) is $3.80/2 = $1.90. Total cost divided by the quantity of output is referred to as the **average total cost**. Column (5) of Table 2.5.2. shows the average total cost of producing tea at different levels of output. Given that total cost is the sum of fixed plus variable costs, we can also derive average total cost by adding average fixed cost and average variable cost. Mathematically, average total cost can be expressed as:

Formula 2.5.2

$$Average\ Total\ Cost\ (ATC) = \frac{Total\ Cost\ (TC)}{Quantity\ (Q)}$$

Formula 2.5.3

$$Average\ Total\ Cost\ (ATC) = Average\ Fixed\ Cost\ (AFC) + Average\ Variable\ Cost\ (AVC)$$

Average fixed cost equals the fixed cost divided by the quantity of output, while **average variable cost** equals the variable cost divided by the quantity of output. Columns (5) and (6) of Table 2.5.2. show the average fixed and average variable costs of producing tea, respectively. Mathematically, we express them as:

Formula 2.5.4

$$Average\ Fixed\ Cost\ (AFC) = \frac{Fixed\ Cost\ (FC)}{Quantity\ (Q)}$$

Formula 2.5.5

$$Average\ Variable\ Cost\ (AVC) = \frac{Variable\ Cost\ (VC)}{Quantity\ (Q)}$$

The second question above refers to the **marginal cost**, which is the additional cost incurred if the firm alters its production level. Column (8) in Table 2.5.2. shows how much total cost increases when *The Tea House* increases production by 1 cup of tea. Mathematically, we can express marginal cost as:

Formula 2.5.6

$$Marginal\ Cost\ (MC) = \frac{\Delta TC}{\Delta Q} = \frac{Change\ in\ Total\ Cost}{Change\ in\ Quantity} = \frac{TC_Q - TC_{Q-1}}{Q_Q - Q_{Q-1}}$$

For instance, if the business increases tea production from 2 to 3 cups, the total cost increases from $3.80 to $4.50, so the marginal cost of the third cup of tea is $4.50 - $3.80 = $0.70. Applying the formula, we have:

$$Marginal\ Cost = \frac{\Delta TC}{\Delta Q} = \frac{Change\ in\ Total\ Cost}{Change\ in\ Quantity} = \frac{TC_Q - TC_{Q-1}}{Q_Q - Q_{Q-1}} = \frac{\$4.50 - \$3.80}{3-2} = \$0.70$$

In summary, both average and marginal costs can be derived from total cost. Average total cost is the cost of a typical unit of output when total cost is divided equally over all the units produced. Marginal cost is the rise in total cost due to an additional unit of output produced.

C. Marginal Product, Diminishing Returns, Productivity, and Marginal Cost

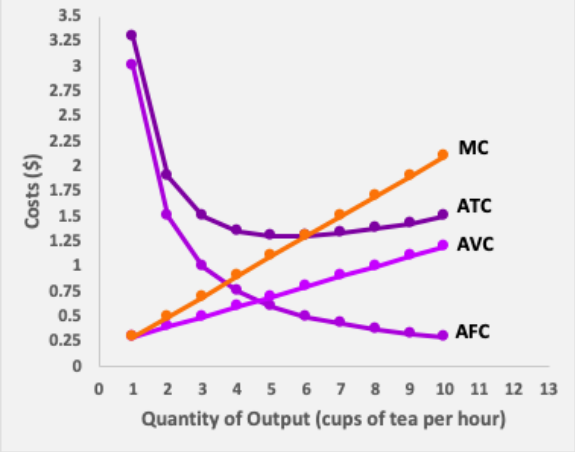
a. Cost Curves and Their Shapes

The cost curves of *The Tea House* share some common features with the cost curves of several firms in the economy. We will discuss three specific characteristics associated with the shapes of the marginal cost curve, the average total cost curve, and the relationship between them.

Graphically, we can show all four cost curves: average total cost (ATC), average fixed cost (AFC), average variable cost (AVC), and marginal cost (MC). The quantity of output is shown on the x-axis, while costs are shown on the y-axis. These curves and their shapes are helpful in analyzing the behavior of firms.

Figure 2.5.3. illustrates The Tea House's Average-Cost and Marginal Cost Curves using the data from Table 2.5.2.

Figure 2.5.3.



b. Rising Marginal Cost

The Tea House's marginal cost increases as the quantity of tea produced increases. The upward-sloping marginal-cost curve usually demonstrates the property of diminishing marginal product. On the one hand, when the business produces fewer cups of tea, they tend to hire fewer workers, and the kitchen is not fully utilized. In this situation, the marginal product of an additional worker is large, and the marginal cost of producing an additional cup of tea is small. On the other hand, when the tea house produces more cups of tea, they hire more workers, the kitchen becomes overcrowded, and the kitchen equipment is likely to be fully utilized. Therefore, *The Tea House* can produce more tea by hiring more workers, but the new workers are not producing the tea efficiently. Hence, when the quantity of tea produced is already high, the marginal product of an extra worker diminishes, and the marginal cost of producing an extra cup of tea becomes more expensive.

i. U-Shaped Average Total Cost

As seen in Figure 2.5.3., *The Tea House*'s average total cost curve is U-shaped. Remember that the average total cost is the sum of average fixed and variable costs. Average fixed cost always decreases as output increases, since the fixed cost is gradually spread over an increasing number of output produced. Average variable cost usually increases as output increases due to diminishing marginal product.

Average total cost, also U-shaped, shows the shapes of both average fixed and variable costs. When the quantity of output is low, such as 1 or 2 cups per hour, the average total cost is very high. This high cost is driven by the high average fixed cost that is spread over a few units. As output increases, the fixed cost is spread over more units. Average fixed cost still shows a declining trend. The average total cost follows this trend until the output reaches 5 cups of tea per hour when average total cost is $1.30 per cup. The trend in average total cost reverses when the tea house produces more than 6 cups of tea per hour. This reversal is now driven by the increase in average variable cost. The U-shaped average total cost is moved along by average fixed cost at the beginning, but when it starts to rise, the average variable cost becomes the dominant driver.

The bottom, or minimum point, of the U-shape average total cost represents the quantity that minimizes average total cost, which is sometimes referred to as the **efficient scale** of the firm. For *The Tea House*, it is either 5 or 6 cups of tea per hour. If the business produces more or less cups of tea than the efficient scale, *The Tea House*'s average total cost increases above the minimum of $1.30.

ii. The Relationship between Marginal Cost and Average Cost

Looking at Figure 2.5.3. Or Table 2.5.2., we can see that when marginal cost is less than average total cost, average total cost is declining, and when marginal cost is greater than average total cost, average total cost is increasing. Why is this the case?

To answer this question, let us use an analogy with grades. Average total cost is similar to a cumulative grade point average (CGPA), and marginal cost is similar to the grade you will get in the course you will enroll in next semester. If your succeeding grade in the next course is lower than your grade point average, your CGPA will decline. If your succeeding grade in the next course is higher than your grade

point average, your CGPA will increase. This is exactly what happens with the average and marginal cost scenario.

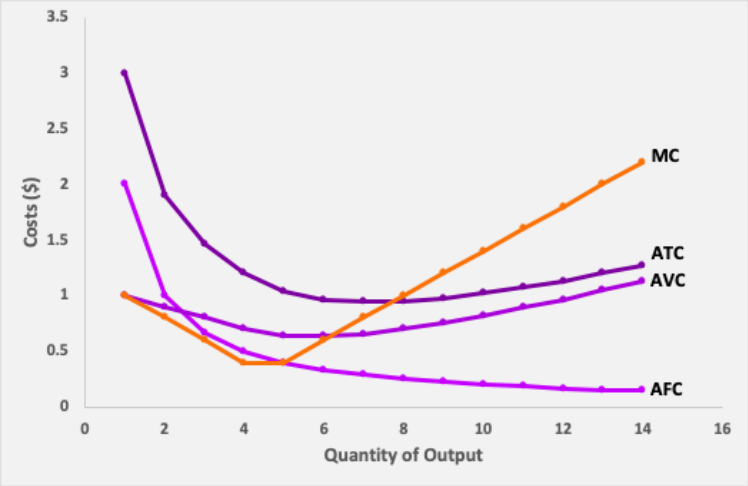
At the point of intersection between marginal and average total cost, the latter is at its minimum. This inflection point of the average total cost changes the relative position of average total cost and marginal cost curves.

c. Typical Cost Curves

Actual firms are often more complicated than our hypothetical firms, *The Cupcake Factory* and *The Tea House*. In several firms, marginal product does not initially decline after the firm hires the first worker. It is possible that the second, third, or fourth worker might have a higher marginal product than the first worker because their set-up as a team makes the distributed tasks easier to do, which translates to more team productivity. Firms following this pattern would exhibit increasing marginal product at first before diminishing marginal product sets in.

Figure 2.5.4. illustrates the cost curves for a more complicated firm. At low levels of output, the firm exhibits increasing marginal product; hence, the marginal cost curve declines. Eventually, the firm begins to exhibit diminishing marginal product, and the marginal cost curve begins to increase. Given this, the combination of increasing then decreasing marginal product also makes the average variable cost curve U-shaped.

Figure 2.5.4.



Despite the differences from the cost curves of *The Tea House*, the cost curves in Figure 2.5.4. still share the three key characteristics we discussed earlier:

- Marginal cost eventually increases with the quantity of output produced.
- The average total cost curve is U-shaped.
- The marginal cost curve intersects the average total cost curve at the minimum of average total cost.

Concept Check 2.12.	
Fixed costs	costs that do not vary with the quantity of output produced
Variable costs	costs that vary with the quantity of output produced
Average total cost	total cost divided by the quantity of output
Average fixed cost	fixed cost divided by the quantity of output
Average variable cost	variable cost divided by the quantity of output
Marginal cost	increase in total cost that arises from an extra unit of production
Efficient scale	quantity of output that minimizes average total cost

D. Costs in the Short-Run and in the Long-Run

The costs incurred are related to time horizon as firms make decisions in the short and long-run. In this subsection, we understand how these circumstances manifest in the firm's production process.

a. The Relationship between Short-Run and Long-Run Average Total Cost

For several firms, their fixed and variable costs are determined according to the time horizon. For example, Harley-Davidson, a motorcycle manufacturer, cannot abruptly expand or change the size of its motorcycle factories within a short period of time (i.e., a few days or months). If Harley-Davidson wants to increase its production within a short timeframe, its only option is to hire more workers in its existing factories. Machinery and other capital goods are fixed (they cannot vary). In this instance, we can say that the cost to the Harley-Davidson factories in the short-run is considered a fixed cost. However, Harley-Davidson can branch out or expand existing factories over the years. Therefore, in the long-run, the cost to its factories becomes a variable cost. Machinery and other capital goods can now vary.

Figure 2.5.5. shows the average total costs in both the short-run and the long-run. Keep in mind, in the long-run, the firm's costs now depend on the firm's level of output, the costs of labor and capital, and the amount of labor and capital needed for each level of output. In the long-run, there are no longer any fixed costs. All costs are now variable. As can be seen in Figure 2.5.5., the firm's average total cost, in the long run, is the lowest cost per unit at each level of output, and these costs are variable. So, the long-run total cost for the firm can be derived from the small, medium, and large factories' average total costs short-run curves by determining the lowest average total costs associated with each level of output.

Figure 2.5.5.. Average Total Cost in the Short and Long Runs

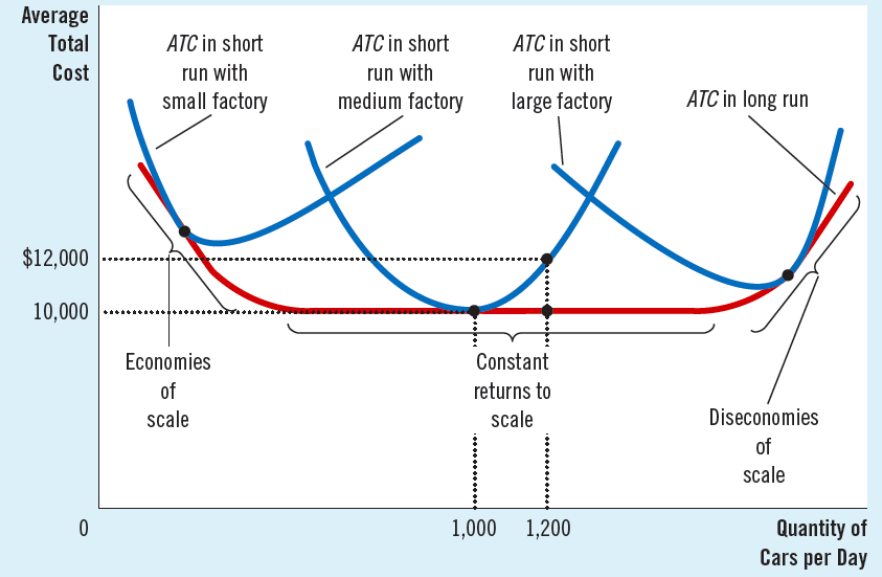


Figure 2.5.5. illustrates how a change in production adjusts costs over the short and the long run time periods. When Harley-Davidson wants to increase its motorcycle production from 1,000 to 1,200 per day, Harley-Davidson's only option in the short-run is to hire additional workers, given its current medium-sized factory. According to the law of diminishing marginal product, it becomes more expensive for Harley-Davidson to hire labor, and the average total cost rises from $10,000 to $12,000 per motorcycle. However, in the long-run, Harley-Davidson can simultaneously expand both the factory and labor force, and average total cost reverts to $10,000.

The length at which a firm transitions to the long-run depends on the nature of the firm. A larger firm such as Harley-Davidson can take more time to establish larger factories or warehouses than a smaller firm such as the coffee shop, which runs simple operations and only needs a small space to run its business.

b. Economies and Diseconomies of Scale

The long-run average total-cost curve is U-shaped, and it demonstrates how costs vary with the scale (size) of a firm's operations. When long-run average total cost decreases as output rises, **economies of scale** occur. This is evident at lower levels of output. When the long-run average total cost increases as output increases, **diseconomies of scale** occur. This is evident at higher levels of output. When the long-run average total cost remains the same as output increases, there are constant **returns to scale**. This is evident at intermediate levels of output.

Economies of scale are achieved when workers become more efficient in their tasks through specialization. For example, if Harley-Davidson hires a lot of workers to produce several motorcycles, Harley-Davidson can lower costs by employing an assembly-line production (a line or series of workers

in a factory by which a succession of identical parts of the motorcycle are assembled). Diseconomies of scale are achieved when coordination problems among several workers happen, and gains from specialization have been fully utilized.

E. Long-Run Long-run cost minimizing input combination

One of the main goals of firms is to maximize profit. Keeping costs at a minimum helps firms to achieve this goal. To produce the level of output with the lowest possible cost, firms need to determine the optimal combination of inputs. This process is referred to as **cost minimization**.

For simplicity, we limit the inputs used in production. These inputs are labor (L) and capital (K). When firms use an input, they aim to fully extract the benefits from utilizing an additional unit of that input. When a firm hires an additional worker or uses an additional unit of capital, we expect an increase in output, the marginal product. Firms want to get the highest marginal product possible from each dollar they spend on either labor or capital. For labor, firms incur costs from paying wages and for capital, firms incur costs from paying rent.

According to the **cost-minimization rule**, the optimal combination of inputs occurs when the marginal product of labor (MPL) per dollar spent on wages is equal to the marginal product of capital (MPK) per dollar spent on rental rate. This rule is expressed as:

Formula 2.5.7

$$\frac{Marginal\ Product\ of\ Labor\ (MPL)}{Wage\ (w)} = \frac{Marginal\ Product\ of\ Capital\ (MPK)}{Rental\ Rate\ (r)}$$

We assume that labor and capital are substitutes; therefore, when the cost of an additional worker is lower, then the firm should hire labor to produce an additional output, given that labor is cheaper than an additional unit of capital.

To get a better understanding, let us consider these two scenarios:

(a) Suppose:

$$MPK = 1,000\ units,\ r = \$1,000,\ MPL = 200\ units,\ w = \$100$$

Solving for the marginal product per dollar spent for the input, we get:

$$\frac{MPL}{w} = \frac{200}{\$100} = 2\ units\ of\ output\ per\ dollar\ for\ labor\ and$$

$$\frac{MPK}{r} = \frac{1,000}{\$1,000} = 1\ unit\ of\ output\ per\ dollar\ for\ capital.$$

When we compare the results, $\frac{MPL}{w} > \frac{MPK}{r}$. This means that the firm is producing more per dollar spent by hiring an additional worker.

Therefore, the firm should continue employing labor instead of capital until diminishing marginal product of labor sets in and $\frac{MPL}{w} = \frac{MPK}{r}$ is achieved.

(b) Suppose:

$$MPK = 1,000\ units,\ r = \$250,\ MPL = 200\ units,\ w = \$100$$

Solving for the marginal product per dollar spent for the input, we get:

$$\frac{MPL}{w} = \frac{200}{\$100} = 2\ units\ of\ output\ per\ dollar\ for\ labor\ and$$

$$\frac{MPK}{r} = \frac{1{,}000}{\$250} = 4\ units\ of\ output\ per\ dollar\ for\ capital.$$

When we compare the results, $\frac{MPL}{w} < \frac{MPK}{r}$. This means that the firm is producing more per dollar spent by renting an additional unit of capital.

Therefore, the firm should continue employing capital instead of labor until diminishing marginal product of capital sets in and $\frac{MPL}{w} = \frac{MPK}{r}$ is achieved.

Concept Check 2.13.	
Economies of scale	long-run average total cost declines as the quantity of output rises
Diseconomies of scale	long-run average total cost increases as the quantity of output rises
Constant returns to scale	long-run average total cost remains the same as the quantity of output increases
Cost minimization	the process of determining the optimal combination of inputs used in order to produce the level of output with the lowest cost

Chapter 2.5 Review Questions

1. A farmer faces diminishing marginal product. If they plant no seeds on their farm, they get no harvest. If they plant 1 bag of seeds, they get 3 plants of tomato. If they plant 2 bags, they get 5 plants. If they plant 3 bags, they get:

A. 6 plants
B. 7 plants
C. 8 plants
D. 9 plants

2. How does diminishing marginal product affect the behavior of a firm as output increases?

A. Both the production function and total-cost curve become steeper.
B. Both the production function and total-cost curve become flatter.
C. The production function becomes steeper, while the total-cost curve becomes flatter.
D. The production function becomes flatter, while the total-cost curve becomes steeper.

3. A company is manufacturing 500 widgets at a total cost of $4,000. Upon increasing production to 501 widgets, its total cost rises to $4,008. For this firm:

A. Marginal cost is $4, and average variable cost is $8 at 501 units.
B. Marginal cost is $8, and average variable cost is $5 at 501 units.
C. Marginal cost is $5, and average total cost is $8 at 501 units.
D. Marginal cost is $8, and average total cost is $8 at 501 units.

4. A factory is producing 20 scooters, with an average total cost of $250 and marginal cost of $150. If the factory were to increase production to 21 units, which of the following MUST occur?

A. Fixed cost would increase.
B. Marginal cost would increase.
C. Average total cost would decrease.
D. Average total cost would increase.

5. The government imposes a yearly $500 license fee on all burger joints. Which cost curves shift as a result?

A. Average total cost and marginal cost
B. Average total cost and average fixed cost
C. Average variable cost and marginal cost
D. Average variable cost and average fixed cost

6. **If increased production enables workers to focus on specific tasks, a company is expected to experience _____ of scale and _____ average total cost.**

   A. Economies; falling
   B. Economies; rising
   C. Diseconomies; falling
   D. Diseconomies; rising

7. **If a factory produces 10 yachts per month, its long-run total cost is $10 million per month. If it produces 12 yachts per month, its long-run total cost is $13 million per month. This factory exhibits:**

   A. Decreasing marginal cost
   B. Increasing marginal cost
   C. Economies of scale
   D. Diseconomies of scale

8. **What is marginal product?**

   A. The increase in total output resulting from hiring one additional worker
   B. The increase in total cost resulting from hiring one more worker
   C. The rise in total product divided by the change in revenue
   D. The increase in total revenue resulting from hiring one more worker

9. **What does the law of diminishing returns indicate?**

   A. As sales increase, total revenue declines due to diminishing returns.
   B. As additional units of a variable input are added to fixed inputs, the marginal product of the variable input will eventually decrease.
   C. A competitive firm's long-run average total cost curve exhibits a U-shape due to economies and diseconomies of scale.
   D. The demand curve for goods produced by purely competitive industries slopes downward.

10. Based on the data below, the marginal product of the sixth worker is

Number of Workers	Units of Output
0	0
1	40
2	90
3	126
4	150
5	165
6	170

A. 180 units of output
B. 30 units of output
C. 45 units of output
D. 5 units of output

Chapter 2.5. Review Quiz Answers

1. A
2. D
3. D
4. C
5. B
6. A
7. D
8. A
9. B
10. D

Chapter 2.6: The Nature and Functions of Product Markets – *Firm Behavior and Market Structure*

Overview

Understanding the fundamentals of product markets hinges on two key aspects: firm behavior and market structure. This chapter analyzes the driving force behind firm decisions - profit, before exploring market structures. This chapter discusses the scenario of perfect competition, with numerous identical firms and effortless entry, followed by the stark contrast of a monopoly dominated by a single firm. Monopolistic competition offers a more nuanced perspective with numerous firms offering similar but differentiated products, while oligopoly introduces the complexities of a market controlled by a few interdependent firms. By comprehending these structures and the behavior of firms within them, you gain valuable insights into market function, resource allocation, and the potential impacts on various stakeholders, laying the foundation for further exploration of economic analysis and real-world market complexities.

Objectives

By the end of this chapter you will be able to:

- Discuss the concept of profit and its central role in motivating firm behavior within various market structures.
- Analyze the characteristics of perfect competition, considering the implications of numerous firms, perfect information, and effortless entry/exit.
- Identify the key features of a monopoly, emphasizing barriers to entry and the potential consequences for market efficiency and consumer welfare.
- Explain the dynamics of monopolistic competition, focusing on product differentiation and the influence of barriers to entry.
- Describe the strategic complexities of an oligopoly, highlighting the interdependence of dominant firms and their potential for coordination.

Introduction

Firms can be categorized according to their market structure. These market structures are perfect competition, monopoly, oligopoly, and monopolistic competition. Each market structure is characterized by competition among sellers, market size, and homogeneity of products being offered. In this section, we discuss each market structure comprehensively and determine how a firm's market power influences its behavior and pricing decisions toward achieving its goal of profit maximization.

A. Profit

One of the primary goals of a firm is to maximize profits. Generally, firms generate revenues from the sales of their goods and services, and incur costs from their production operations. The difference between total revenues and total cost is the firm's profit:

Formula 2.6.1

$$Profit = Total\ Revenue - Total\ Cost$$

Total revenue is simply the price of the good multiplied by the quantity sold. If Leslie produces 10,000 cupcakes and sells each cupcake at $2, then her total revenue amounts to $20,000.

Total cost, on the other hand, is more complicated due to the concept of opportunity cost. Recall, opportunity cost is the net benefit foregone from giving up an alternative. According to economists, a firm's cost of production includes the opportunity costs and other costs that will be discussed.

a. Costs as Opportunity Costs

A firm's opportunity costs of production may either appear as a) recognizable or b) less obvious. Using *The Cupcake Factory* as an example, when the business spends $1,000 on flour, that amount of money ($1,000) is an opportunity cost since they forfeit the chance of using it to purchase something else. In the same way, the salaries they pay to their workers are a part of the firm's cost. In both of these instances, *The Cupcake Factory* has incurred actual expenses. These expenses or opportunity costs are referred to as **explicit costs.**

Some opportunity costs are less obvious than others. These less obvious ones do not necessitate an actual expense and are referred to as **implicit costs**. For example, imagine that the owner of *The Cupcake Factory* is a skilled writer and could earn $100 per hour working as a writer. For every hour that *The Cupcake Factory* is active, the owner is forgoing $100 in income that they could have earned as a writer. This opportunity cost should also be accounted for in their costs incurred at the cupcake factory. Therefore, the total cost of running *The Cupcake Factory* is the sum of both the owner's explicit and implicit costs.

Economists and accountants differ in the way they analyze cost estimates. Unlike accountants, whose concern is limited to monitoring cash flows, economists are interested in production and pricing decisions. For this reason, economists take into consideration both the explicit and the implicit costs, while accountants only consider explicit costs.

Suppose the owner of *The Cupcake Factory* gives up the opportunity to earn income as a writer; their accountant will not count this income as part of the total cost of the cupcake factory. Since there is no actual money outlay, this implicit cost is not shown on the financial statements of *The Cupcake Factory*. An economist, however, counts this implicit cost and uses this income as a part of the rationale as to

whether the business owner should keep their business running or not. If the income earned from being a writer increases from $100 to $500 per hour, they might decide to close *The Cupcake Factory* because it becomes too costly to operate the factory relative to taking the writing job with a higher pay.

b. The Cost of Capital as an Opportunity Cost

A common implicit cost that firms incur is the opportunity cost of the financial capital that has been used to operate the business. For example, the owner of *The Cupcake Factory* used $400,000 of their savings to buy the business from its previous owner. If, instead, they had invested this amount of money in a time deposit account, with an annual interest rate of 4 percent, they would have earned $16,000 per annum ($400,000 X 4%). The business owner, therefore, has given up $16,000 per annum in interest income to operate *The Cupcake Factory*. This amount, $16,000, is the implicit opportunity cost of the cupcake business. For an economist, the implicit cost of $16,000 is part of the business's total cost of production, but to an accountant, this implicit cost is not accounted for in the financial statements of *The Cupcake Factory* since no actual cash outflow occurs.

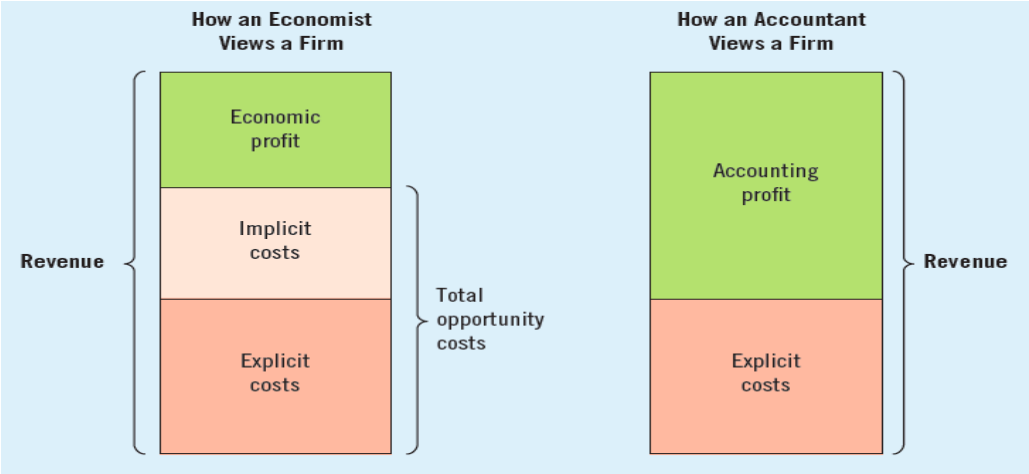
Suppose the financial capital invested by the business owner is a combination of their personal savings of $200,000 and a business loan of $200,000 with a borrowing rate of 6 percent. In the business owner's financial statements, the accountant will only include the interest expense of $12,000 ($200,00 x 6% of the explicit cost) as part of the total cost. However, for an economist, an additional implicit cost of $10,000 (foregone interest on savings at 5 percent per annum) is also accounted for. This implicit cost of $10,000 is derived from the business owner's $200,000 personal savings, which they could have invested at 5% annually instead of using it to finance their cupcake business. As a result, the total opportunity cost of $22,000 ($10,000 + $12,000).

c. Accounting, Economic, and Normal Profits

Now that we know that economists and accountants measure costs differently, we can say that they also measure profit differently. An economist measures a firm's **economic profit** by subtracting both the explicit and implicit opportunity costs of producing the output from its total revenue. An accountant measures a firm's **accounting profit** by subtracting only the explicit costs from its total revenue.

As seen in Figure 2.6.1., accounting profit tends to be larger than economic profit because of the unaccounted implicit costs. From an economist's perspective, a business thrives when the total revenue is more than sufficient to cover all opportunity costs, both explicit and implicit.

Figure 2.6.1.



Economic profit is essential in decision-making since it serves as a signal as to whether a business is still profitable or not. If the economic profit is positive, then the business is earning, and the firm thrives in the industry. If the economic profit is negative (economic losses), then it means that there is a better opportunity for the owner to earn higher income, and the business should close down. When economic profit is zero, **normal profit** occurs. Normal profits are usually experienced in a perfectly competitive market in the long-run.

To summarize, firms should not solely depend on accounting profit to make business decisions. It is possible that the accounting profit is positive but the economic profit is negative or zero because of the high implicit costs incurred by the firm.

Concept Check 2.14.	
Total revenue	the amount a firm receives for the sale of its output
Total cost	market value of the inputs a firm uses in production
Profit	total revenue minus total costs
Explicit cost	input costs that required an actual monetary outlay by the firm
Implicit cost	input costs that do not require an actual monetary outlay by the firm
Accounting profit	total revenue minus total explicit cost
Economic profit	total revenue minus total cost, including both explicit and implicit costs
Normal profit	occurs when economic profit is zero

B. Perfect Competition

A perfectly competitive market is characterized by the existence of many buyers and sellers, and homogenous (same) products offered by many different sellers. With this in mind, any single seller or buyer in the market has no influence on the market price of the goods being sold. Each market participant accepts the good's price as given.

Suppose a perfectly competitive market for corn exists, and there are many consumers who want to buy corn, then no single consumer has the power to demand a price they want. In the same way, each corn producer who competes with several other corn producers offering identical corn, has no control over the price of the corn. Hence, both the buyers and the sellers in competitive markets are **price takers**.

Another characteristic of a perfectly competitive market is the free entry or exit of sellers. Using our market for corn example, anyone can easily establish a corn-producing firm in the market, while any existing corn-producing firm can easily exit the market. This free entry or exit characteristic becomes more relevant and meaningful as we discuss the long-run equilibrium in a perfectly competitive market.

a. Profit Maximization

As discussed earlier, a firm's goal is to maximize profit, which is obtained from the firm's total revenue minus its total cost. Using the information of *King Corn Farm* in Table 2.6.1., as an example, let us determine how firms in a competitive market earn the highest possible profit from their business.

Table 2.6.1.

(1) Quantity (Q)	(2) Total Revenue (TR)	(3) Total Cost (TC)	(4) Profit (TR-TC)	(5) Marginal Revenue (MR = ΔTR/ΔQ)	(6) Marginal Cost (MC = ΔTC/ΔQ)	(7) Change in Profit (MR-MC)
0 bushels	$0	$3	-$3			
1	6	5	1	$6	$2	$4
2	12	8	4	6	3	3
3	18	12	6	6	4	2
4	24	17	7	6	5	1
5	30	23	7	6	6	0
6	36	30	6	6	7	-1
7	42	38	4	6	8	-2
8	48	47	1	6	9	-3

Column (1) of Table 2.6.1. presents the number of bushels of corn *King Corn Farm* produces. Column (2) presents the total revenue the farm generates. Total revenue is $6 (price of the corn) multiplied by the quantity sold. Column (3) presents the farm's total cost, with $3 as fixed cost, which is the initial cost incurred by the farm even without producing corn.

Column (4) shows *King Corn Farm*'s profit, which is calculated as total revenue minus total cost. If the farm does not produce any corn, it loses $3, its fixed cost. If it produces 1 bushel of corn, the farm earns a profit of $1. If it produces 2 bushels of corn, the farm earns a profit of $4 and so on. As can be seen in Table 2.6.1., *King Corn* earns its highest profit of $7 when it produces 4 or 5 bushels of corn.

Notice that the profit-maximizing quantity of corn occurs when the marginal revenue and marginal cost of each corn produced are equal. Column (5) shows the marginal revenue of *King Corn Farm*, which is computed as follows:

Formula 2.6.2

$$Marginal\ Revenue = \frac{\Delta TR}{\Delta Q} = \frac{Change\ in\ Total\ Revenue}{Change\ in\ Quantity} = \frac{TR_Q - TR_{Q-1}}{Q_Q - Q_{Q-1}}$$

Applying this formula, using the information in Table 2.6.1., if the firm produces an additional bushel of corn from 1 to 2, the marginal revenue is $6.

$$Marginal\ Revenue = \frac{\Delta TR}{\Delta Q} = \frac{Change\ in\ Total\ Revenue}{Change\ in\ Quantity} = \frac{TR_Q - TR_{Q-1}}{Q_Q - Q_{Q-1}} = \frac{\$12 - \$6}{2 - 1} = \$6$$

Column (6) shows the marginal cost of *King Corn Farm*, which is computed as follows:

$$Marginal\ Cost = \frac{\Delta TC}{\Delta Q} = \frac{Change\ in\ Total\ Cost}{Change\ in\ Quantity} = \frac{TC_Q - TC_{Q-1}}{Q_Q - Q_{Q-1}}$$

Applying this formula using the information in Table 2.5.3., if the firm produces an additional bushel of corn from 1 to 2, the marginal cost is $3.

$$Marginal\ Cost = \frac{\Delta TC}{\Delta Q} = \frac{Change\ in\ Total\ Cost}{Change\ in\ Quantity} = \frac{TC_Q - TC_{Q-1}}{Q_Q - Q_{Q-1}} = \frac{\$8 - \$5}{2 - 1} = \$3$$

The corresponding change in profit for each bushel of corn produced is shown in Column (7), which is calculated as the difference between marginal revenue and marginal cost (MR - MC). When *King Corn*

Farm produces an additional bushel of corn from 1 to 2, it generates an additional profit of $3 (MR - MC = $6 - $3 = $3).

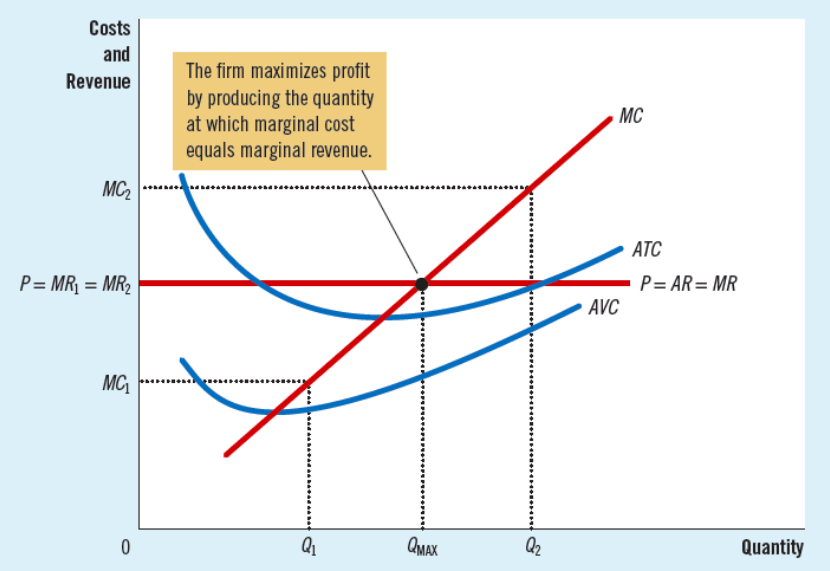
When we compare the marginal revenue and the marginal cost, we see that when marginal revenue is greater than the marginal cost, the firm can increase its production to boost profit. In our example, in order for *King Corn* to boost profit, the farm must produce 5 bushels of corn. This level of output, 5 bushels, occurs at a “turning point." Producing beyond this point, profits begin to decline. Producing 6 bushels of corn or more, a marginal cost exceeds marginal revenue, thus generating lower profit for the farm.

King Corn Farm can determine the quantity of corn production that maximizes profit by comparing its marginal revenue and marginal cost, and adjusting its production level as needed. Theoretically, **profit maximization is achieved when MR=MC or MR-MC=0**. When MR > MC, the firm continues to produce more to earn more profit until MR equates to MC. When MR < MC, the firm decreases its production to earn more profit until MR equates to MC.

Graphically, the profit-maximizing condition is determined by analyzing the firm’s cost curves, as shown in Figure 2.6.2. The typical cost curves of firms in a perfectly competitive market exhibit the common features we discussed in the previous section. The U-shaped average total cost curve (ATC) and the MC intersect where the ATC is at its minimum.

Figure 2.6.2. also shows a horizontal line at the market price (P). This line is horizontal because regardless of the quantity sold, the price remains the same because market participants are price takers. For this reason, the price is equal to both the firm’s average revenue (AR) and the firm’s marginal revenue (MR) in a perfectly competitive market.

Figure 2.6.2.



Suppose the firm is producing at Q_1. At this level of production, the corresponding point on the MR line is greater than the corresponding point on the MC line. This means that MR > MC, and implies that if the firm increases its production by an additional unit, the additional revenue can still cover the additional cost. As a result, the firm earns an additional profit.

Suppose the firm is producing at Q_2. At this level, the corresponding point on the MR line is lower than the corresponding unit on the MC line. This means that MR < MC, and implies that the firm is generating negative additional profit. The total profit may still be positive, but not as high as the profit at the previous level of quantity produced.

Whether the firm starts at a low-level Q_1 or at a high-level Q_2, the firm adjusts its production level to achieve the profit-maximizing level Q_{max}, where MR=MC. From Q_1, it increases production up to Q_{max} and from Q_2, it reduces production down to Q_{max}. As shown in Figure 2.6.2., profit is maximized at the intersection of MR and MC. This profit-maximizing rule is not only applicable to a perfectly competitive market but also to other market structures, which we will discuss in the next subsections. Note, for a perfectly competitive firm, the price of the good is also equal to the MC at the profit-maximizing level of quantity. In summary, the **profit-maximizing condition in a perfectly competitive market** is:

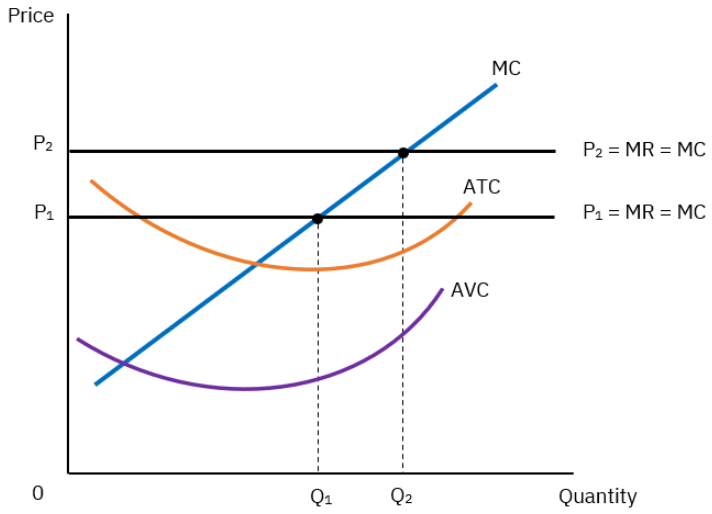
Formula 2.6.3

$$Price\ of\ the\ good\ (P)\ =\ Marginal\ Revenue\ (MR)\ =\ Marginal\ Cost\ (MC)$$

Short-run supply and shut-down decision

As shown in Figure 2.6.3., the MC curve also depicts the firm's supply curve because the marginal cost determines the quantity of the good that the firm is willing to sell at any price.

Figure 2.6.3.



For example, at price $P_1 = MC_1$, the quantity at which the firm willingly produces and sells is at Q_1, the profit-maximizing quantity at this price level. When the price increases to $P_2 = MC_2$, the quantity at which the firm willingly produces and sells increases to Q_2, the new profit-maximizing quantity at this new price level. There are, however, some caveats to this conclusion, which we examine next.

By now, we already know how much a firm should produce to maximize profit and the condition at which profit is achieved. However, this is not the only decision that a firm faces in operating its business. In some instances, competitive firms need to decide whether to keep producing and selling the good in the market or to leave the business.

When the economic environment of business operations is not in their favor, firms can either shut down or exit the market. The decision to shut down or exit the market depends on the time horizon. A **shutdown** occurs in the short-run and is temporary, while an **exit** occurs in the long-run and is permanent. The short-run and long-run decisions vary because if the firm shuts down temporarily, the firm still needs to cover and pay the fixed costs. If the firm exits the market permanently, it no longer needs to pay for all the fixed and variable costs.

When a firm decides to shut down, it loses the opportunity to earn revenue from the sale of its product. Shutting down saves the firm from incurring the variable costs of producing the product. However, the firm still needs to cover the fixed costs. Hence, the firm shuts down if the revenue it would generate from the quantity produced is lower than the variable costs of producing the product.

The **shutdown condition** compares Total Revenue (TR) and Variable Cost (VC). The firm will shut down if TR is less than VC.

Formula 2.6.4

$$shut\ down\ if\ TR\ <\ VC$$

By dividing both sides by the quantity, **Q**, the shutdown condition becomes:

Formula 2.6.5

$$shut\ down\ if\ TR/Q\ <\ VC/Q$$

On the one hand, we know that $TR\ =\ P\ x\ Q$, thus, we can express the left-hand side of the inequality as P. On the other hand, the right-hand side of the inequality is the average variable cost or AVC. For this reason, we can restate the shutdown rule as:

Formula 2.6.6

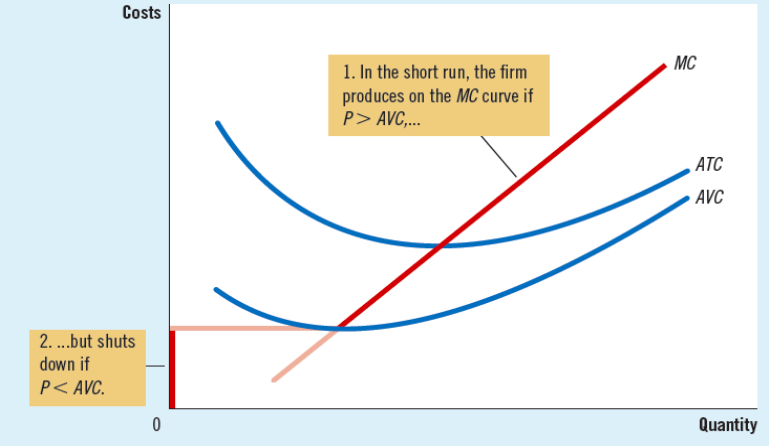
$$shut\ down\ if\ P\ <\ AVC$$

This means that if the price of the good is less than the average variable cost of production, the firm should shut down. Comparing the price with the average variable cost of a good makes sense, because if the firm sells the good in the market to earn revenue, then that revenue should more than compensate for the costs the good incurs.

When temporary mishaps happen but are expected to reverse within a short period of time, the firm is better off halting production in the short-run when the price is insufficient to cover the variable cost of the good. Although the firm still pays for the fixed costs, it saves itself from incurring more losses from the variable costs if it continues its operations. The firm can reopen once there are favorable conditions, and the price of the good is expected to exceed the average variable cost.

Figure 2.6.4.

We graphically show the shutdown condition in Figure 2.6.4. As illustrated, the competitive firm's short-run supply curve starts at the point on the marginal cost curve where P = AVC moving upwards. This means that at any level of quantity where P ≥ AVC, the firm is willing to continue its operations. Otherwise, the firm should shut down.



b. Long-Run Supply and Exit Condition

When a firm decides to exit the market, it loses all the opportunity to earn revenue from the sale of its product. With exiting the market, not only does the firm save itself from incurring variable costs, but also fixed costs. Therefore, the firm exits the market if the revenue it would generate from the quantity produced is lower than the total cost of producing the product.

The **exit condition** compares Total Revenue (TR) and Total Cost (TC). The firm will exit if TR is less than TC.

Formula 2.6.6

$$exit\ if\ TR\ <\ TC$$

By dividing both sides by the quantity, **Q**, the exit condition becomes:

Formula 2.6.7

$$exit\ if\ TR/Q\ <\ TC/Q$$

On the one hand, we know that $TR = P\ x\ Q$, thus, we can express the left-hand side of the inequality as P. On the other hand, the right-hand side of the inequality is the average total cost or ATC. For this reason, we can restate the exit rule as:

Formula 2.6.8

$$exit\ if\ P\ <\ A\,TC$$

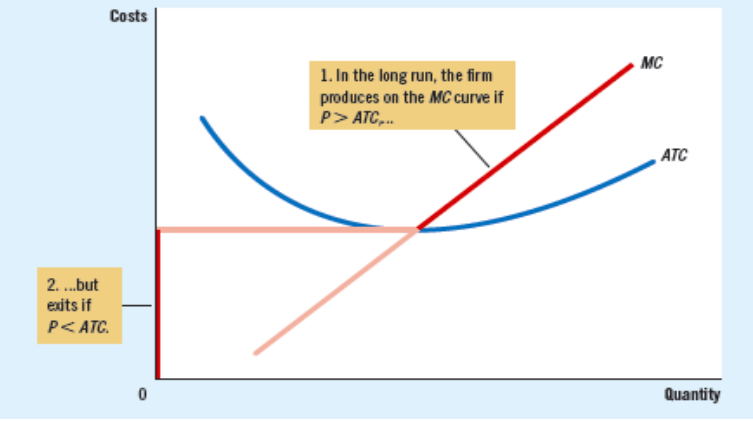
This means that if the price of the good is less than the average total cost of production, the firm should exit the market. When existing firms exit, the market creates more room for potential firms to enter. When profitable opportunities become available, the entry condition is the opposite of the exit condition. If the price of the good is greater than the average total cost of production, firms should enter the market.

Formula 2.6.9

$$enter\ if\ P\ >\ A\,TC$$

Figure 2.6.5.

We graphically show the exit condition in Figure 2.6.5. As illustrated, the competitive firm's long-run supply curve starts at the point on the marginal cost curve where P=ATC moving upwards. This means that at any level of quantity where P ≥ ATC, the firm is willing to continue its operations. Otherwise, the firm should exit the market.



c. Measuring Profit: Graphical Representation

In general, profit is equal to total revenue (TR) minus total cost (TC). If we multiply and divide both sides by Q, we can restate the profit equation as:

Formula 2.6.10

$$Profit = (TR/Q - TC/Q) \, x \, Q$$

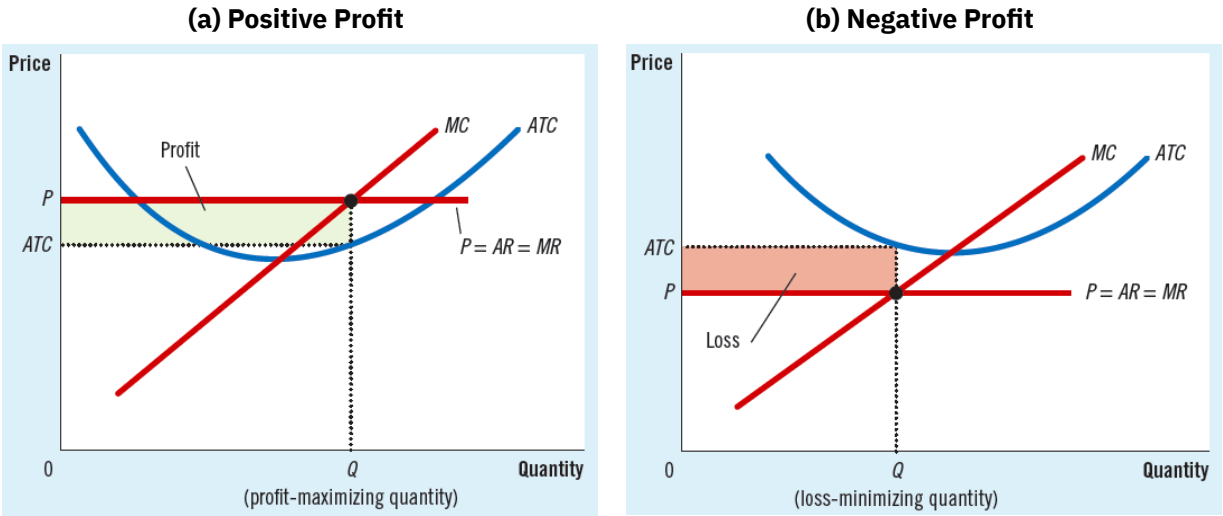
We know that TR/Q is the average revenue (AR), P is equal to AR in a perfectly competitive market, and TC/Q is average total cost (ATC). Hence,

Formula 2.6.11

$$Profit = (P - ATC) \, x \, Q$$

As shown in Figure 2.6.6, we measure the profit graphically. Note, the **profit-maximizing condition occurs where P = MR = MC.** In panel (a) of Figure 2.6.6., the firm generates a positive profit since P > ATC, which is represented by the shaded rectangle. To get this area, we multiply the height (P - ATC) and the width (Q), which is essentially our profit equation (2.6.11). In panel (b), the firm incurs a negative profit (loss) since P < ATC. In this situation, maximizing profit means minimizing losses.

Figure 2.6.6.



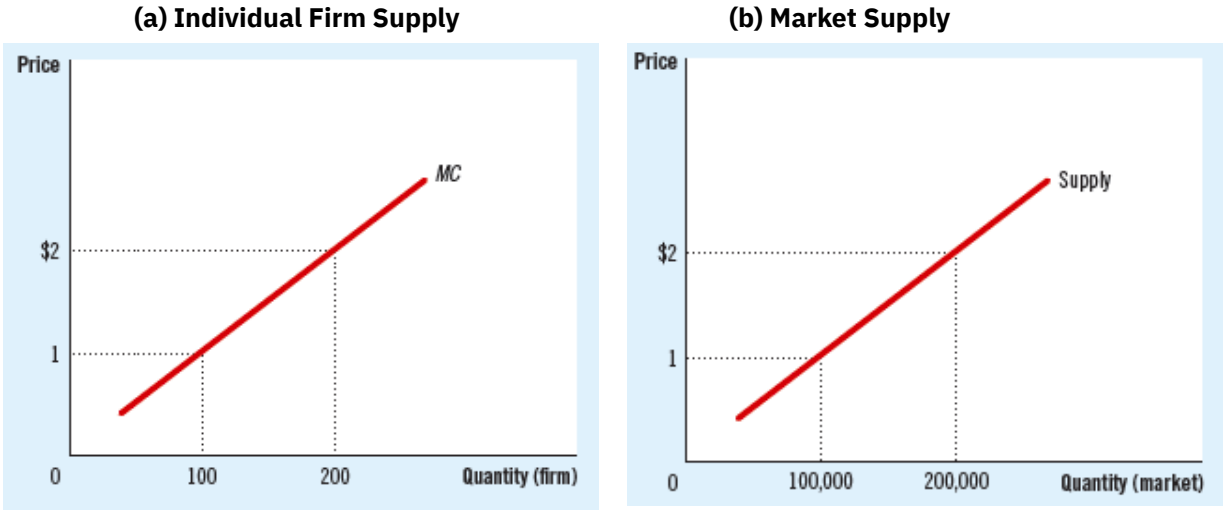
d. Firm and Market Behaviors in Short-Run and Long-Run Equilibria

The market supply curve in a competitive market adjusts over time. In the short-run, entry and exit are less likely to occur as barriers hinder firms from doing so. Thus, we can assume that there is a fixed number of firms over short periods of time. However, as it becomes easier to enter and exit the market, the number of firms adjusts in the long-run as market conditions change.

i. The Short Run: Market Supply with a Fixed Number of Firms

Suppose that there are 1,000 identical firms in the market. As shown in Figure 2.6.7. Panel (a), for any given price level, each firm produces the profit-maximizing quantity of output, where P = MC = MR. **The firm's short-run supply curve is equivalent to the marginal cost curve when P > AVC.** Summing up all the quantities supplied by all the firms in the market determines the market supply curve. As shown in Panel (b), the market supply is 1,000 times the quantity produced by each firm.

Figure 2.6.7. Short-Run Market Supply



ii. The Long Run: Market Supply with Entry and Exit

Suppose firms are able to enter and exit the market without any barriers. In this instance, existing and potential firms have similar cost curves.

The decision to enter or exit the market depends on the incentives that owners are willing to accept. If existing firms in the market continue to earn profit, then new entrants will have an incentive to join the market. This expands the number of firms and the quantity of goods supplied in the market. As a result, the price of a good decreases and profit shrinks. If there are too many firms in the market, then firms start to incur losses. Some existing firms will exit the market. When this happens, the number of firms is

reduced, and the price of the goods increases, and profit increases. Firms will enter and exit the market until economic profit is zero.

Recall, we express a firm's profit as:

Formula 2.6.12

$$Profit = (P - ATC) \, x \, Q$$

If P = ATC, the firm has zero profit. If P > ATC, firms generate a positive profit, which attracts new firms to enter the market. If P < ATC, firms incur a negative profit, which drives some firms to exit. The entry and exit of firms in the market ceases when incentives are exhausted and **P = ATC_{min}**.

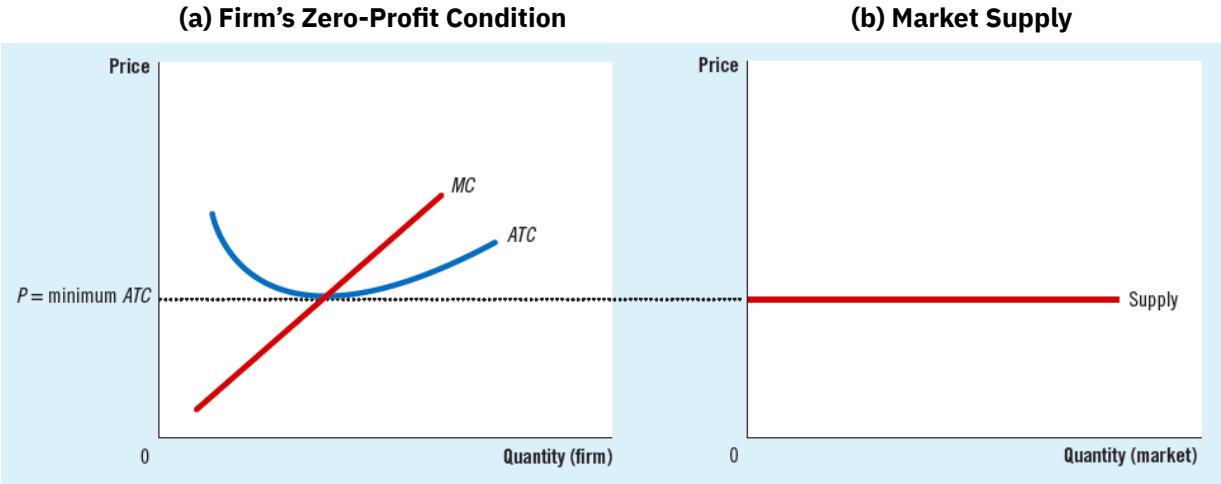
In a perfectly competitive market, firms maximize profits by producing a quantity of goods where P = MC = MR. With the entry and exit of firms in the market, prices are driven down to the level of average total cost. At this point, P = MC = ATC. We know from the previous section that MC intersects ATC at its minimum, when the firm is operating efficiently. Hence, **in the long-run equilibrium, with free entry and exit, the market exhibits productive and allocative efficiency in which resources are allocated accordingly, and provide maximum satisfaction to the society.**

- **Allocative efficiency** is achieved at a level of quantity where P = MR = MC. This means that resources are utilized in the best way possible, such that the marginal social benefit is equal to the marginal social cost. Any level of quantity greater than or less than the quantity where P = MC, is considered to be an allocative inefficient.

- **Productive efficiency** is achieved at the level of quantity where **P=ATC_{min}**. This means that the entry and exit of firms in the market drive the price down, and firms produce at the lowest cost possible.

Figure 2.6.8. shows two panels that illustrate the long-run equilibrium in a perfectly competitive market. In Panel (a), we see that firms produce **Q_{max}**, where **P = MC = ATC_{min}** and profit is zero. At this price level, there is no incentive to enter or exit the market. When **P = ATC_{min}**, long-run equilibrium is achieved and the market supply curve is horizontal as shown in Panel (b). Any price above this level would earn positive profits, attracting new entrants that would increase the quantity supplied. Any price below this level would earn negative profits, causing some firms to leave the market, which would decrease the quantity supplied. The market will eventually adjust to the level where **P = ATC_{min}**, when there are enough firms to supply the demand at this price level.

Figure 2.6.8.

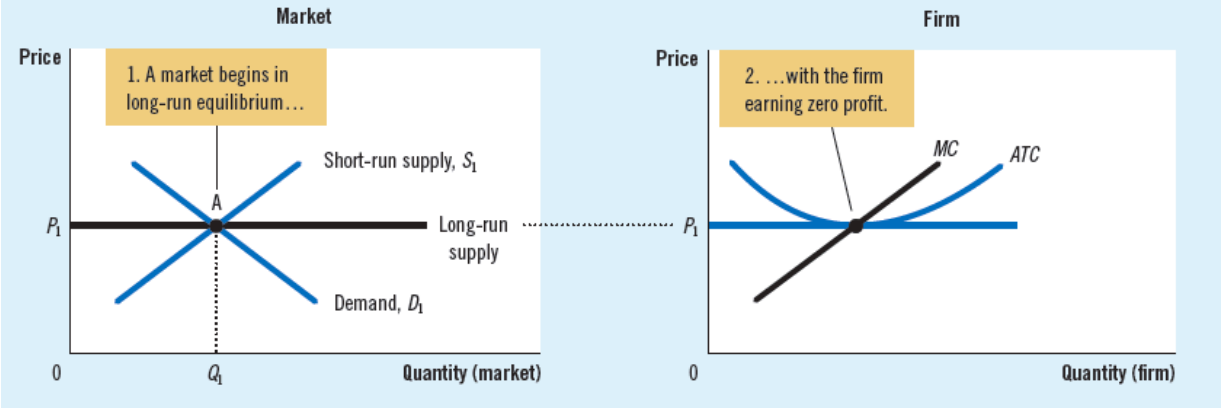


One may ask, "Why do firms remain in the market when profit is zero?" Recall, there are two types of profit: economic profit and accounting profit. **In the long-run equilibrium, economic profit is driven to zero, but accounting profit remains positive.** For some firms, having a positive accounting profit, where revenues are greater than explicit costs, is enough motivation for them to keep running their business and stay in the market.

iii. A Shift in Demand in the Short Run and Long Run

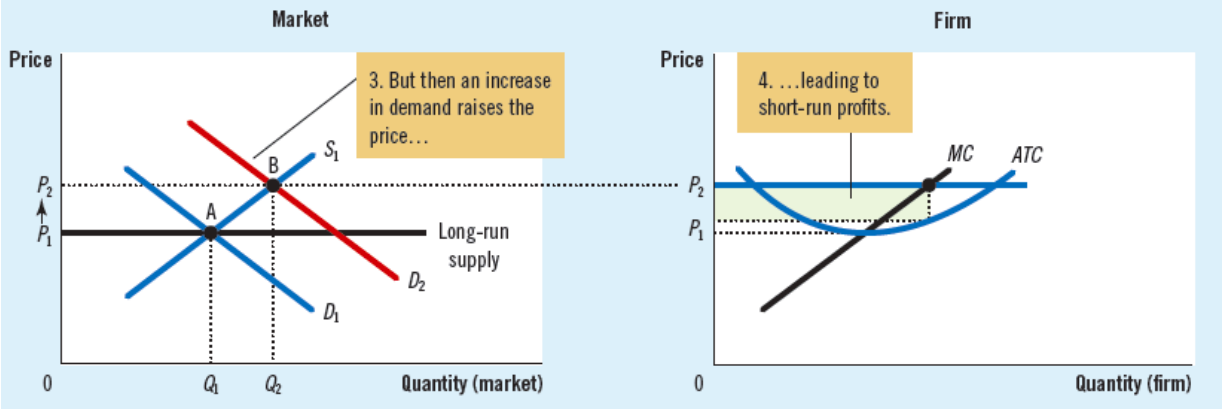
So far, we have discussed how competitive firms in the market make supply decisions. We now determine how markets respond when changes in demand occur, considering the time horizon. Suppose the market for corn is established in a long-run equilibrium, which means that P = ATC and economic profit is zero. As shown in Panel (a) of Figure 2.6.9., the long-run equilibrium is at point A (Q_1, P_1).

Figure 2.6.9. Panel (a) Initial Condition



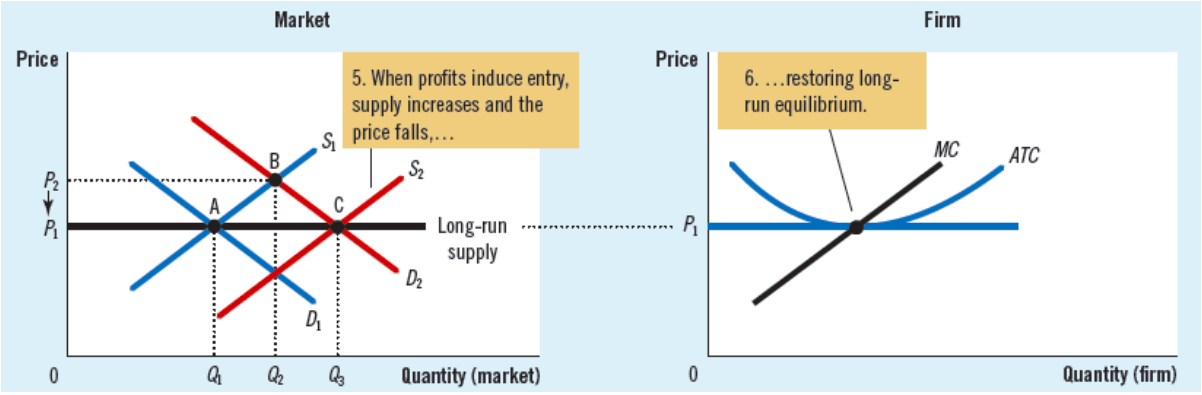
Let's assume researchers found that corn contains a substance that boosts the immune system. This results in an increase in quantity demanded at every price level, which shifts the demand curve to the right, from D_1 to D_2, as shown in Panel (b). The short-run equilibrium changes from point A to point B, where both quantity and price increase. This implies that existing firms increase their production due to the higher price. The new short-run equilibrium occurs where P > ATC, and firms are generating positive profits.

Figure 2.6.10. Panel (b) Short-run Response



Over time, the positive profit attracts new entrants to the market, which shifts the short-run supply curve to the right, from S_1 to S_2, as shown in Panel (c). Eventually, the market adjusts to a lower price until it reaches the ATC_{min} level once again, where economic profit is zero. At this point, entry and exit cease and the market moves to a new long-run equilibrium, point C (P_1, Q_3). The price of corn returns to P_1, but the quantity supplied increases to Q_3. Each firm is operating again, efficiently with more firms in the market.

Figure 2.6.11. Panel (c) Long-run Response



Concept Check 2.15.	
Perfectly competitive market	a market with many buyers and sellers exchanging homogenous products, which make each participant a price taker
Price taker	accepts the market-determined price as given
Profit-maximization	occurs when marginal revenue (MR) = marginal (MC)
Shut down condition	a firm closes in the short-run when price (P) < average variable cost (AVC)
Exit condition	a firm exits the market in the long-run when price (P) < average total cost (ATC)
Long-run equilibrium of a competitive firm	entry and exit in the market cease at a quantity level where price (P) = marginal cost (MC) = minimum average total cost (ATC_{min})
Allocative efficiency	occurs at the level of quantity where P = MR = MC, and is only true for a perfectly competitive market
Productive efficiency	occurs at the level of quantity where P = ATC_{min}

C. Monopoly

This type of market structure is the extreme opposite of a perfectly competitive market. There can be many buyers in the market, but there is no competition among sellers. There is only one seller in the market. The sole seller or the monopolist produces a unique product that others cannot replicate or produce. The monopolist enjoys market power and can charge a high price for the profit-maximizing quantity it produces. Hence, monopolists are price makers.

a. Sources of Market Power

When there is only one seller in the market, barriers to entry prevent other firms from participating in the market. Some of these barriers include the following:

i. Monopoly Resources

Owning a key resource for use in production or for sale in the market gives the owner-seller sole access to it. That is, the owner-seller is preventing others from utilizing it for free. In a small town, for example, if a certain resident owns the only water well in the community, then the owner can sell the water to the other residents at a high price. The owner's market power allows them to demand a high price, even if the marginal cost of drawing water from the well is low.

In reality, most resources are owned by more than one seller, and competition is present. Nevertheless. monopolies do exist and the prime example of one is the Aluminium Company of America (Alcoa), which has a monopoly on the world's production of aluminum.

ii. Government Regulation

Government policies on a patent, copyright, trademark, and public franchise enable a firm to have market power.

- ➔ In the US, a ***patent*** of a new product gives a seller or a firm the exclusive right to sell that product in the market for a period of 20 years. The government uses patents to incentivize firms to research and develop new products. Without patent protection, the firm may not have the drive to further develop or innovate a product. Firms from the Information Technology (IT) and Pharmaceutical industries usually apply for patents.

- ➔ According to the US Patent and Trademark Office, a ***trademark*** is "*any word, name, symbol, device, or any combination, used or intended to be used to identify and distinguish the goods/services of one seller or provider from those of others, and to indicate the source of the goods/services.*" This granted trademark legally protects the firm's exclusive use of the product's name. Some famous trademarks include Nike, Apple, Starbucks, Coca-Cola, and so on.

- ➔ The government grants a ***copyright,*** *which is* an exclusive right for book authors, film and music producers, and other inventors to use their creations for a lifetime. This right extends even to the creator's heirs up to 70 years after the creator's demise. A copyright incentivizes individuals and firms to invest in creative endeavors in order to produce new books, films, music, or software, for example.

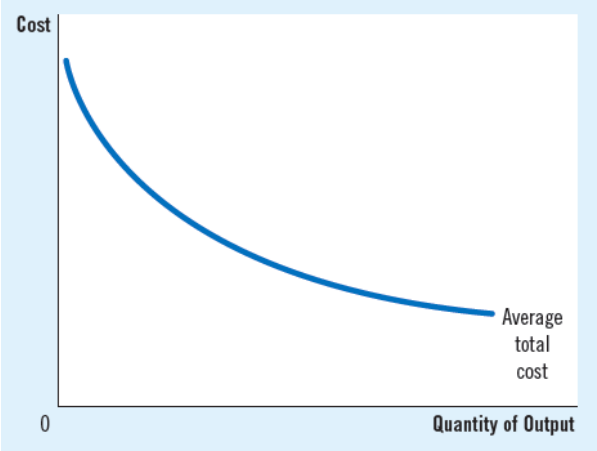
- ➔ The government grants a ***public franchise***, which permits a firm to be the sole legal source of a good or service. For instance, state and local governments frequently assign one firm as the only provider of water, electricity, or natural gas.

iii. Natural Monopolies

A natural monopoly is a type of monopoly that supplies a good or service to the entire market cheaper than numerous other firms.

Consider electricity as the good supplied in the market. Producing electricity requires massive investments in infrastructure, equipment, land, grid connection, power plants, etc., which contributes to a high fixed cost. Since electricity is a necessity, we expect almost everyone in the population to demand it. This means that the first firm producing the electricity in the market enjoys economies of scale because the high fixed cost is distributed to a large number of users. Thus, the average total cost is at its minimum (see Figure 2.6.12.)

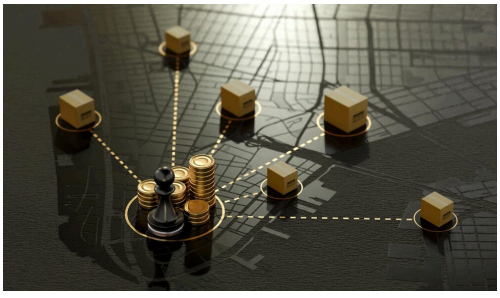
Figure 2.6.12.



If additional firms join the market, they would also be incurring high fixed costs that increase the market's total cost. Since the number of electricity users remains the same, the higher total cost will pull up the average total cost; therefore, economies of scale are no longer achieved. If one of the firms expands, it will drive down its own average total cost, which allows it to offer electricity at a lower price. Eventually, other firms will not be able to offer electricity at a lower price and, as a result, close down. Hence, only one firm will survive in the market. As such, competition is undesirable and causes wastage of resources. So, in a natural monopoly, only one firm producing at the lowest cost will allocate goods and services efficiently.

iv. Network Externalities

A firm, usually the first one in the market, gains from a situation in which the usefulness of a product increases as the number of users increases. We refer to this situation as **network externalities**. An example of this is the computer operating system Microsoft Windows. The more people who use this software, the more it becomes valuable and preferred by consumers. The popularity and usefulness of Microsoft Windows drive away potential entrants from entering the software market, as the existing firm has already captured a significant share of demand in the market.



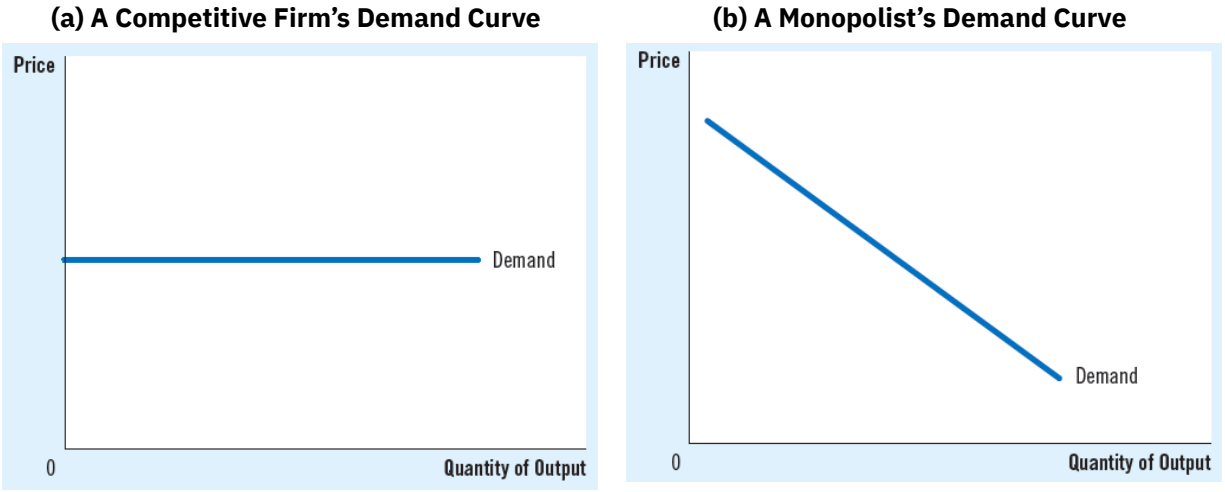
Concept Check 2.16.	
Monopoly	a type of market structure in which only one seller sells a good or service in the market
Price maker	the power to influence the price in the market
Patent	exclusive right to sell a product for a period of 20 years
Trademark	legal protection against other firms' use of a symbol, word/s, logo, etc.
Copyright	exclusive right to produce and sell a creation (i.e., book, music, film)
Public franchise	a government assignment to a sole firm to legally provide a good or service to the public
Natural monopoly	occurs when economies of scale is achieved when only one firm supplies the entire market at the lowest average total cost
Network externalities	occurs when the usefulness of a product increases as the number of users increases

b. Monopoly versus Competition

While a competitive firm has no power to influence the price of a good, a monopolist does have the power to influence the price of its product. As was previously presented, a perfectly competitive firm is a price-taker and accepts the price as given. A monopolist, in contrast, is a price-maker and charges a higher price at a reduced quantity as opposed to the perfectly competitive firm.

Due to their contrasting characteristics, a competitive firm and a monopolist have different demand curves, as shown in Figure 2.6.13. Panel (a) illustrates a horizontal and perfectly elastic demand curve for a competitive firm since the price remains constant regardless of the quantity of output produced. Panel (b) illustrates a downward-sloping demand curve since a monopolist can choose what price to charge to consumers. According to the law of demand, if the price is high, there is less demand for the product, and if the price is low, there is more demand for the product.

Figure 2.6.13.



A monopolist would like to produce the largest quantity of its output and charge the highest price possible. However, the monopolist cannot produce large quantities of output, because **the market demand curve imposes a limit on the monopolist's capability to profit from its market power.** The combinations of price and quantity along the market demand curve depict the choices of production and price level for a monopolist. Hence, the monopolist can choose any point on the demand curve.

Among the quantity and price combinations available, at what quantity and price will the monopolist produce and sell? Just like any other firm, a monopolist aims for profit maximization. The succeeding discussions will focus on the revenue, costs, and profit in a monopolistic market.

c. Monopoly's Revenue

Suppose in Dairy Town, there is only a single producer of milk. As shown in Table 2.6.2, the monopolist's revenue depends on the amount of milk it produces.

Columns (1) and (2) of Table 2.6.2. illustrate the monopolist's demand schedule. At a price of $11, the monopolist produces nothing. At $10, it produces 1 gallon of milk. As the monopolist lowers the price, more gallons of milk are produced. Therefore, at $8, 3 gallons of milk are sold. This table is consistent with the law of demand, and graphically, the demand curve is downward-sloping.

Column (3) of Table 2.6.2. shows the total revenue of the monopolist at each combination of price and quantity. Hence, total revenue is the product of price (P) and quantity (Q). Column (4) is the average revenue, which is the typical amount of revenue received per unit sold. It is derived from dividing total revenue by the quantity of output. Similar to a competitive firm, the average revenue is the price of the good.

Column (5) of Table 2.6.2. shows the monopolist's marginal revenue, which is the additional revenue that the firm receives from an additional unit of output produced and sold. Moreover, the marginal

revenue is the change in total revenue when quantity increases by 1 unit. For instance, when the firm increases production from 3 to 4 gallons of milk, the marginal revenue is $4 ($28 - $24).

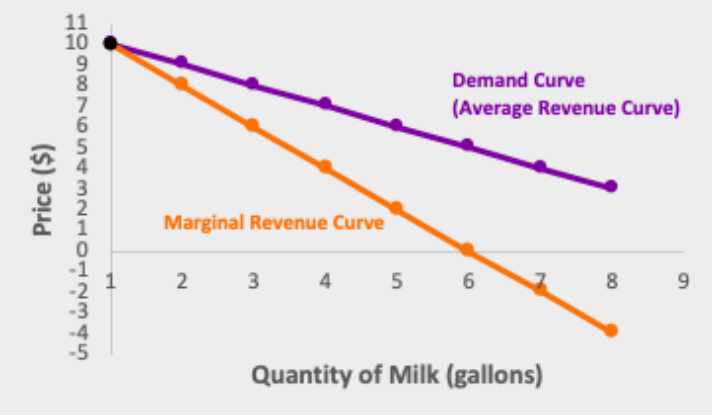
Comparing columns (2) and (5), notice that the marginal revenue is less than the price of its good. For instance, if the monopolist increases milk production from 3 to 4 gallons, its total revenue increases only by $4, although it sells the additional gallon of milk for $7. The monopolist can only sell 4 gallons of milk if it lowers the price by $1. However, in doing so, the monopolist loses $1 for the previous 3 gallons it sold for $8. This is the reason why the marginal revenue of the fourth gallon is less than its price.

Table 2.6.2.

(1) Quantity of Milk (Q)	(2) Price (P)	(3) Total Revenue (TR = P X Q)	(4) Average Revenue (AR = TR/Q)	(5) Marginal Revenue (MR = $\Delta TR/\Delta Q$)
0 gallons	$11	$0		
1	10	10	$10	$10
2	9	18	9	8
3	8	24	8	6
4	7	28	7	4
5	6	30	6	2
6	5	30	5	0
7	4	28	4	-2
8	3	24	3	-4

Figure 2.6.14. illustrates the demand and marginal revenue curves for a monopoly firm. Since the monopolist's price is equal to its average revenue, the demand curve is the same as the average revenue curve. Both curves share the same starting point since the marginal revenue of the first unit sold is always equal to the price of the good. However, after this point, the two curves diverge, and the marginal revenue curve lies below the demand curve.

Figure 2.6.14.

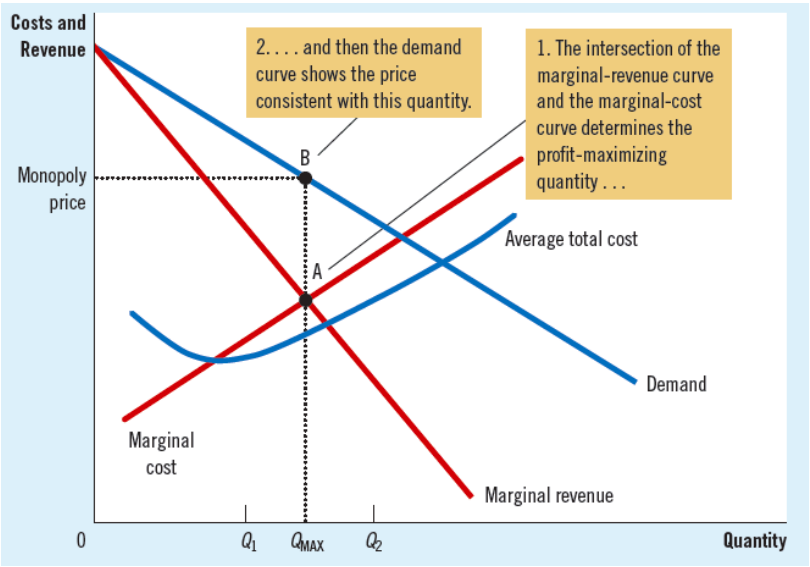


When the marginal revenue is negative, it is no longer sustainable for the monopolist to increase its production. At this price level, the monopolist receives less revenue from selling more units.

d. Profit Maximization

To determine the profit-maximizing level of output of a monopolist, we refer to Figure 2.6.15. that shows the monopolist demand curve, marginal revenue curve, and the cost curves. By this time, we should already be familiar with a firm's typical cost curves, as discussed in Section 2.5. The demand and marginal revenue curves of a monopolist resemble Figure 2.6.15.

Figure 2.6.15.



Suppose the monopoly firm is producing at Q_1. At this level of output and price, the corresponding point on the marginal revenue (MR) curve is greater than the corresponding point on the marginal cost (MC) curve. As a result MR > MC. This implies that if the monopoly firm increases its production by an additional unit, the additional revenue can still cover the additional cost; hence, the firm earns an additional profit and increases the total profit.

Suppose the firm is producing at Q_2. At this level of output and price, the corresponding point on the MR curve is lower than the corresponding point on the MC curve. This means that the MR < MC, and the firm is generating a negative additional profit that pulls down the total profit of the firm. The total profit may still be positive but not as high as the profit at the previous level of quantity produced.

Whether the monopoly firm starts at a low level Q_1 or at a high level Q_2, it recalibrates its production level to achieve the profit-maximizing Q_{max}, where MR=MC. For example, from Q_1, the monopoly firm increases production until Q_{max} is reached, and from Q_2, it reduces production until Q_{max} is reached. As shown in Figure 2.6.15, the monopolist's profit-maximizing quantity is at point A, where MR and MC intersect.

The profit-maximizing condition (MR=MC) that determines the level of quantity to be produced is the same for a monopolist and a competitive firm. However, the price relative to marginal revenue differs for the two types of market structures:

Price for a perfectly competitive firm is P = MR = MC, and **a monopoly firm is P > MR = MC.**

This implies that **MR = MC determines the profit-maximizing quantity for both a competitive firm and a monopoly firm, but a monopolist charges a price higher than the marginal revenue and marginal cost.**

The price at which the monopolist charges for its product corresponds to the point on the demand curve that matches the same quantity level as Q_{max}. As seen in Figure 2.6.15, this occurs at point B. The price at this point is the highest price that consumers are willing to pay for the output.

e. A Monopoly's Profit

In general, profit is equal to total revenue (TR) minus total cost (TC). If we multiply and divide TR and TC by Q, profit can also be determined as:

Formula 2.6.13

$$Profit = (TR/Q - TC/Q)\,x\,Q$$

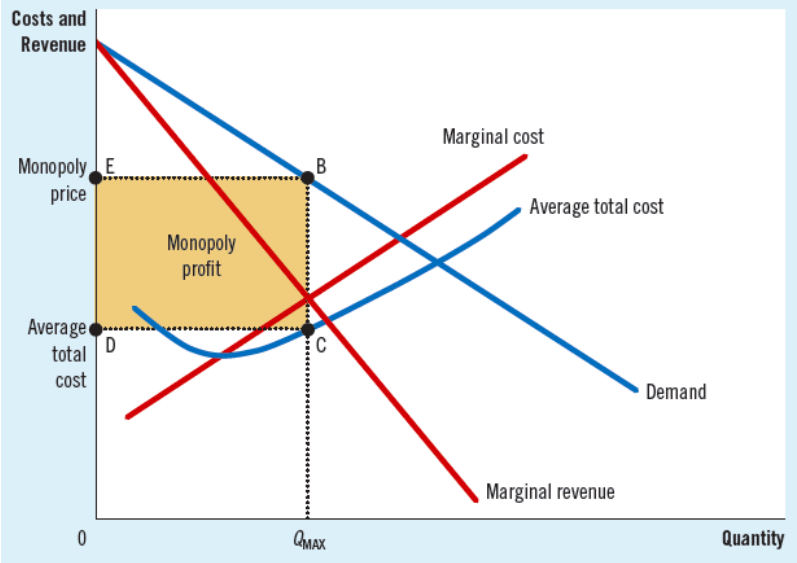
We know that TR/Q is the average revenue (AR), P is equal to AR in a perfectly competitive market, and TC/Q is average total cost (ATC). Hence,

Formula 2.6.14

$$Profit = (P - ATC)\,x\,Q$$

As shown in Figure 2.6.16, we measure the monopolist's profit graphically using equation 2.6.7. Note, the **profit-maximizing condition occurs where P > MR = MC.** The shaded area EBCD, a rectangle, represents the monopoly profit. We can, therefore, calculate the area by multiplying its height (segment EB or DC) and its width (segment ED or BC). Segment EB or DC measures $\mathbf{Q}_{max}$ while segment ED or BC measures (P-ATC). Hence, monopoly profit is equal to (P-ATC) x $\mathbf{Q}_{max}$.

Figure 2.6.16.



f. Inefficiency of Monopoly

We know that a perfectly competitive market is the ideal market structure that produces desirable societal outcomes (see Section 2.3.) where the profit-maximizing condition occurs at P = MR = MC. In this case, total surplus, the measure of economic well-being of consumers and producers, is maximized. Recall, total surplus is composed of the consumer surplus, which is the difference between a buyer's willingness to pay and the price of the good, and the producer surplus is the difference between the price of the goods and the seller's cost of production.

A monopoly market is the opposite of a perfectly competitive market, and the monopoly firm charges a price greater than the marginal cost (P > MC). By charging a price that is greater than its marginal cost, the monopolist earns a high profit; but for consumers, this higher price is undesirable. For this reason, the consumer surplus under the monopoly condition is lower than the consumer surplus under the

perfectly competitive market condition. In this regard, the economic well-being is not maximized under the monopoly market condition.

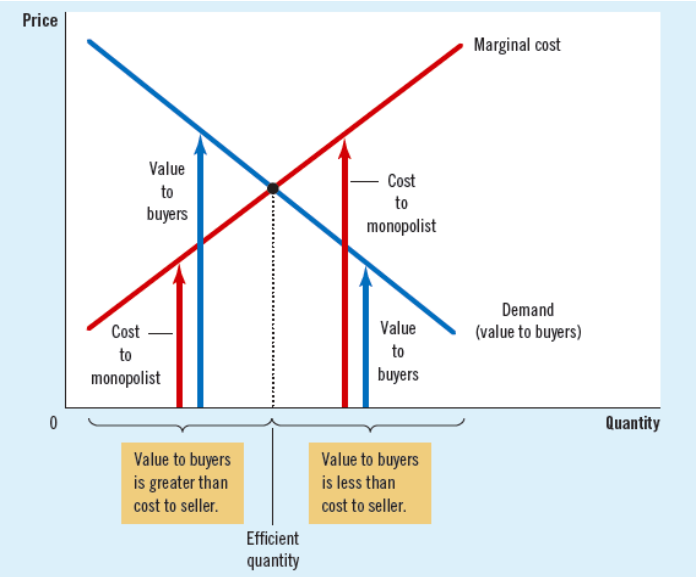
i. The Deadweight Loss

Suppose the monopoly firm is managed by a benevolent social planner, who cares for the welfare of their consumers, then their goal is to maximize the total surplus; that is, to maximize both the consumer and producer surplus. Total surplus can also be defined as the difference between the value of the good to consumers and the costs incurred by the monopolist in producing the good.

As shown in Figure 2.6.17., the benevolent social planner will choose the socially efficient quantity, where the demand curve (consumers' willingness to pay) intersects with the marginal cost curve (costs of the monopolists). Quantities lower than this efficient quantity are in the region where the value of an additional unit to consumers is greater than the cost of producing it. Thus, increasing the quantity increases the total surplus. Quantities higher than the efficient quantity are in the region where the value of an additional unit to consumers is less than the cost of producing it. Thus, reducing the quantity lowers the total surplus. At the efficient quantity, the value of an additional unit to consumers is exactly the same as the additional cost of producing it.

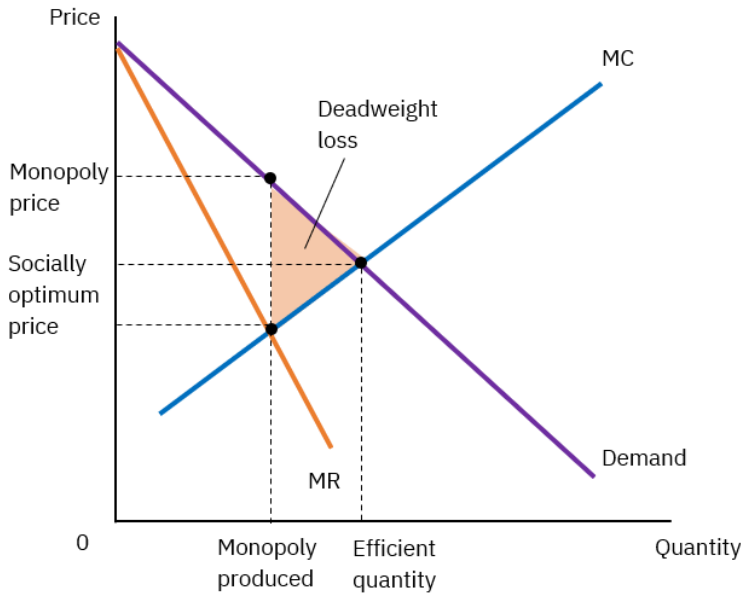
To maximize the total surplus, the benevolent social planner will charge a price that corresponds to the efficient quantity. Similar to a competitive firm, a benevolent social planner will charge a price equal to the marginal cost (P = MC).

Figure 2.6.17.



Using Figure 2.6.17., we can analyze and compare the welfare effects of the social planner and the monopolist. They both produce different output amounts, i.e., a social planner chooses the efficient quantity where demand is equal to marginal cost and charges the corresponding price ($P_{efficient}$). A monopolist produces at a lesser quantity, where MR = MC, and charges a price greater than the price of the social planner. The marginal cost is equal to the marginal revenue where ($P_{monopolist} > P_{social\ planner} > MC_{=MR}$). As seen in the figure, monopoly quantity is less than the efficient quantity of output.

Figure 2.6.18.



As shown in Figure 2.6.18., the inefficiency caused by a monopoly firm is represented by the deadweight loss triangle. This is the portion of the total surplus lost because of monopolist market power, which enables the monopolist to charge a higher price at a reduced quantity relative to what a benevolent social planner does. In a monopoly market, society's economic well-being is reduced and not maximized. The higher the price a monopolist charges, which is above the socially optimal price, the larger the deadweight loss triangle. We can measure the area of the triangle by applying the formula for the area of a triangle: (base x height)/2.

g. Price Discrimination

Price discrimination occurs when different prices are charged to different types of consumers, even if the costs of producing the goods are the same. Not all firms practice price discrimination.

Firms that practice price discrimination exhibit the following characteristics:

➔ The firm has market power because of limited competition among sellers.

➔ Consumers have varying willingness to pay, and firms have the ability to know which consumers are willing to pay the higher price.

➔ The firm must be able to categorize or segment the market such that consumers who buy their product at a low price do not resell the good at a higher price (arbitrage or presence of a secondary market is not allowed).

There are three types of price discrimination:

1) First Degree (Perfect Price Discrimination)

Suppose the seller has complete knowledge of the consumers' willingness to pay; the seller then uses this information to charge a price equivalent to the consumer's maximum willingness to pay. First-degree (or perfect) price discrimination is, therefore, the practice of charging different prices that perfectly match the maximum willingness to pay each consumer for the same good. Although in reality, this is extremely difficult for the firm (if not impossible) to do, because the firm lacks the ability to precisely measure the exact customer's willingness to pay for the product.

However, some weak practices of first-degree discrimination are exhibited in car dealerships and professional services, for example. A car dealer may post a price that is significantly above marginal cost but would discreetly negotiate a discount with a customer on a case-to-case basis. In the same way, doctors or lawyers may publish a higher professional fee for their services but may collect varying amounts depending on how they assess their clients' willingness to pay.

2) Second Degree

For some services that require continuous use, a seller can charge a higher upfront fee for the initial use and thereafter, a lower rate for subsequent usage. A seller can also charge different prices, depending on the number of items a consumer buys – a higher price per unit for a single purchase and a lower price per unit for a bulk purchase. Second-degree price discrimination is a practice in which a seller charges declining prices for different ranges of quantities.

Some examples of second-degree price discrimination are:

- Electricity, in which consumers are usually charged a higher rate per unit for initial kilowatt-hours and a lower rate for subsequent units.
- Parking fees, in which higher fees are charged first three hours and lower prices for succeeding hours).
- Retail versus wholesale or big box stores that charge a higher price per item for a single purchase and a lower price per item for several purchases or bulk items.

3) Third Degree

A seller charges different prices to different categories of consumers based on age, need, demographics, or any other form of segmentation.

Some examples of third-degree price discrimination are:

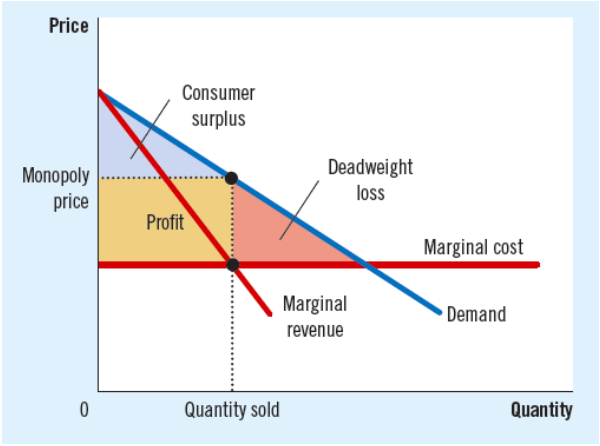
- Movie ticket pricing, in which senior citizens and students pay a lower price and regular movie goers pay a higher price.
- Ticket pricing in which business travelers pay a high price and leisure travelers pay a lower price.
- Educational resources pricing in which non-students pay a higher price and students pay a lower price.

Price discrimination affects the economic well-being of consumers and producers. Using Figure 2.6.19., we can show how societal welfare is impacted due to the ways in which total surplus, consumer surplus, and producer surplus are determined when monopoly firms practice price discrimination.

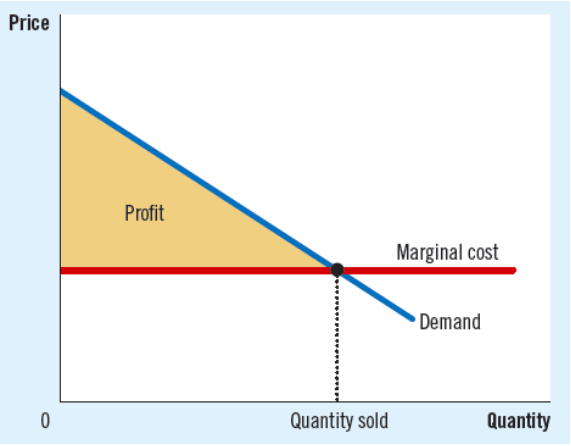
For simplicity, we assume that the firm's cost is the same per unit (constant per-unit cost with no economies of scale as quantity increases) and that MC and ATC are equal. This makes the MC curve horizontal.

Figure 2.6.19.

(a) Monopolist with Single Price



(b) Monopolist with Perfect Price Discrimination



As seen in Panel (a), when a monopolist charges a single price (the same price listed for the product to all consumers, regardless of their individual willingness to pay), is higher than marginal cost to consumers, the total surplus is reduced by the amount of the deadweight loss. The seller is able to maximize profit at this price level and quantity, but some consumers are displaced. For this reason, only a small consumer surplus is gained. In Panel (b), when a monopolist practices perfect price discrimination (first-degree), the monopolist is able to extract all the surplus from consumers by

charging a price that is equivalent to the consumer's maximum willingness to pay. Hence, all surplus gained from the market goes entirely to the monopoly firm, further increasing the monopolist's profit.

As mentioned earlier, perfect price discrimination is almost impossible in reality. However, second and third degree price discriminations are still practiced by monopoly firms.

Table 2.6.3

	Competition	Monopoly
Similarities		
Goal of firms	Maximize profits	Maximize profits
Rule for maximizing profit	*MR = MC*	*MR = MC*
Can earn economic profits in the short run?	Yes	Yes
Differences		
Number of firms	Many	One
Marginal revenue	*MR = P*	*MR < P*
Price	*P = MC*	*P > MC*
Produces welfare-maximizing level of output?	Yes	No
Entry in the long run?	Yes	No
Can earn economic profits in the long run?	No	Yes
Price discrimination possible?	No	Yes

Concept Check 2.17.	
Profit-maximizing condition for a monopolist	quantity at which MR = MC and where P > MC and lies on the demand curve
Deadweight loss	represents the inefficiency caused by a monopoly firm exercising its market power by charging a higher price and producing lower quantity.
Price discrimination	the practice of charging different prices to different consumers

D. Monopolistic Competition

From its name, a **monopolistically competitive market is a hybrid of the two extreme market structures: monopoly and perfect competition**. Some of its characteristics resemble a monopolist, and some resemble a perfectly competitive firm.

These are:

- from monopoly: distinct and differentiated product
- from perfect competition: presence of several buyers and sellers, and free entry and exit of firms in the market

Monopolistically competitive firms include restaurants, chocolates, cafes, books, and shoes, to name a few. For example, there are many chocolate producers; however, different chocolates can be identified by their brands, taste, size, flavors, and so on. You can differentiate Hershey's from Cadbury or Ferrero from Toblerone. You'll find that most items you have or use at home, at work, or in school are manufactured by firms belonging to this type of market structure.

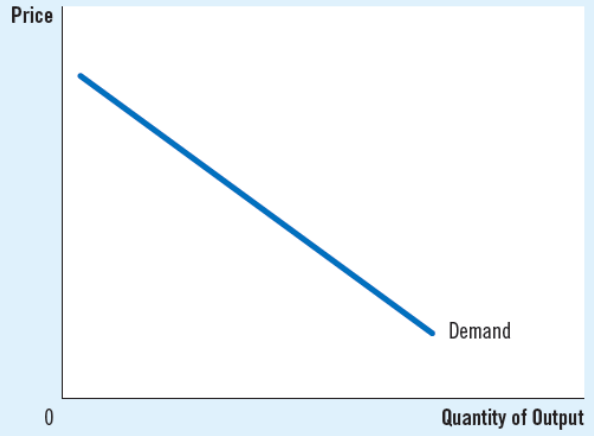
a. Monopolistic Competition's Demand

Similar to a monopolist, **monopolistically competitive firms have some degree of market power and can influence the price of their products.** Product differentiation allows monopolistically competitive firms to have market power, although this market power is weaker than a monopolist because of the competition among several of these firms. In essence, monopolistically competitive firms are also price-makers who **have more of an ability to charge a higher price** than perfectly competitive firms.

Figure 2.6.20 illustrates a downward-sloping demand curve for a monopolistically competitive firm. This firm can choose what price to charge its consumers. If the price is high, there is less demand for the product, and if the price is low, there is more demand for the product.

Just like a monopolist, the market demand curve imposes a limit on a monopolistically competitive firm's capability to profit from its modest market power. The combinations of price and quantity along this curve depict the choices of production and price level that the firms can choose.

Figure 2.6.20



b. Monopolistic Competitive Firm's Marginal Revenue

Suppose we are analyzing *Moon Cafe*, one of the several neighborhood coffee shops. This cafe sells the best coffee, Caffe Americano. As shown in Table 2.6.4., *Moon Cafe*'s revenue depends on the amount of coffee it produces.

Table 2.6.4.

(1) Quantity of Caffe Americano (Q)	(2) Price (P)	(3) Total Revenue (TR = P X Q)	(4) Average Revenue (AR = TR/Q)	(5) Marginal Revenue (MR = $\Delta TR/\Delta Q$)
0	$6.00	$0.00		
1	5.50	5.50	$5.50	$5.50
2	5.00	10.00	5.00	4.50
3	4.50	13.50	4.50	3.50
4	4.00	16.00	4.00	2.50
5	3.50	17.50	3.50	1.50
6	3.00	18.00	3.00	0.50
7	2.50	17.50	2.50	-0.50
8	2.00	16.00	2.00	-1.50
9	1.50	13.50	1.50	-2.50
10	1.00	10.00	1.00	-3.50

Columns (1) and (2) of Table 2.6.4. illustrate the *Moon Cafe*'s demand schedule. At a price of $6, the firm produces nothing. At $5.50, it produces 1 cup of Caffe Americano. As the cafe lowers the price of its coffee, more cups of coffee are produced and consumed. Hence, at $1, 10 cups of Caffe Americano are sold. *Moon Cafe*'s demand curve is downward-sloping and adheres to the ***law of demand***.

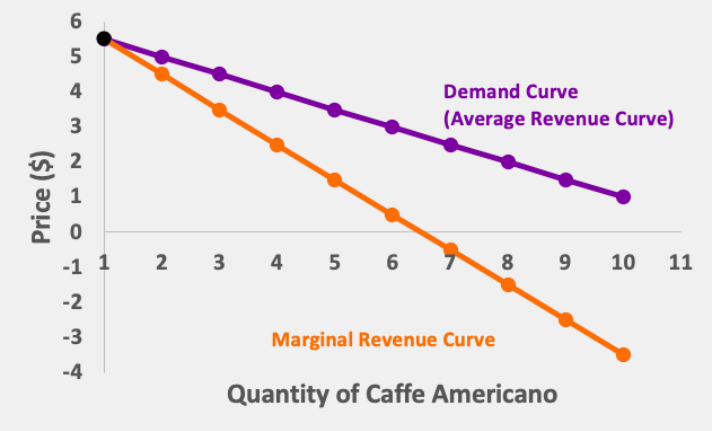
Column (3) of Table 2.6.4. shows the total revenue of the monopolist at each combination of price and quantity. Recall, total revenue is price (P) times quantity (Q). Column (4) is the average revenue, which is the typical amount of revenue received per unit sold. It is derived by dividing total revenue by the quantity of output. Similar to a competitive firm, the average revenue is the price of the good.

Column (5) of Table 2.6.4. shows *Moon Cafe*'s marginal revenue, which is the additional revenue that the firm receives from an additional unit of output produced and sold. Accordingly, the marginal revenue is the change in total revenue when quantity increases by 1 unit. For instance, when the cafe sells an additional cup of coffee, from 4 to 5 cups of Caffe Americano, the marginal revenue is $1.50 ($17.50 - $16).

Comparing Columns (2) and (5), notice that the marginal revenue is less than the price of a cup of coffee. For instance, if *Moon Cafe* increases its coffee production from 4 to 5 cups, its total revenue increases only by $1.50, although it sells the cup of coffee for $3.50. *Moon Cafe* can only sell 5 cups of Caffe Americano if it lowers the price by $0.50. However, in doing so, it loses $0.50 for each of the previous 4 cups it sold for $4. This is the reason why the marginal revenue of the fifth cup is less than its price.

Figure 2.6.21. illustrates the demand and marginal revenue curves for *Moon Cafe*, a monopolistically competitive firm. Since the price is equal to its average revenue, the demand curve is the same as the average revenue curve. Both curves share the same starting point since the marginal revenue of the first unit sold is always equal to the price of the good. However, after this point, the two curves diverge, and **the marginal revenue curve lies below the demand curve.**

Figure 2.6.21.

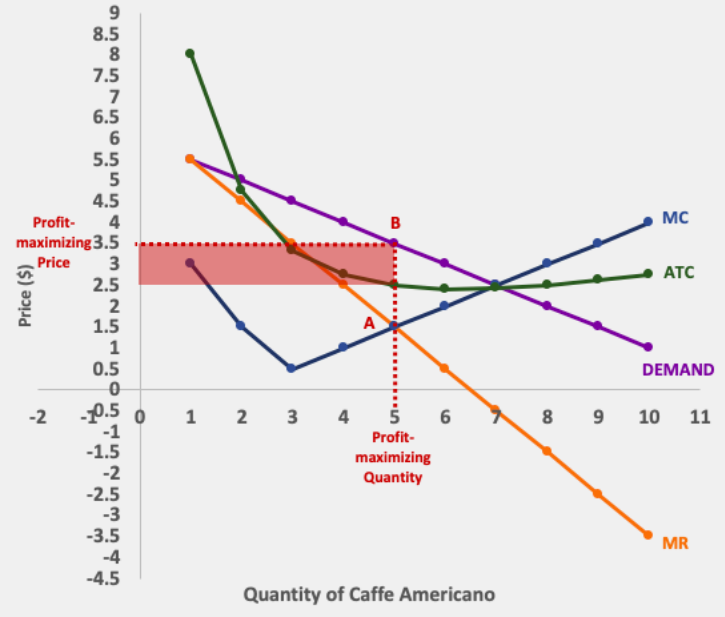


When marginal revenue is negative, it is no longer sustainable for a firm to increase its production. At this price level, the monopolistically competitive firm receives less revenue from selling more units. Graphically, the demand and marginal revenue curves of a monopolist and a monopolistically competitive firm look similar.

c. Profit Maximization

To determine the profit-maximizing output of a monopolistically competitive firm (in this case, *Moon Cafe*), we refer to Figure 2.6.22., which shows the cafe's demand curve, marginal revenue curve, and the cost curves. By this time, we should already be familiar with a firm's typical cost curves, as discussed in Section 2.5. The demand and marginal revenue curves are adopted from Figure 2.6.22.

Figure 2.6.22.



Suppose *Moon Cafe* is producing at Q = 3. At this level, the corresponding point on the marginal revenue (MR) curve is greater than the corresponding point on the marginal cost (MC) curve, which means that MR > MC. This implies that if the cafe increases its production by an additional unit, the additional revenue can still cover the additional cost; hence, the cafe earns additional profit and increases the total profit.

Suppose the cafe is producing at Q = 7. At this level, the corresponding point on the MR curve is lower than the corresponding unit on the MC curve, which means that MR < MC. This implies that the cafe is generating a negative additional profit that decreases the total profit of the cafe. The total profit may still be positive but not as high as the profit at the previous level of quantity produced.

Whether the cafe starts at a low level or at a high level of production, it recalibrates its production level to achieve the profit-maximizing quantity (Q = 5 in this case), where MR = MC. From Q = 3, the cafe increases production until $Q_{profit\text{-}max}$= 5, and from Q = 7, it reduces production until $Q_{profit\text{-}max}$= 5. As shown in Figure 2.6.22., *Moon Cafe*'s profit-maximizing quantity is at point A, where MR and MC intersect.

The profit-maximizing condition (MR = MC), which determines the level of quantity to be produced, is the same for monopolistic competitive, monopolist, and perfectly competitive firms. However, the price relative to marginal revenue differs for monopolistic competitive and perfectly competitive firms:

For a perfectly competitive firm: P = MR = MC

For a monopolistically competitive firm: P > MR = MC

This implies that **MR = MC determines the profit-maximizing quantity for both a competitive firm and a monopolistically competitive firm, but the monopolistically competitive firm charges a price higher than the marginal revenue and marginal cost.**

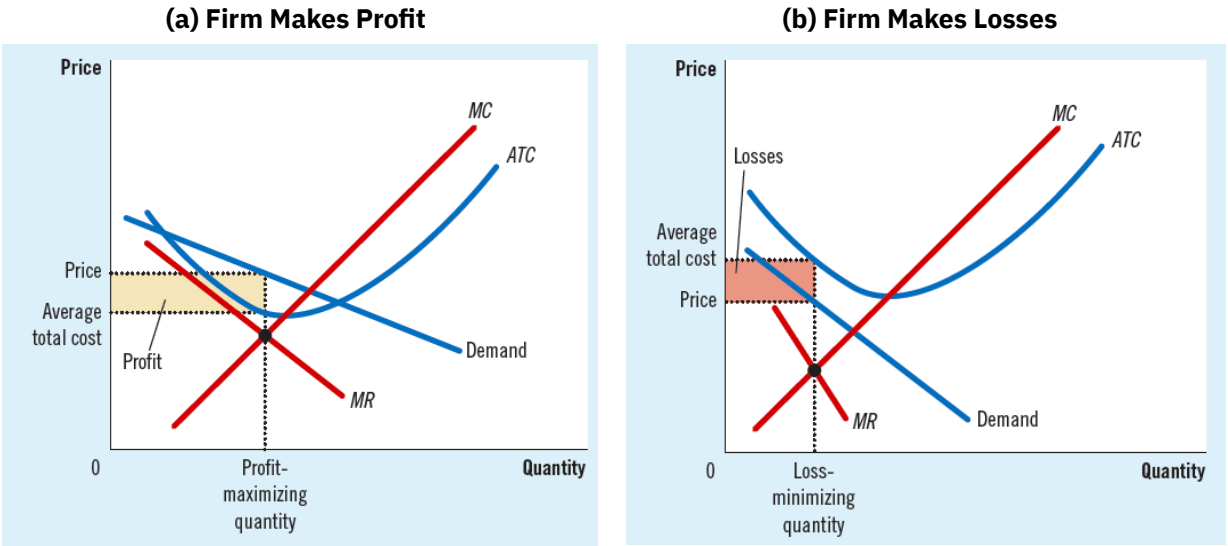
The price at which the monopolistically competitive firm charges for its product corresponds to the point on the demand curve that matches the same quantity level as the profit-maximizing quantity (Q = 5). As seen in Figure 2.6.22., this occurs at point B. The price at this point is the highest price that consumers are willing to pay for the output.

The shaded rectangular area in Figure 2.6.22. represents the profit of a monopolistically competitive firm. We can calculate this area by multiplying its height and its width. Hence, similar to the other market structures, its profit is equal to (P-ATC) x $Q_{profit\text{-}max}$.

d. Short-Run and Long-Run Equilibrium

In the short-run, a monopolistically competitive firm behaves like a monopolist. It maximizes profit by choosing a quantity, where MR = MC, and then charges a higher price. This higher price can be determined by parallelly moving up to a point on the demand curve. Figure 2.6.23. shows two scenarios in the **short-run** at which a monopolistically competitive firm **earns a profit (Panel a), given that P > ATC and incurs losses (Panel b), given that P < ATC.**

Figure 2.6.23.

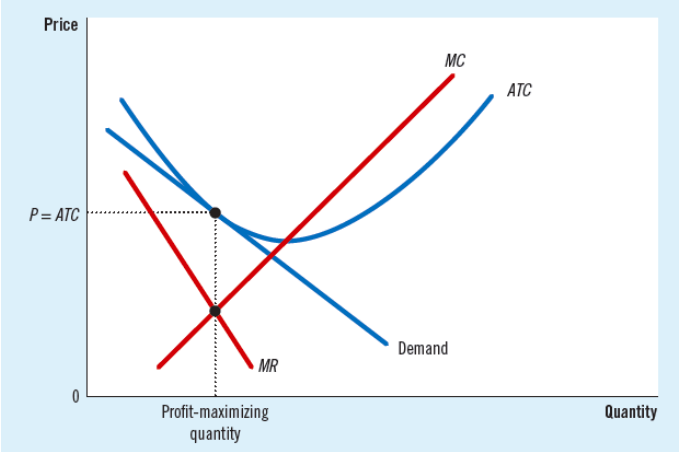


The scenarios above are temporary, and the market adjusts when profits are earned and when losses are incurred. When existing firms make a profit (as seen in Panel a), there is an incentive for potential entrants to enter the market. The entry of new firms expands the available products in the market, thus decreasing each firm's demand share and profit.

Moreover, when firms are incurring losses (as seen in Panel b), there is an incentive for existing firms to exit the market. The exit of some firms decreases the available products in the market, thus increasing each of the remaining firms' demand share and profit.

Monopolistically competitive firms continue to enter and exit the market until there is zero economic profit. At this stage, the monopolistically competitive market reaches **long-run equilibrium** when **P = ATC** as shown in Figure 2.6.24. At this tangency point, there is no incentive for new firms to enter and for existing firms to exit. The maximum profit is zero, where MR is still equal to MC. **In the long-run, monopolistically competitive firms behave like perfectly competitive firms.**

Figure 2.6.24.



e. Excess Capacity and Inefficiency

Although monopolistically competitive firms and perfectly competitive firms behave similarly in the long-run, there are two notable differences between their market structures: excess capacity and markup.

i. Excess Capacity

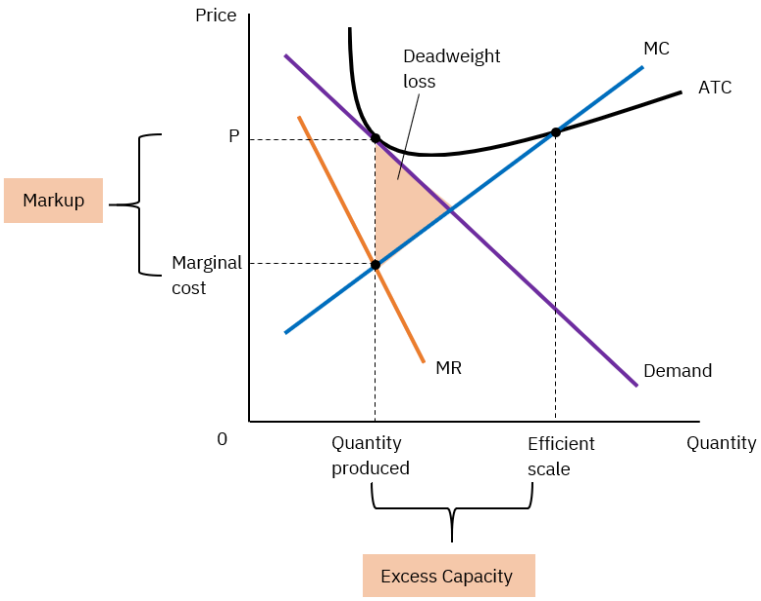
In the long-run, monopolistically competitive firms achieve maximum profit at a quantity where ATC is not at its minimum. As seen in Panel (a), Figure 2.6.25., it produces at a point on the ATC curve where the ATC is downward-sloping. This means it can be more cost-efficient if the firm produces more. However, by producing more, the monopolistically competitive firm would need to reduce the price in order to increase the quantity of output sold. Unlike a perfectly competitive firm that produces efficiently, where ATC is at its minimum, as seen in Panel (b), a monopolistically competitive firm operates with excess capacity. That is, the firm is producing at a level below its minimum level of efficiency.

ii. Markup over Marginal Cost

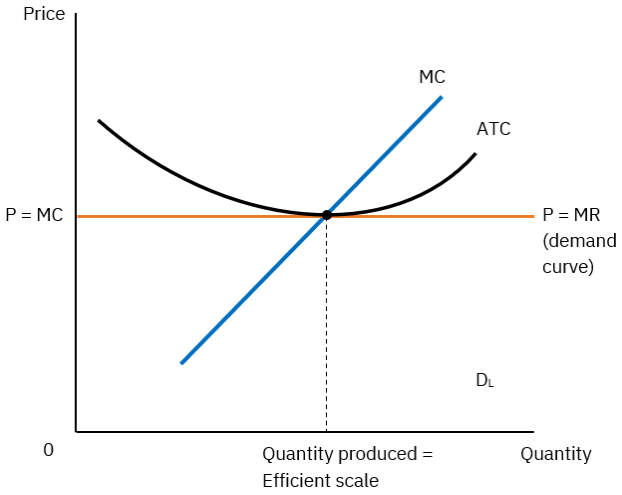
As shown in Panel (b), a perfectly competitive firm's price is equal to its marginal cost (P = MC) because it is a price-taker. Since a monopolistically competitive firm has some degree of market power because of product differentiation, it charges a price greater than its marginal cost (P > MC). This practice is referred to as markup.

Figure 2.6.25.

(a) Monopolistically Competitive Firm



(b) Perfectly Competitive Firm



iii. Inefficiency in Monopolistic Competition

A perfectly competitive market, as discussed, operates efficiently because of:

1) productive efficiency, where P = ATC, and

2) allocative efficiency, where P = MR = MC for the quantity produced.

These two conditions are not met in a monopolistically competitive market. Under a monopolistically competitive market, P > MC and P > minimum ATC. For this reason, the monopolistically competitive market is inefficient.

Also, as seen in Panel (a) Figure 2.6.25., the inefficiency of a monopolistically competitive market is represented by the deadweight loss triangle. This is the portion of the total surplus lost because the firms exercise some degree of market power in producing a quantity lower than the efficient scale but at a higher price than marginal cost. This is measured by solving for the area of a triangle: (base x height)/2.

f. Product Differentiation and Role of Advertising

Monopolistically competitive firms offer differentiated products. This means that buyers are able to distinctly identify a certain product from another even if these products serve the same purpose or they function similarly. For example, buyers can distinguish which pair of sneakers is from Nike, Adidas, or New Balance. Firms get their modest market power from product differentiation. To gain an advantage over the other competitors, a monopolistically competitive firm engages in advertising or marketing its products.

The goal of advertising is to obtain brand loyalty, to entice more customers to purchase the firm's product, and to sustain consumer interest for a long period of time. For this reason, the firm gains customer loyalty by lowering its sensitivity to price increases, and elasticity of demand for the product decreases. Advertising, if done right, expands a firm's customer base and prevents customers from switching to another competitor's product. Advertising takes several forms, such as website ads, social media posts, TV and radio commercials, billboards, newspaper and magazine ads, and direct mail.

When a firm decides to advertise, it incurs a cost, which increases the average total cost. The budget allocation for advertising varies depending on how products are differentiated. Firms that offer highly differentiated consumer products (i.e., juice, toothpaste, chocolates, chips, etc.) typically allocate 10 to 20 percent of their revenue to advertising. Firms that offer almost identical products (i.e., wheat, sugar, crude oil, for example) do not spend much (often nothing at all) on advertising. Overall, approximately 2 percent of a firm's total revenue is used for advertising. In deciding how much to allocate, the firm should assess whether the marginal revenue of advertising will exceed its marginal cost.

Advertising may also convey to consumers the quality of the firm's product, especially if it is obvious that the firm spent a substantial amount of money on advertising. The firm is confident that the ad will bring in more consumers even if viewers find it to be uninformative. As such, advertising often conveys the message that a firm's product is of a better quality than its competitors if the benefit of attracting customers is the main motive.

Table 2.6.5.

	Market Structure		
	Perfect Competition	**Monopolistic Competition**	**Monopoly**
Features that all three market structures share			
Goal of firms	Maximize profits	Maximize profits	Maximize profits
Rule for maximizing profit	*MR = MC*	*MR = MC*	*MR = MC*
Can earn economic profits in the short run?	Yes	Yes	Yes
Features that monopolistic competition shares with monopoly			
Price taker?	Yes	No	No
Price	*P = MC*	*P > MC*	*P > MC*
Produces welfare-maximizing level of output?	Yes	No	No
Features that monopolistic competition shares with perfect competition			
Number of firms	Many	Many	One
Entry in the long run?	Yes	Yes	No
Can earn economic profits in the long run?	No	No	Yes

Concept Check 2.18.	
Profit-maximizing condition for a monopolistically competitive firm	quantity at which MR = MC, where P > MC and lies on the demand curve
Short-run equilibrium in monopolistic competition	a condition in which firms maximize profit at a quantity level where P > MR = MC and P > ATC, or minimize losses at a quantity level where P > MR = MC and P < ATC.
Long-run equilibrium in monopolistic competition	a condition in which there is no incentive for new firms to enter or existing firms to exit the market; it occurs at a quantity level where P > MR = MC and P = ATC.
Excess capacity	a situation at which the firm produces at a quantity level lower than its efficient scale
Mark up	the practice of pricing a product above its marginal cost due to some degree of market power
Product differentiation	a market characteristic in which the firms' products are distinct and distinguishable from each other even if the products nature and functionalities are similar

E. Oligopoly

An ***oligopoly*** market is characterized by a few sellers offering similar or differentiated products. Unlike other market structures, the few firms in this market are interdependent. One firm's behavior can substantially influence the profits of other firms. Hence, each firm strategically makes decisions and reacts to its competitor's actions.

In analyzing competition among these firms, oligopolists adopt a game theory approach, which is only relevant to this type of market structure. Within our context, **game theory** is the study of how a firm behaves and responds to strategic situations involving other firms in the market. This approach is irrelevant to perfectly competitive or monopolistically competitive markets, given that each firm has only a small share of the market and does not need to have strategic interactions with several other competitors. Intuitively, game theory is also not necessary for a monopolist since the monopolist is the only seller in the market. In addition, unlike a monopolist, who has all the market power, an oligopolist does not have enough power to influence the market.

Examples of industries that fall under the category of oligopoly in the U.S. are airlines, automobiles, telecommunications, and entertainment.

a. Interdependence and Kinked Demand Curve

One of the distinguishing characteristics of oligopoly is **interdependence**, in which a firm makes business decisions considering the actions and reactions of its competitor. Before an oligopoly firm takes action, it thinks about what its competitors are going to do first. Oligopoly is like a chess game where a player simulates their opponent's moves and responds strategically to win.

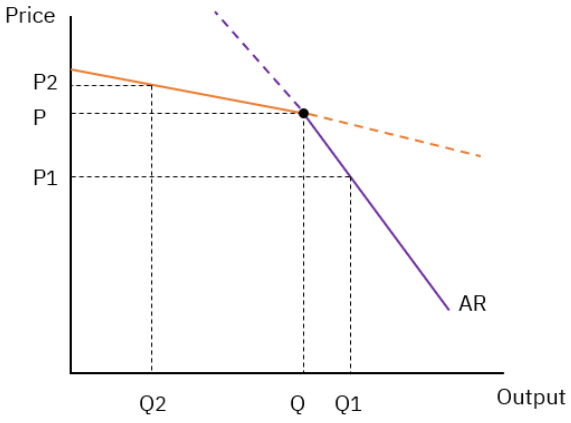
In the case of an oligopoly, profit maximization is not one of its main objectives. Oligopoly firms also try to find a balance between their decisions and those of the other firms. In an oligopoly market, rival firms compete for market share. In doing so, these firms may forego profits to gain an additional share of the market.

Due to the interdependent nature of oligopoly firms, modeling these firms' behavior in an oligopoly market is complex and difficult to comprehend. However, we can use a kinked demand model to understand how these types of firms may react to price changes and to help us predict their behavior. As seen in Figure 2.6.26, the demand is represented by the AR curve, which has an elastic region above price, P, and an inelastic region below P.

If the price of the good is above P, consumers are more sensitive to price changes. If the price increases from P to P2, then demand will substantially decrease. It is not sensible for a firm to increase its price because it will lose a large share of the market as well as revenues when other firms keep their prices at P.

If the price of the good is below P, consumers are less sensitive to price changes. If the price decreases from P to P1, then demand will minimally increase. It may seem sensible for a firm to decrease the price to get a modest additional market share. However, other firms will follow suit. Eventually, the market shares will even out, and the competition will be back to its initial position. In the end, there is no incentive for an oligopoly firm to reduce its price.

Figure 2.6.26.

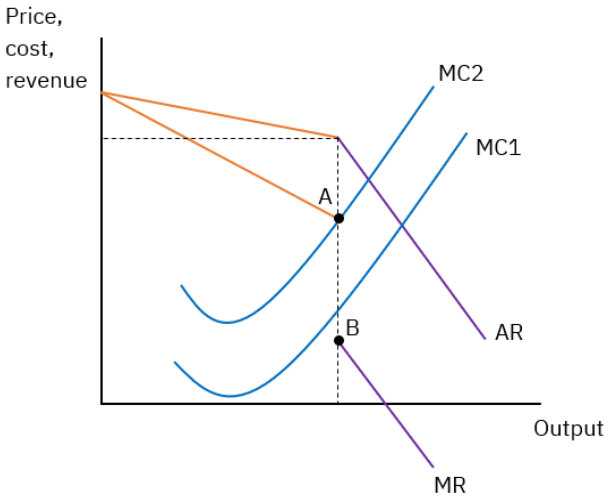


Suppose that the oligopoly firm is a profit-maximizer. Similar to other market structures, the oligopoly firm produces at a quantity where MR = MC and where P > MC due to market power. Figure 2.6.27. illustrates the demand, marginal revenue, and marginal cost curves of a profit-maximizing oligopolist.

On the one hand, the elastic region of the demand curve has a corresponding flatter MR curve that lies below the elastic portion of the demand curve, and extends to point A. On the other hand, the inelastic region of the demand curve has a corresponding steeper MR curve that lies below the inelastic portion of the demand curve that starts at point B.

The kinked demand curve creates a discontinuity, which is represented by the vertical gap (segment AB) in the MR curve.

Figure 2.6.7.



As shown in Figure 2.6.27., the marginal cost incurred changes within the vertical gap, shown as the increase from MC_1 to MC_2 or vice-versa, and the profit-maximizing condition holds. Regardless of whether MR = MC_1 or MR = MC_2, the profit-maximizing quantity and price do not change. Hence, a firm does not need to change the price of the good.

Based on the kinked demand model, firms in an oligopoly market have no incentive and no need to engage in price competition. This model predicts price rigidity in the market. Due to interdependence, an oligopolist may instead engage in non-price competitions (i.e., branding, quality) to gain a greater market share.

b. Collusion and Cartels

Interdependence can be onerous since firms have to make the best guess as to what their rivals are doing. They interact without directly communicating, and rely on observations and simulations to determine each other's market behavior. However, firms in an oligopoly market have an easier option. That is, to gather together and act as one. When firms form an agreement and decide to charge the same price and produce the same quantity as a monopolist would do, this collective action is referred to as **collusion**. Collusion allows these firms to manipulate pricing and create inefficiencies, which are unfavorable to consumers. Firms that have colluded are known as a **cartel**. The Organization of the Petroleum Exporting Countries (OPEC) is one of the best known cartels in the world, who collectively influence the global oil market.

Suppose that there are only two milk companies in Dairy Town, *Firm A* and *Firm B*. Both firms can collude and agree to sell a total of 60 gallons of milk at $60 per gallon, with a total profit of $3,600. At these quantity and price levels, *A* and *B* collectively act like a profit-maximizing monopolist. If they decide to divide the production level equally, each of them would produce 30 gallons of milk at $60 per gallon, with a profit of $1,800 each.

Ideally, forming cartels would produce the best outcome for oligopolists. However, most of the time, this does not happen. It is difficult for the firms to agree on the distribution of profits because each firm wants a greater market share. Moreover, the government may not allow collusion and decide to regulate the market.

In the absence of collusion, firms act according to their own self-interest and strategize based on how they think their rival firms would act. Going back to *Firm A* and *Firm B*, if *B* expects *A* to produce only 30 gallons at $60 per gallon, *B* can choose to produce the same quantity, earning a profit of $1,800. But since *B* wants to have a greater market share, it chooses to produce 40 gallons, increasing the total production to 70 gallons at $50 per gallon. In this case, *B* will gain more market share and earn more profit if *A* does nothing.

How will *Firm A* respond? Suppose *Firm A* acts in a similar manner to *Firm B*, then each firm will produce 40 gallons, increasing the total production to 80 gallons, but at a lower price of $40 per gallon. If firms *A* and *B* act according to their own self-interest, they will be producing more quantity, charging a lower price, and earning less profit compared to a monopolist. Instead of making a profit of $1,800, producing 30 gallons at $60 per gallon, each firm will now earn a reduced profit of $1,600, producing only 40 gallons at $40 per gallon.

Firms may continue to produce more at the expense of a decreased profit but stop at a certain threshold when there is no more incentive for them to act or react against each other. Oligopolists will never be able to operate like perfectly competitive firms because they do not want to relinquish the market power they have. Recall, perfectly competitive firms are price takers, whereas oligopolists often collude with their rivals to set prices.

When firms *A* and *B* each settle with producing and selling 40 gallons of milk at $40 per gallon, a **Nash equilibrium** is achieved. This equilibrium is a situation in which economic actors interacting with one another each choose the best strategy, given the strategies that all the other actors have chosen. At this equilibrium, no firm has an incentive to make a different decision.

c. Game Theory and Strategic Behavior

So far, we have established that firms in an oligopoly market are interdependent. They can collude and extract monopoly profit but find it difficult to cooperate. Game theory allows us to understand why such a situation occurs and helps us to see how a firm strategically responds to its rival's action and finds the ***Nash*** equilibrium.

Let us see how we can use game theory to illustrate and understand how a Nash equilibrium is determined. A common example (game) used to determine a Nash equilibrium is known as the *prisoner's dilemma*, in which two players have competing incentives that cause them to choose a less-than-optimal outcome. This example helps us to understand why it is difficult to cooperate when one's interests are at odds, and cooperating is not always in one's best interest.

So, game theory prisoner's dilemma aids in setting the foundation for a situation in which two players cooperate with each other to obtain the optimal reward. This simple game can be applied to a duopoly situation (two oligopoly firms) when the two firms choose to cooperate.

i. Prisoner's Dilemma

The game theory experiment, called the prisoner's dilemma, is about two criminals, *Criminal 1* and *Criminal 2*, who have been arrested by the police. The police have substantial evidence that both of the criminals committed petty theft, with a penalty of one year prison sentence. The police also suspect *Criminal 1* and *Criminal 2* of committing a major bank robbery but lack evidence to convict them. The criminals are interrogated in separate rooms, and the interviewing police officer offers each of them the following deal:

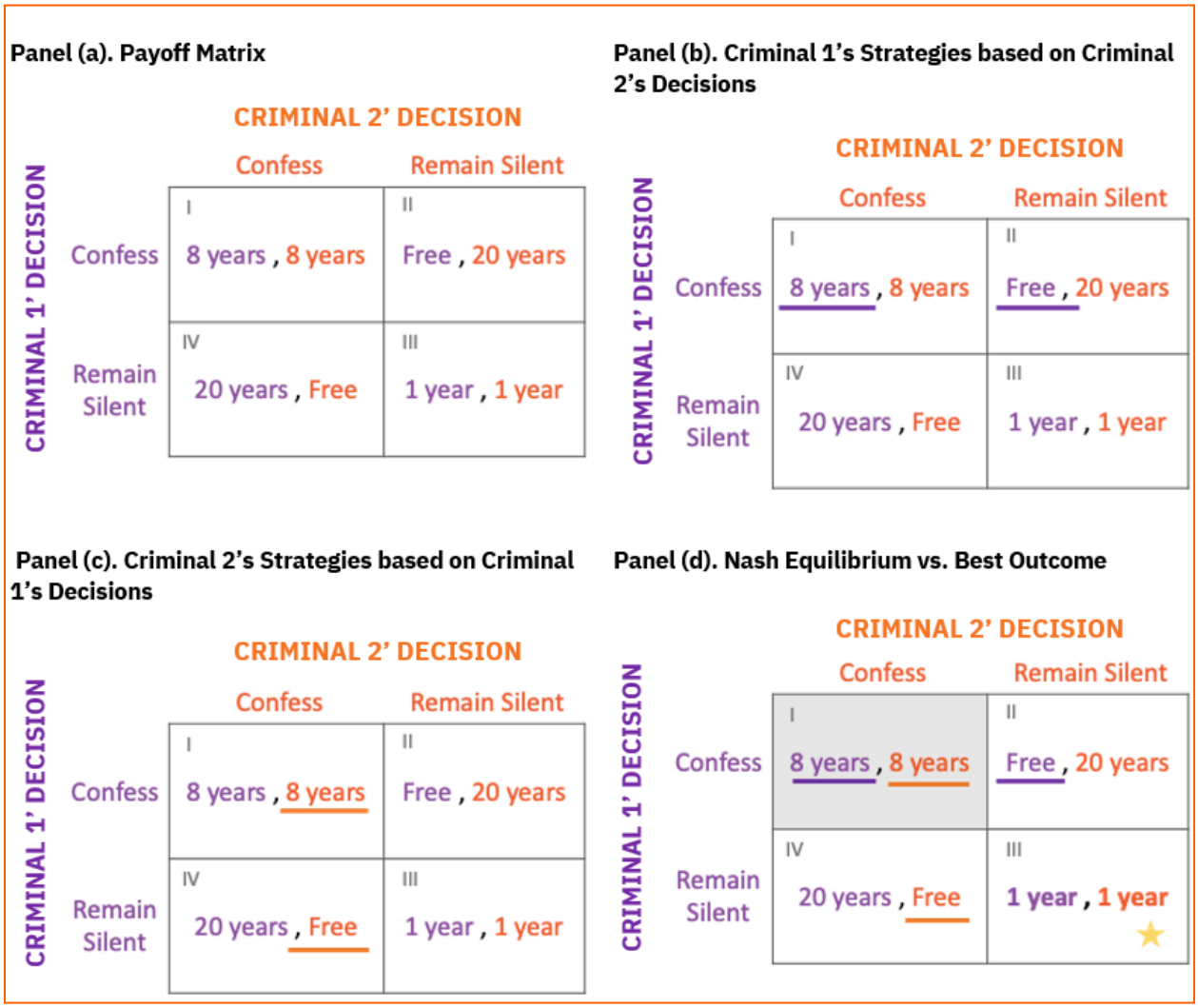
- If you remain silent, you will face a one-year jail sentence.
- If you confess to the major bank robbery and incriminate your partner, you will receive immunity and face no jail sentence, but your partner will face a twenty-year jail sentence.
- If you both confess to the crime, each of you will face an eight-year jail sentence.

In this situation, what should the criminal pair do? The decision is to choose between confessing or remaining silent.

To aid us in analyzing the situation, we use *Criminal 1* and *Criminal 2*'s **payoff matrix** reflecting their choices, as shown in Figure 2.6.28. Panel (a).

A payoff matrix is a table that shows the payoffs that each player, a criminal in this case, gains from every combination of strategies of the players. We see *Criminal 1* and *Criminal 2*'s two choices, which are to confess or remain silent. For each cell, the left outcome (in purple text) refers to *Criminal 1*'s payoff, while the right outcome (in orange text) refers to *Criminal 2*'s payoff. For example, if both criminals confess, each of them would serve 8 years in prison, as shown in Quadrant I.

Figure 2.6.28. Criminal 1 and Criminal 2's Payoff Matrix



Let's consider *Criminal 1*'s decision first, as shown in Figure 2.6.28., Panel (b). If *Criminal 2* confesses, *Criminal 1*'s best strategy is to confess and get only an 8-year jail sentence (quadrant I) relative to 20 years (quadrant IV) if they remain silent. If *Criminal 2* remains silent, *Criminal 1*'s best strategy is still to confess with no jail time (quadrant II) relative to 1 year if they remain silent. Regardless of *Criminal 2*'s decision, *Criminal 1* is better off confessing.

In game theory, we call this a **dominant strategy**, which is the best strategy a player chooses regardless of what the other players choose to do. For *Criminal 1*, their dominant strategy is to confess, whether *Criminal 2* decides to confess or not.

Now, let's consider *Criminal 2*'s decision, as shown in Figure 2.6.28., Panel (c). Since they face the same choices as *Criminal 1*, we can expect *Criminal 2*'s strategies to be the same as *Criminal 1*'s. Whether *Criminal 1* decides to confess or not, *Criminal 2*'s dominant strategy is also to confess.

As seen in Figure 2.6.28., Panel (d), both the criminals confess and face 8 years of jail time. This outcome (quadrant I) is a **Nash equilibrium**, in which each criminal chooses the best strategy available, given the possible strategy of the other criminal.

However, this Nash equilibrium outcome is worse than the alternative outcome if both of them remain silent (quadrant III). Because *Criminal 1* and *Criminal 2* act according to their own self-interest, each of them faces the worst outcome. If they somehow were able to cooperate and agree to remain silent, then they would achieve the best or optimal outcome, each only serving one year.

Even if both criminals had agreed to remain silent beforehand while they were being interrogated, *Criminal 1* and *Criminal 2* would still consider making a choice in their own self-interest. That is, each of them decides to confess. Cooperation between the two criminals is challenging, given that cooperation is individually irrational and unpredictable.

ii. Duopoly

Suppose there are two competing game console manufacturers in the market, *Firm X* and *Firm Y*, and they need to make a decision of either charging a lower price ($400) or a higher price ($500) for their respective products. The more favorable price for the firm depends on the price the other firm charges.

To aid us in analyzing this situation, we use *X* and *Y*'s **payoff matrix** to illustrate their choices, as shown in Figure 2.6.29. Panel (a). We see the two choices of *X* and *Y*, which are to either charge a lower price of $400 or higher price of $500. For each cell, the left outcome (in purple text) refers to *Y*'s profit (payoff), while the right outcome (in orange text) refers to *X*'s profit (payoff). For example, if both *X* and *Y* charge a price of $400, each of them would earn a profit of $10 million, as shown in Quadrant I.

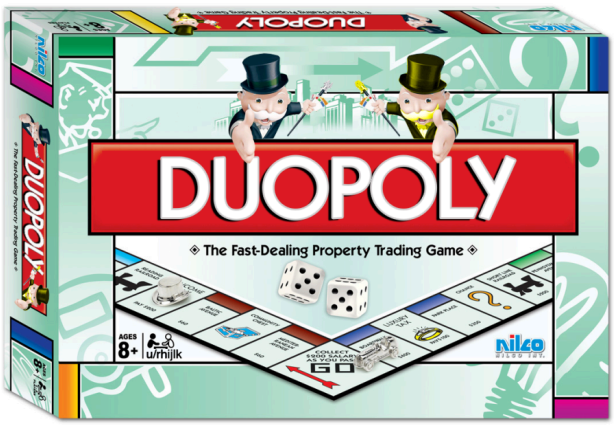
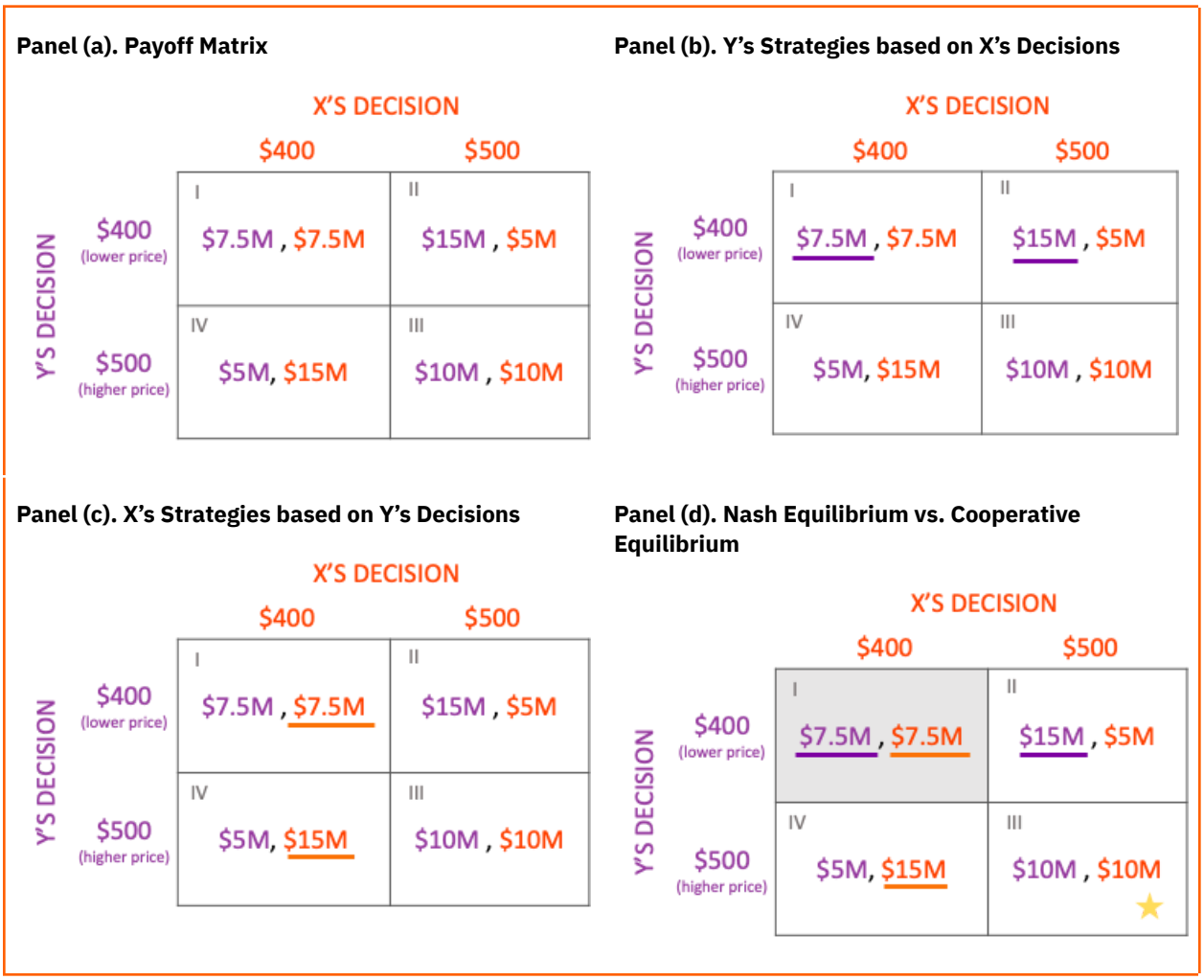


Figure 2.6.29. X and Y's Payoff Matrix



What is the optimal decision for Firm X and Firm Y? Let's consider Y's decision first, as shown in Figure 2.6.29., Panel (b). If X charges a lower price of $400, Y's best strategy is also to charge at a lower price of $400, earning a higher profit of $7.5 million (quadrant I) relative to $5 million (quadrant IV) if Y charges a higher price. If X charges a higher price of $500, Y's best strategy is still to charge a lower price of $400, with a higher profit of $15 million (quadrant II) relative to $10 million (quadrant III) if Y charges a higher price. Regardless of what X's decision is, Y is better off charging a lower price of $400. Y dominant strategy is a lower price, whether X decides to charge $400 or $500 for its game console.

Now, let's consider X's decision as shown in Figure 2.6.29., Panel (c). Since firm X faces the same choices as Y, we can expect X to use the same strategy as firm Y. Whether Y decides to charge $400 or $500, X's dominant strategy is also to charge a lower price of $400.

As seen in Figure 2.6.29., Panel (d), both Firm X and Firm Y charge a lower price of $400, with each firm earning a profit of $7.5 million. This outcome (quadrant I) is a Nash equilibrium, in which each firm chooses the best strategy available given the strategy of the other firm. However, this Nash equilibrium

outcome is worse than the alternative outcome if both X and Y cooperate and charge a higher price of $500 (quadrant III). If they had chosen to cooperate, each of them could have earned a higher profit amounting to $10 million. Since self-interest prevails, X and Y fail to cooperate. Hence, each of them faces a worse outcome, with a profit of $7.5 million.

Concept Check 2.6.19.	
Interdependence	a firm makes business decisions by considering the actions and reactions of competitor firms
Collusion	an agreement among oligopolists to set the same price and quantity level as a monopolist would do
Cartel	group of firms acting in unison
Game theory	the study of how a firm behaves and responds to strategic situations involving other firms in the market
Payoff matrix	a table that shows the payoffs that each player gains from every combination of strategies of the players
Dominant strategy	best strategy a player chooses regardless of what the other players choose to do
Nash equilibrium	a situation in which economic actors interacting with one another each choose the best strategy, given the strategies that all the other actors have chosen. At this equilibrium, no firm has an incentive to make a different decision.

Chapter 2.6 Review Questions

1. *Individual X* opens up a cotton candy stand for three hours. *X* spends $10 on ingredients and sells $60 worth of cotton candy. In the same three hours, *X* could have trimmed neighbor's trees for $40. *X* earns an accounting profit of _____ and an economic profit of _____.

A. $50; $10
B. $90; $50
C. $10; $50
D. $50; $90

2. Which of the following applies to a firm in a perfectly competitive market?

A. Average revenue is initially negative and then becomes positive.
B. Marginal revenue is decreasing.
C. Total revenue increases then decreases.
D. Marginal revenue equals marginal revenue.

3. A monopolist switches from charging a single price to practicing perfect price discrimination. This reduces:

A. The quantity of output produced
B. The firm's profit
C. Consumer surplus
D. Total surplus

4. When advertising fosters brand loyalty among consumers, it might _____ the elasticity of demand and _____ the markup of price over marginal cost.

A. Increase; increase
B. Increase; decrease
C. Decrease; increase
D. Decrease; decrease

5. What characterizes monopolistic competition?

A. Few dominant firms and low barriers to entry
B. Large number of firms and significant barriers to entry
C. Ability to maintain long-run economic profit
D. Large number of firms and low barriers to entry

6. In the long run, a monopolistically competitive firm:

A. Faces a horizontal demand curve
B. Faces a vertical demand curve
C. Earns zero economic profit
D. Earns positive economic profit

7. In the short-run, what is the equilibrium condition for a competitive market with identical firms, if new firms are getting ready to enter. What are the relationships among price P, marginal cost MC, and average total cost ATC?

A. P > MC and P > ATC
B. P > MC and P = ATC
C. P = MC and P > ATC
D. P = MC and P = ATC

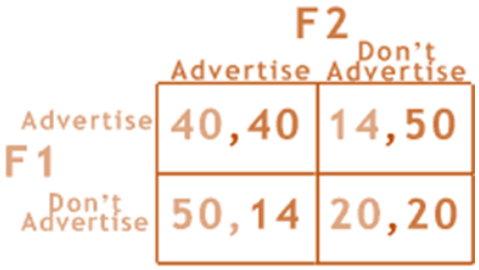
8. Suppose taco trucks in New Jersey are a perfectly competitive market in the long-run equilibrium. One day, the city starts imposing a $100 per month tax on each stand. How does this policy affect the number of tacos consumed in the short run and the long run?

A. Down in the short run, no change in the long run
B. Up in the short run, no change in the long run
C. No change in the short run, down in the long run
D. No change in the short run, up in the long run

9. Why is it difficult to use the profit-maximizing model to describe oligopoly behavior?

A. Oligopolists don't have enough data to figure out their marginal costs, so the theory is wrong.
B. Oligopolists don't know what their dominant strategy is because they don't apply the prisoner's dilemma.
C. There are too many firms to be able to figure out how profit maximization works in such industries.
D. An oligopolist's demand curve depends on the behavior of its competitors.

10. The payoff matrix shown below describes the situation faced by two firms in the same industry in deciding whether to advertise or not. If the firms have to make a decision once and for all about advertising, it can be predicted that:



A. Both firms will play their dominant strategies and earn profits of 40 each.

B. Firm 1 will advertise and earn a profit of 50, while Firm 2 will not advertise and earn a profit of 14.

C. Both firms 1 and 2 will play their dominant strategies and earn profits of 20 each.

D. Neither firm 1 nor firm 2 has a dominant strategy, so we cannot predict the outcome of the game.

Chapter 2.6. Review Quiz Answers

1. A
2. D
3. C
4. C
5. D
6. C
7. C
8. C
9. D
10. C

Chapter 3: Factor Markets

Chapter Overview

Firms produce goods and services by transforming inputs into outputs. These inputs, also called ***factors of production***, drive the production process. Labor, capital, and land are considered the most important factors of production that firms utilize. For instance, a hospital uses doctors and nurses (labor), a building, clinic offices, laboratory and equipment (capital), and the physical space where the hospital is located (land) to provide medical services to individuals. Similarly, a bakery uses bakers, salespersons and cashiers (labor), ovens and refrigerators (capital), and the land where the bakery is located to provide baked goods to individuals.

For this chapter, we will analyze how competitive firms behave in the factor markets and make decisions on the profit-maximizing quantity of labor. We focus on labor, but the process of decision-making also applies to other factors of production. We use the principles of demand and supply to understand the equilibrium input price and the quantity of input employed.

Learning Objectives

By the end of this chapter, you should be able to:

- Understand the derived demand for labor and how it relates to the demand for goods and services.
- Analyze the concept of the production function and its connection to marginal product, diminishing marginal product, and profit maximization.
- Apply the firm's hiring of labor conditions to determine optimal labor input and wage levels.
- Discuss the factors affecting the supply of labor and wage determination in the labor market.
- Explain how changes in demand and supply lead to equilibrium in the labor, land, and capital market.
- Explore the concept of monopsony and its impact on factor markets and competition.

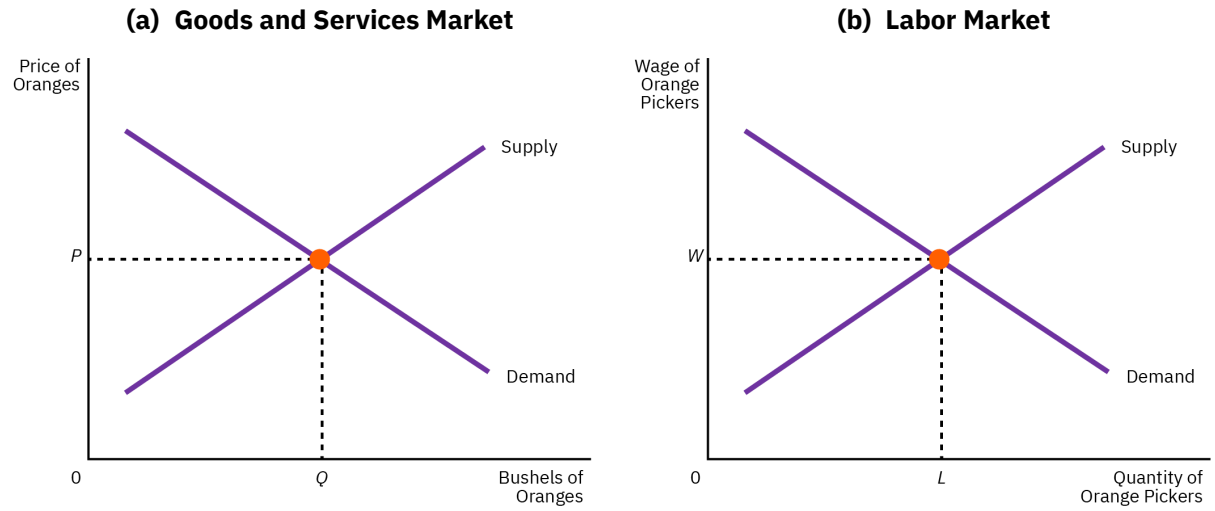
A. The Demand for Labor

Derived Factor Demand

To simplify for discussion purposes, we will analyze the labor market. However, the principles and equilibrium analysis for labor also apply to the other factors of production, such as capital. A competitive firm’s demand for labor is determined by the consumers’ demand for the firm’s product. Hence, the demand for labor is a derived demand. If the demand for a firm’s product increases, the demand for labor also increases.

Consider the market for oranges. If the demand for oranges increases because it's the flu season and more people need vitamin C, the demand curve for oranges shifts to the right (see Figure 3.1. Panel a). This means that for a firm to service the surge in consumers' demand for oranges, it needs to hire more workers. Similar to the shift of the demand curve in the goods and services market, the demand curve in the labor market also shifts to the right (see Figure 3.1. Panel b). Moreover, the demand and supply curves determine the equilibrium wage and quantity of workers in the labor market.

Figure 3.1. Supply and Demand for Different Markets



The Competitive Profit-Maximizing Firm

Suppose that a firm operates an orange orchard and decides the number of workers to pick and harvest oranges on a weekly basis. Once the decision is made, the workers are free to pick as many oranges as they can. The firm sells the oranges to consumers, pays the workers' wages, and keeps the excess as profit.

In this scenario, we assume the following:

1. The firm is competitive both in the market for oranges (as a seller) and in the labor market (as a buyer). With this, the firm is a price-taker and accepts the price of oranges and prices of labor (wage) as given. It has no power to dictate the price it charges to consumers and the wages it pays to its workers. The firm only has control over the quantity of oranges to produce and sell and the number of workers to hire.

2. The firm is profit-maximizing. Its main goal is to earn the highest profit, which is the difference between the total revenue from the sale of oranges and the total cost of producing them. The firm's supply of oranges and demand for laborers, therefore, depend on this profit-maximizing goal.

The Production Function and the Marginal Product of Labor

A firm's hiring decision depends on how the size of its workforce influences the quantity of output produced. In the case of the orange producer, it must evaluate how the number of its workers affects the number of oranges it harvests and sells. These are shown in Columns (1) and (2) in Table 3.1.

Table 3.1. How the Competitive Firm Decides How Much Labor to Hire

(1) Labor (L)	(2) Output (Q)	(3) Marginal Product of Labor (MPL = $\Delta Q/\Delta L$)	(4) Marginal Revenue Product of Labor (MRP = P x MPL)	(5) Wage (W)	(6) Marginal Profit (ΔProfit = VMPL - W)
0 workers	0 bushels				
1	100	100 bushels	$1,000	$500	$500
2	180	80	800	500	300
3	240	60	600	500	100
4	280	40	400	500	- 100
5	300	20	200	500	- 300

The firm's ability to produce oranges is depicted graphically by a production function (see Figure 3.2.), which represents the relationship between the input (laborers) and the output (oranges). For now, we keep the other inputs or factors of production (trees, land, machinery, etc.) fixed. This firm's production function demonstrates that with 1 worker, 100 bushels of oranges will be harvested per week; with 2 workers, 180 bushels; and so on.

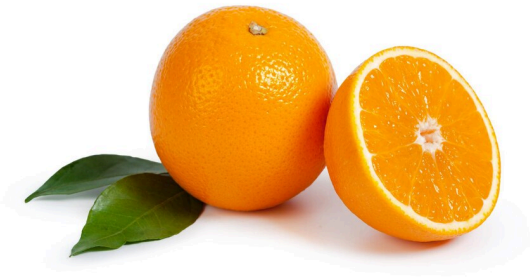
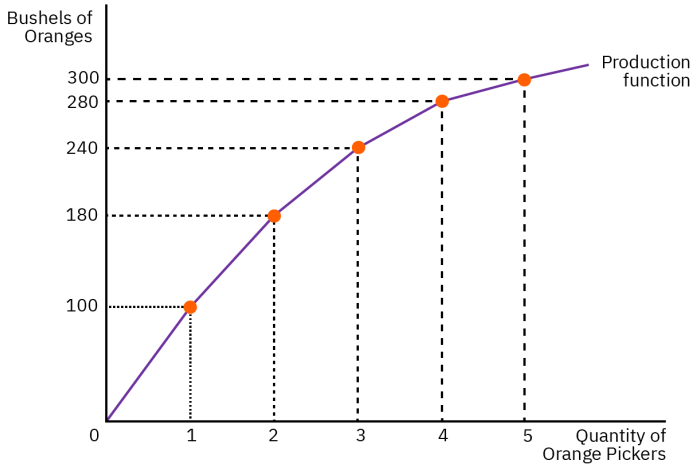


Figure 3.2. The Production Function



To understand how a firm decides on the number of workers to hire, it has to determine the **marginal product of labor** – the additional output produced by an additional worker. As seen in Table 3.1. Column (3) and Figure 3.2., as the firm hires an additional worker, the contribution of the new worker is lower than the previously hired worker. When a second worker is hired, the total number of oranges produced increases from 100 to 180 bushels. This means that the second worker is able to contribute an additional or marginal product of 80 bushels, which is lower than what the first worker could contribute. When a third worker is hired, their marginal product is 60 bushels.

Notice that the production process demonstrates **diminishing marginal product** – as the number of workers increases, the marginal product of labor decreases. Why is this so? The first few workers hired would choose to harvest the low-hanging oranges and by the time the new workers are hired, they are left with the oranges that are harder to pick. As expected, the new workers would contribute less to the production of oranges. Given this, the production function is increasing at a decreasing rate, starting with a steeper slope and getting flatter as more laborers are hired.

Marginal Revenue Product and the Competitive Firm's Hiring of Labor

Since the primary goal of a firm is to achieve maximum profit, it is concerned about how much money it can earn by producing and selling oranges. In its decision to hire, it evaluates how much profit each worker will generate for the firm. The firm needs to determine each worker's additional contribution to revenue minus the worker's salary.

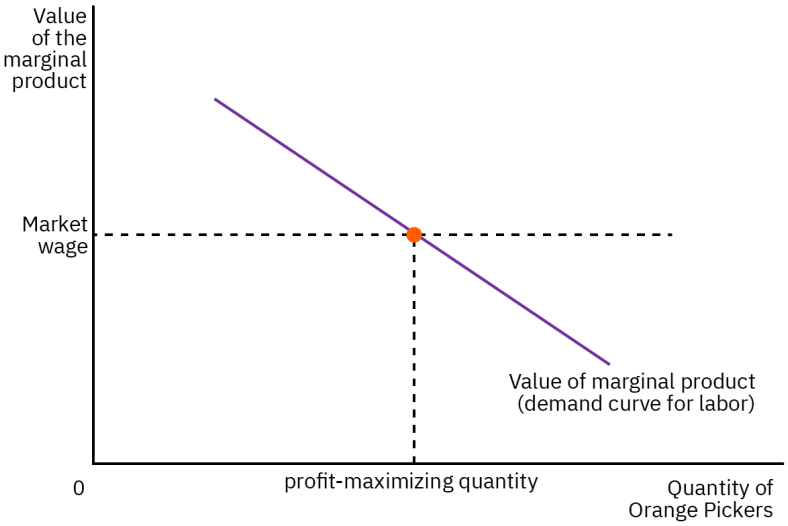
To determine the worker's contribution to revenue, we translate the marginal product of labor (measured in bushels of oranges) into monetary terms (measured in dollars), which is referred to as the value of the marginal product or **the marginal revenue product (MRP)**. We calculate this by multiplying the marginal product of labor by the market price of the output. As seen in Table 3.1. Column (4), if the price of a bushel of oranges is $10, the MRP of the second worker or their contribution to revenue is $800 (80 bushels x $10 = $800). We interpret this as the additional revenue the firm generates from

hiring an additional unit of input or factor of production (in this case, labor). Given that the price is constant for a competitive firm and the marginal product decreases as additional workers are hired, we can expect that the MRP will decrease as the number of workers increases.

Suppose that the market wage for workers in an orange orchard is $500 per week. As seen in Table 3.1., the firm earns a profit by hiring the first worker. If we get the difference between the MRP in Column (4) and the wage in Column (5), the first worker's contribution to profit is $500. If the firm hires another worker, it is still profitable since the second worker contributes an additional $300 profit. Similarly, hiring the third worker is still profitable as he contributes an additional $100 profit. However, hiring additional workers beyond this number would be less profitable to the firm. As seen in Table 3.1., hiring the fourth worker reduces the profit by $100 and the fifth worker by $300. This means that the firm's decision to hire should be limited to 3 workers only.

Figure 3.3. illustrates the downward-sloping MRP curve, reflecting the inverse relationship between the MRP and the number of workers hired. It also shows the horizontal market wage line. At the intersection of the two is the profit-maximizing quantity of a competitive firm. Below this level, the firm can still hire an additional worker to increase the profit. Above this level, the firm should reduce its workforce to increase its profit. **Hence, a competitive, profit-maximizing firm hires workers up to the point where the marginal revenue product (MRP) is equal to the market wage (W).** The MRP curve also represents the labor demand curve.

Figure 3.3. Marginal Revenue Product



Shifts in the Labor Market Demand Curve

Knowing that the marginal revenue product represents the labor demand curve, here are some factors that can shift the labor demand curve:

1. **Output Price**

   When the output price changes, the marginal revenue product also increases and vice-versa. For example, if the price of a bushel of oranges increases, each worker generates a higher amount of contribution to profit. This increases the labor demand from the firms that supply oranges. The opposite occurs when the price of a bushel of oranges decreases.

2. **Technological Change**

   Technology can either increase or decrease the marginal revenue product of labor. If it complements labor and helps workers to be more productive, then it raises the number of goods that each worker can produce and boosts profit. Hence, this increases the labor demand. If it replaces labor (i.e., a cheap robot), then technology reduces the marginal revenue product of labor and the contribution of each worker to profit. Eventually, hiring workers would be unnecessary.

3. **The Supply of Other Factors**

   The factors of production may be codependent on each other. For example, a worker needs a ladder to climb trees. If the supply of ladders decreases, the marginal product of the workers will also decrease; hence, demand for workers will also decrease.

B. Supply of Labor

In general, the higher the wage (price of labor), the more that workers will supply labor in the market. An individual can either use his time to work or to enjoy leisure. If the individual chooses leisure, he gives up the opportunity to earn income. If the individual chooses to work, he gives up the opportunity to enjoy leisure. Since individuals have financial needs, there is an incentive for them to spend time working to earn more. For this reason, we demonstrate labor supply as an upward-sloping curve, indicating that as the wage increases, labor supply increases as workers choose to spend more hours at work.

Note that there may be instances where the supply curve would slope backward. This happens when the amount of wage increase poses a high opportunity cost and no longer incentivizes individuals to spend more hours working. In this case, the individual chooses leisure despite the high wage rate. For purposes of discussion, however, we use the upward-sloping labor supply curve.

Shifts in the Labor Supply Curve

The labor supply curve shifts when individuals alter the time they want to work at a given wage.

Here are some events that might cause a labor-supply curve to shift.

1. **Changes in Tastes**

   Individuals may change their views or preferences about work. For example, among the female population, the proportion employed in the labor force increased from 34 percent in the 1950s to 57 percent in 2018 in the US. There can be a lot of factors that could contribute to this, but one of them is smaller family size, which allows more mothers to have more time to work. This event shifts the labor supply curve to the right.

2. **Changes in Alternative Opportunities**

   Individuals may shift careers or choose to work in another labor market when better opportunities in which their skills still match open up. For example, when the wage increases in the market for apple pickers, the workers in the orange orchard may choose to switch occupations, which decreases the labor supply curve for apple pickers.

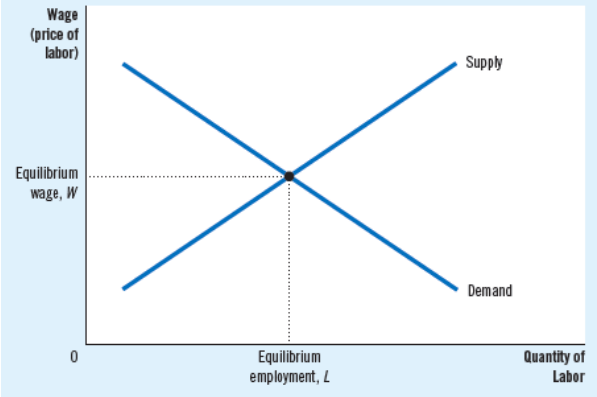
3. **Immigration**

   Workers who move from one place to another to work, whether within or outside the country, cause a shift in the labor supply of a particular labor market.

C. Equilibrium in the Labor Market

The equilibrium in the labor market is similar to the goods and services market. However, instead of the equilibrium price and quantity of the good, we determine the equilibrium wage (price of labor) and the number of workers (quantity of labor). Figure 3.4. shows the equilibrium in the labor market, and it is represented by the point of intersection between the labor supply and demand curves. This means that at this point, the workers earn the value of their marginal contribution to the production of goods and services.

Figure 3.4. Equilibrium in a Labor Market

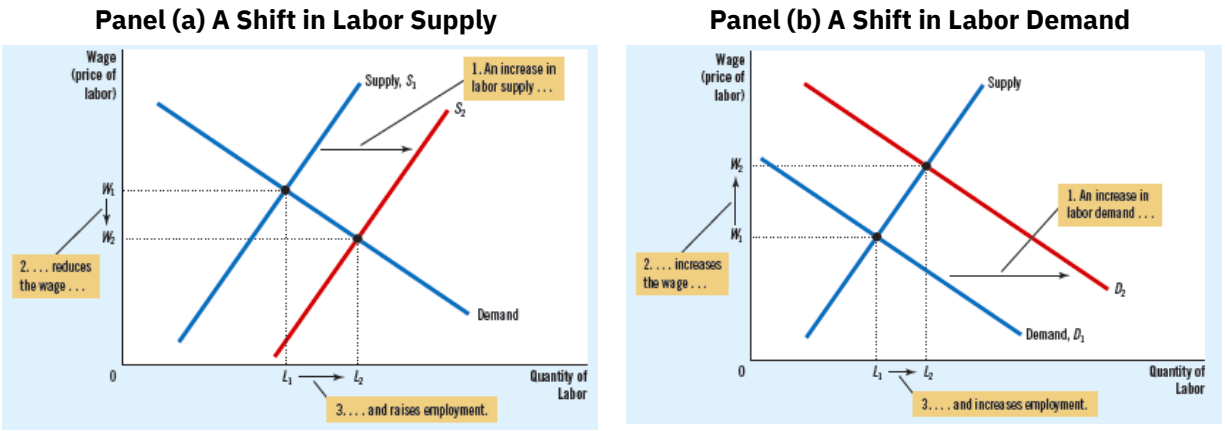


The equilibrium wage and level of employment change when shifts in the labor supply or demand curve occur. Figure 3.5. Panel (a) shows a shift in the labor supply. Suppose there is an immigration surge of new workers. This increases the supply of labor from S_1 to S_2. At the current wage rate, labor supply is greater than the labor demand. The market then adjusts, and the equilibrium wage falls from W_1 to W_2. At this lower wage, firms have a demand for laborers; thus, employment increases from L_1 to L_2. Note that the change in the wage reflects a reduced marginal revenue product of labor: with additional workers, the increased output from an extra worker decreases.

Figure 3.5. Panel (b) shows a shift in the labor demand. Suppose that the firm's output price increases. This increases the demand for labor from D_1 to D_2. At the current wage rate, labor demand is greater

than the labor supply. The market then adjusts, and the equilibrium wage rises from W_1 to W_2. At this higher wage, employment increases from L_1 to L_2. Note that the change in wage reflects an increased marginal revenue product of labor: with a higher output price, the increased output from an extra worker generates more profit.

Figure 3.5. Shifts and Labor Market Equilibrium



Equilibrium wage is determined through the interaction of individuals looking for work (labor supply) and firms looking for workers (labor demand). The equilibrium changes when shifts in the supply or demand curve for labor occur. At the same time, firms achieve profit maximization when labor demand establishes that the equilibrium wage always equals the marginal revenue product of labor.

D. Other Factors of Production: Land and Capital

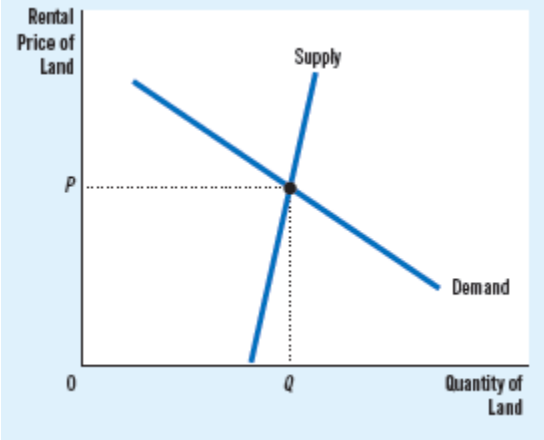
As previously mentioned, a firm employs not only labor but also land and capital. **Land** is a physical space where the firm's business is located or built. **Capital** is the stock of equipment and structures used for production, which includes but is not limited to buildings, machinery, computers, and so on. Using the orange orchard business as an example, the capital stock includes the ladders used by workers to climb the orange trees, the trucks used for delivery, the warehouses used to keep the oranges, and the orange trees themselves.

Equilibrium in the Markets for Land and Capital

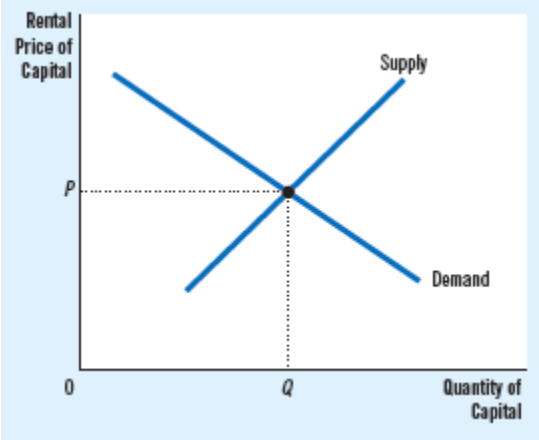
Similar to the labor market, the supply and demand for land and capital determine its equilibrium rental price and quantity, respectively. Figure 3.6. Panel (a) shows the market for land, while Panel (b) shows the market for capital. The rental price is what the firm pays to the landlord or lessor. Furthermore, the labor demand and capital demand are determined in the same way as the labor demand. That is, when the orange producer decides on the quantity of land and ladders to rent, it follows the same principles and thought process as when the firm decides on the number of workers to hire. *For both land and capital, the firm raises the quantity until the factor's marginal revenue product equals the factor's rental price.*

Figure 3.6. The Markets for Land and Capital

Panel (a) The Market for Land



Panel (b) The Market for Capital



E. Monopsony

So far, we have discussed the labor market in the context of competitive firms. What if there is only one firm that has a demand for labor? A labor market with a single firm that has a demand for labor is called a **monopsony**. If a firm does not have competitors in hiring workers, potential applicants only have a single option. Intuitively, the sole firm that demands labor has the power to dictate the wage it pays to its workers and that this wage is lower than what a competitive firm will pay. What does the demand and supply framework tell us about monopsony and labor market outcomes?

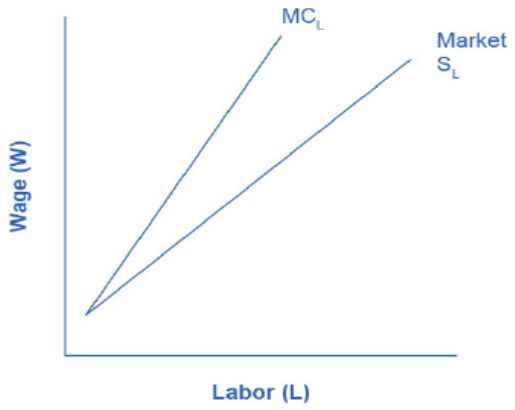
Monopsony is the counterpart of monopoly on the demand side. A monopsonist can choose a wage it wishes to pay; however, if it wants to hire more workers, it should be willing to increase the wage it pays. As seen in Table 3.2., as the firm hires more workers, the wage rate (per hour), the total cost of labor, and the marginal cost of labor also increase.

Table 3.2. Marginal Cost of Labor.

Supply of Labor	Wage Rate (per hour)	Total Cost of Labor	Marginal Cost of Labor
1	$1	$1	$1
2	2	4	3
3	3	9	5
4	4	16	7
5	5	25	9

As shown in Figure 3.7., a monopsony has an upward-sloping labor supply curve (also the market supply curve), which means that as wages increase, the quantity of labor supply increases. It is also notable that the marginal cost of labor is greater than the wage rate when the number of workers exceeds one. Why is this so? To hire an additional worker, the firm increases the wage rate not only to the new worker but also to the existing workers in the firm. Graphically, the marginal cost of labor curve is above the market supply of labor curve.

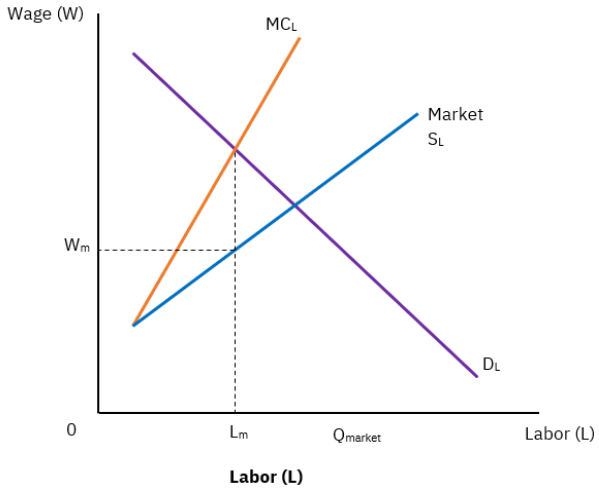
Figure 3.7. Marginal Cost of Labor



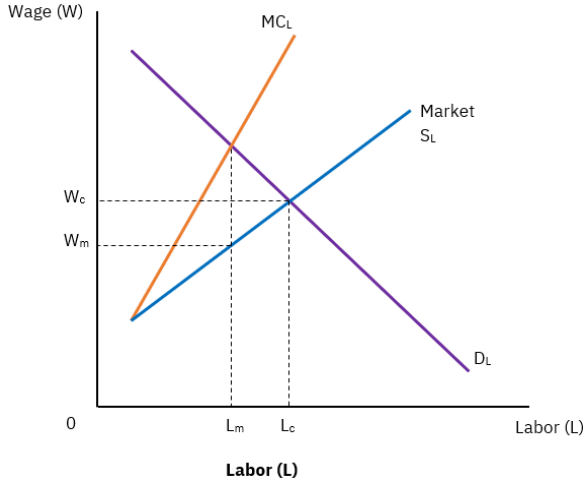
On the one hand, a profit-maximizing monopsonist chooses the number of workers to hire at L_m where the demand (marginal revenue product) is equal to the marginal cost of labor (see Figure 3.8. Panel (a)). However, the wage rate that the firm pays its workers corresponds to the point on the labor market supply curve that matches the same quantity level as L_m. On the other hand, a profit-maximizing competitive firm hires workers at L_c, where the demand (marginal revenue product) is equal to the labor market supply (see Figure 3.8. Panel (b)) and accepts W_c as the wage rate it pays to its workers. Relatively, a monopsonist hires fewer workers and pays a lower wage rate than a competitive firm.

Figure 3.8. Labor Market Outcomes

Panel (a) Monopsony Labor Market Outcomes



Panel (b) Monopsony vs Perfect Competition



Concept Check 3.1.	
Factors of production	the inputs used to produce goods and services
Production function	the relationship between the quantity of inputs used to make a good and the quantity of output of that good
Marginal product of labor (capital)	the increase in the amount of output from an additional unit of labor (capital)
Diminishing marginal product	the property whereby the marginal product of an input declines as the quantity of the input increases
Value of the marginal product	the marginal product multiplied by the price of the output
Marginal revenue product	another term for value of the marginal product; interpreted as the additional revenue the firm generates from hiring an additional unit of input or factor of production
Firm's hiring of labor condition	value of the marginal product is at least equal to the price of the output
Monopsony	a market in which a single firm is the only buyer (in the case of the labor market, there is only one firm that has a demand for labor)

Chapter 3 Review Questions

1. **How is the demand curve for labor determined if firms are competitive and profit-maximizing?**
    A. By the opportunity cost of workers' time
    B. By the value of the marginal product of labor
    C. By the value of the marginal product of capital
    D. By the ratio of the marginal product of labor to the marginal product of capital

2. **A pizzeria operating in a competitive market sells its output for $20 per pizza and pays workers $10 per hour. To maximize profit, it should hire workers until the marginal product of labor is**
    A. ½ pizza per hour
    B. 2 pizzas per hour
    C. 10 pizzas per hour
    D. 15 pizzas per hour

3. **Which of the following causes a rightward shift of the labor supply curve?**
    A. More dads leave the job market to raise their children at home.
    B. Great entertainment methods are introduced, increasing the value of leisure.
    C. An increase in the number of workers coming in from abroad due to more relaxed immigration laws.
    D. An increase in government benefits for retirees.

4. **A technological advancement that enhances the marginal product of labor will shift the _____ curve to the _____.**
    A. Demand; left
    B. Demand; right
    C. Supply; left
    D. Supply; right

5. **A company implements a wellness program that significantly boosts employee productivity. As a profit-maximizing firm, the company is most likely to:**
    A. Reduce the number of employees needed to maintain the same level of output.
    B. Hire more employees to capitalize on the increased output potential of each worker.
    C. Decrease wages to compensate for the rise in worker productivity.
    D. Maintain current employment levels and enjoy the benefits of increased profits.

Note: Use Table 3.3. below to answer question 6 to 8

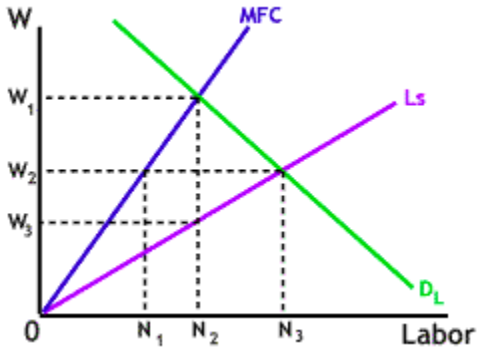
Workers	Tables/Hour
0	0
1	5
2	12
3	20
4	27
5	33
6	38
7	42
8	45

6. **Suppose this firm sells its output in a perfectly competitive market and hires its inputs in competitive markets. If the price of a table is $5, and the wage paid to the workers is $30, how many tables will the firm produce to maximize profits?**
   A. 33
   B. 20
   C. 12
   D. 38

7. **What is the marginal revenue product of labor when profit is maximized?**
   A. $30
   B. $33
   C. $27
   D. $25

8. **If wages are $30 per hour, for what range of prices for tables would the firm choose to hire exactly 6 workers?**
   A. At least $4.28 but not quite $5.00
   B. At least $5.00 but not quite $6.00
   C. At least $6.00 but not quite $7.50
   D. At least $7.50 but not quite $10

Note: Use Figure 3.9. below to answer questions 9 and 10.



9. If the firm depicted in the graph acts as a profit maximizer, which of the following wage-labor combinations will it choose?

A. Wage = W2 and Labor = N3
B. Wage = W1 and Labor = N2
C. Wage = W3 and Labor = N3
D. Wage = W3 and Labor = N2

10. If, instead, the firm in Figure 3.9 were able to practice perfect "wage discrimination" in hiring, what wage would it pay the last worker hired, and how many workers would it employ?

A. Wage = W2 and Labor = N3
B. Wage = W1 and Labor = N2
C. Wage = W3 and Labor = N3
D. Wage = W3 and Labor = N2

Chapter 3 Review Answers

1. B
2. A
3. C
4. B
5. B
6. A
7. A
8. C
9. D
10. A

Chapter 4: Market Failure and the Role of the Government

Chapter Overview

Microeconomics examines how individual choices impact markets and society. This chapter analyzes how these "externalities" affect market efficiency and explores tools like taxes, subsidies, and permits to make polluters pay or beneficiaries contribute.

Private goods like coffee, club goods like gyms, and public goods like clean air each pose unique challenges. The "free-rider" problem, where individuals enjoy public goods without contributing, demands solutions like government funding or user fees.

Income inequality, measured by tools like the Lorenz Curve, is influenced by factors like education and inheritance. Policies like progressive taxation and social safety nets aim to address it, but each has its own limitations.

Learning Objectives

By the end of this chapter, you should be able to:

- Analyze market failures: Understand and analyze externalities (positive and negative), their impact on efficiency and welfare, and policy tools for internalizing them (command-and-control, taxes, subsidies, permits).
- Distinguish and analyze different good types: Define and differentiate private, club, and public goods, analyze the "free-rider problem" and its implications for public goods provision, and understand common resources and the "tragedy of the commons" theory.
- Evaluate resource management challenges: Analyze the challenges of sustainable management of both public goods and common resources.
- Measure and understand income inequality: Define and measure income inequality using tools like the Lorenz Curve and Gini Coefficient.
- Analyze and explore solutions for income inequality: Understand the factors contributing to income inequality and analyze various policy options aimed at addressing it.

A. Externalities

Firms earn profit through the production of goods and services that consumers need or want. For example, an oil company earns from producing gasoline that consumers use to fuel their cars, or a beverage company earns from producing soft drinks that individuals consume during social events. Both firms and consumers receive private benefits and incur private costs from selling and buying products

and services. However, the benefits and costs of producing the good or service may also accrue to third parties who are not part of the transaction or the market.

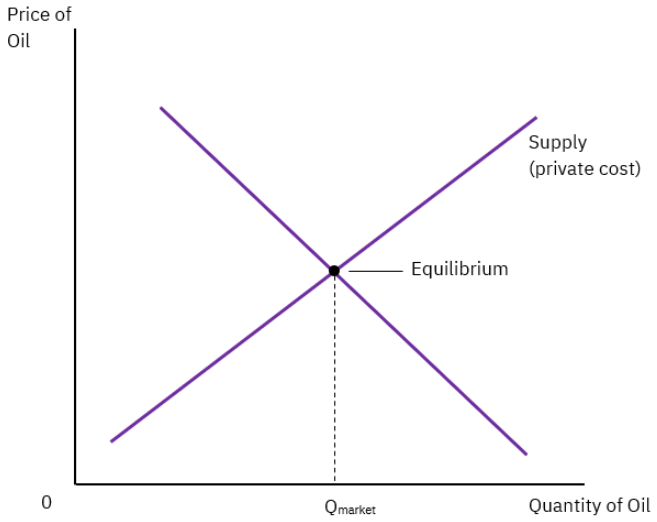
In previous sections, we have only measured the direct marginal benefits and marginal costs of producing and consuming a specific good or service to buyers and sellers but not to third parties. This unaccounted effect of one person's actions on the well-being of a third party is called an **externality**. In this section, we discuss externality as a market failure, its impact on resource allocation, and the role of the government in improving market outcomes.

Marginal Social Benefit and Marginal Social Cost

In Chapter 2.3., we learned about welfare economics. Efficiency is achieved when both the consumer surplus and producer surplus are maximized. Since both measure the economic well-being of buyers and sellers, it follows that the total surplus (sum of consumer and producer surplus) measures the society's economic well-being. Total surplus is the difference between the value to buyers (private marginal benefit) and the cost to sellers of producing the good (private marginal cost). At the market equilibrium, total surplus is maximized, and efficient allocation of resources is achieved. This efficient outcome holds true in the absence of externalities.

Figure 4.1.1. The Market for Oil

Using the market for oil, Figure 4.1.1. shows the efficient market outcome without accounting for externalities. The demand curve represents the value to buyers or the marginal private benefit, while the supply curve represents the cost to sellers or the marginal private cost. At the equilibrium quantity, Q_{MARKET}, total surplus is maximized, and efficiency is achieved.



If externalities are present but unaccounted for, market failure occurs, and market equilibrium is inefficient. This means that the equilibrium fails to maximize the overall societal benefit. Depending on the impact of the externality, the cost or benefit may be understated or overstated. Hence, measuring costs and benefits should also include the unintended benefits and costs to third parties. Specifically, we account for the **marginal social benefit**, which is the sum of the marginal private benefit to buyers and the benefits accruing to third parties, and **marginal social cost,** which is the sum of the marginal private cost to sellers and the costs accruing to third parties.

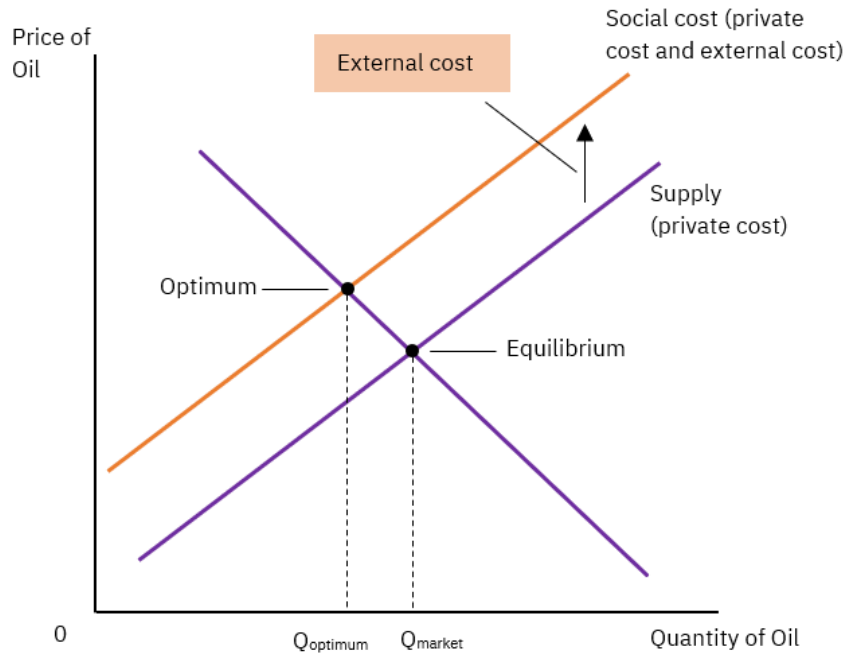
a. Negative Externalities

Suppose we are analyzing oil companies, a known contributor to air pollution. That is, for each unit of oil produced, a certain amount of hazardous and toxic air pollutants enters the atmosphere. This poses adverse effects and health risks to third parties, hence, a negative externality.

When this negative externality is taken into consideration, the costs incurred by third parties affected by air pollution are added to the marginal private cost, and the total becomes the marginal social cost. Figure 4.1.2. illustrates the marginal social cost of producing oil. It is above the marginal private cost because of the external costs imposed on society by oil production. The difference between the two is the cost of the air pollution emitted as a byproduct of oil production.

The socially optimal quantity, $Q_{OPTIMUM}$, is the intersection between the marginal private benefit and the marginal social cost. Below this level of production, the value of the oil to consumers is greater than the social cost of producing it; hence, more should be produced. Above this level of production, the social cost of producing oil is greater than the value of the oil to consumers; hence, less should be produced.

Figure 4.1.2. Negative Externality and Socially Optimal Outcome



Notice that the socially optimal quantity of oil, $Q_{OPTIMUM}$, is less than the equilibrium quantity, Q_{MARKET}. This inefficiency occurs because at market equilibrium, the negative externality is not accounted for and only private costs are considered. At Q_{MARKET}, the marginal consumer values oil at less than the social cost of producing it (the marginal private benefit is below the marginal social cost curve). Hence, decreasing oil production and consumption below Q_{MARKET} increases overall economic well-being.

To reach the socially optimal quantity of oil, the government can impose a tax on oil producers. With this, the supply curve shifts to the left by the size of the tax. The new supply curve would coincide with the marginal social cost curve, which represents the socially optimal quantity of oil when the tax accurately accounts for the negative externality (in this case, the cost of air pollution).

The imposition of tax is referred to as internalizing the externality because it provides buyers and sellers an incentive to consider the external impact of their actions or decisions. On the one hand, the oil producers would find it costly to produce more oil; thus, they would limit oil production. On the other hand, the tax would also reflect an increased oil price; thus, consumers would buy less of it.

Particulates from vehicle pollution

Household waste

Noise pollution from neighbours

Air pollution from smokers

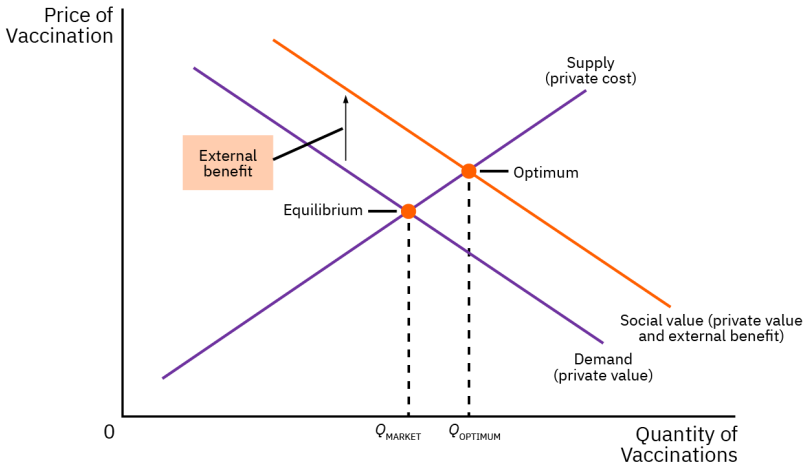
b. Positive Externalities

When a certain activity or decision yields benefits to third parties, a positive externality occurs. Consider vaccination, for instance. The private benefit of vaccination to users is health protection. However, beyond this, vaccination also has positive effects on third parties. When herd immunity has been achieved, the further spread of the disease is effectively prevented, thereby safeguarding a larger portion of the population.

When this positive externality is taken into consideration, the benefits of the vaccination to third parties are added to the marginal private benefit, which equals the marginal social benefit. Figure 4.1.3 illustrates the marginal social benefit of taking the vaccine. It is above the marginal private benefit of taking the vaccine. The difference between the two is the external benefit of taking the vaccines.

The socially optimal quantity, $Q_{OPTIMUM}$, is the intersection between the marginal private cost and the marginal social benefit. Below this level of consumption, the social benefit of the vaccine is greater than the marginal private cost of producing it, hence, more should be availed. Above this level of consumption, the marginal private cost of producing it is greater than the social benefit of the vaccine; hence, less should be availed.

Figure 4.1.3. Positive Externality and Socially Optimal Outcome



Notice that the socially optimal quantity of vaccine, $Q_{OPTIMUM}$, is greater than the equilibrium quantity, Q_{MARKET}. This inefficiency occurs because at market equilibrium, the positive externality is not accounted for and only private benefits are considered. At Q_{MARKET}, the marginal social benefit curve is above the marginal private cost curve; hence, increasing vaccine production and consumption above Q_{MARKET} increases overall economic well-being.

To reach the socially optimal quantity of vaccine, the government can offer a subsidy. With this, the demand curve shifts to the right by the size of the subsidy. If the subsidy precisely accounts for the positive externality (in this case, herd immunity), the new demand curve would coincide with the marginal social benefit curve, where the socially optimal quantity of vaccine is achieved. A subsidy is also a form of internalizing the externality.

In summary, if not accounted for, negative externalities lead to overproduction (surplus), and positive externalities lead to underproduction (shortage). To remedy this market failure, the government can impose tax or grant subsidy, whichever is applicable.

Public libraries / community spaces

Museums and Galleries

Free school meals / nutritional advice

Remedies

Public Policies Toward Externalities

i. Command-and-Control Policies: Regulation

For products that cause negative externalities (i.e., air pollution), the government can establish regulations or laws in any of the following forms: prohibiting production and use (banning) of the product, setting a maximum level of pollution, limiting the quantity of production, or using a specific technology to reduce harmful effects of the production or consumption of the good. In the US, the Environmental Protection Agency (EPA) is the government agency assigned to develop and enforce policies to protect the environment.

ii. Market-Based Policy 1: Corrective Taxes and Subsidies

The government can internalize the externality by imposing a tax, called a corrective tax or Pigovian tax, as a response to negative externalities or by granting a subsidy as a response to positive externalities. An ideal corrective tax would be equivalent to the additional cost accruing to third parties, and an ideal corrective subsidy would be equivalent to the additional benefit accruing to third parties.

Relative to establishing regulations, imposing corrective taxes and granting subsidies are preferred by economists. For instance, the imposition of corrective tax basically puts a price on the right to pollute. As a result, the responsibility for pollution reduction is placed on companies that have the highest costs associated with mitigating it. Given this, the EPA can effectively reduce pollution levels while minimizing overall costs by imposing a tax. Furthermore, companies may also be encouraged to find cleaner technology to avoid paying taxes and to reduce their contribution to air pollution.

In Chapter 2.3., recall that tax imposition causes a deadweight loss and reduces total surplus. However, corrective tax is an exception. When externalities are present, corrective taxes enhance economic efficiency by altering the market outcome closer to the socially optimal equilibrium.

iii. Market-Based Policy 2: Tradable Pollution Permits

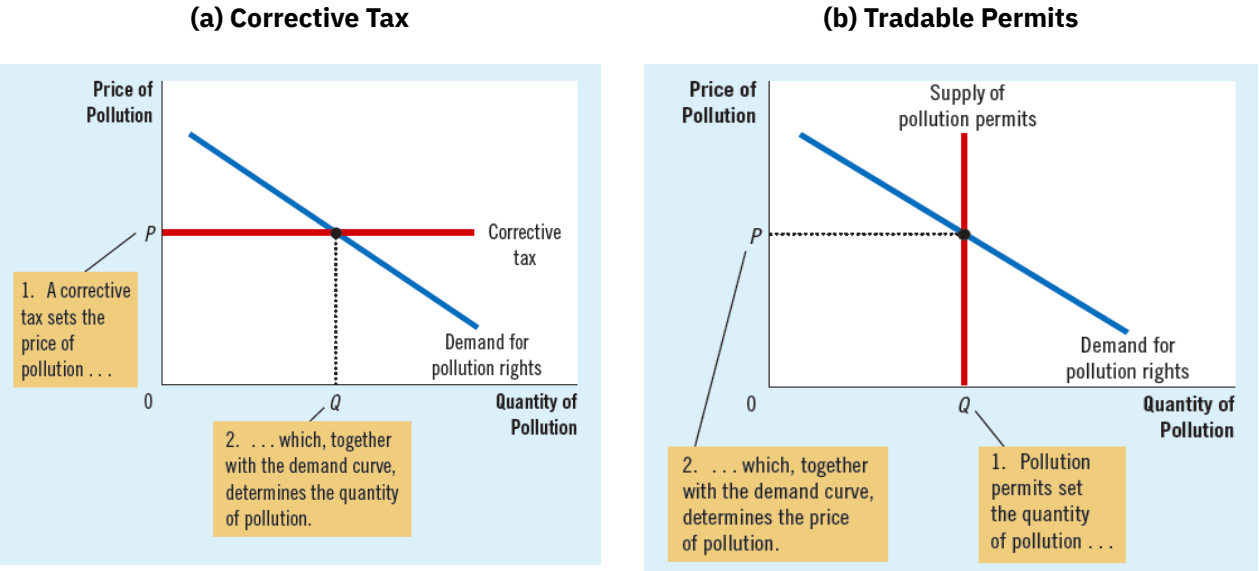
Suppose there are two mills – a paper mill and a steel mill. The EPA requires each mill to reduce its pollution to 250 tons of glop annually. Both mills can form an agreement and propose an alternative distribution to the EPA. The steel mill wants to raise its emissions of glop from 250 to 350 tons. The paper mill has agreed to lower its emission from 250 to 150 tons of glop in exchange for a payment of $4 million from the steel mill. Effectively, the total emission of glop would still be 500 tons.

The EPA should accept the proposal because the two mills are better off, given that they voluntarily agree to the arrangement. Furthermore, the target amount of pollution remains the same. In this situation, social welfare is enhanced by permitting the paper mill to sell its pollution rights to the steel mill.

If the EPA allows these trades, it effectively creates a new scarce resource: pollution permits, and the invisible hand guides this market. Hence, the permits would be allocated to firms that value them most

based on their willingness to pay. If the firm relies heavily on its existing production process, which emits a lot of pollution, then there is more willingness from the firm to purchase a permit.

Figure 4.1.4. Equivalence of Tradable Permits and Corrective Taxes



Reducing pollution either through tradable permits or corrective tax results in the same market outcome. In Figure 4.1.4., we compare different markets, one using corrective tax and the other using tradable permits. The demand curve in both markets depicts the right to pollute. When the price of polluting is high, fewer firms will choose to pollute and vice-versa. As seen in Panel (a), the supply curve for pollution rights is horizontal and perfectly elastic because the firms have no limitation in polluting as long as they pay the corresponding tax. As seen in Panel (b), the supply curve for pollution rights is vertical and perfectly inelastic because there is a fixed number of permits to be traded. In both cases, the price and quantity are determined by the intersection of the supply and demand curves. Regardless of the remedy used, the price and quantity of pollution are the same.

Private Solutions to Externalities

i. Moral Codes and Social Sanctions

Values and beliefs may define how individuals act or make decisions considering other people's well-being. For example, some people may abide by the principle "Do unto others as you would have them do unto you." This would influence them not to litter or not to pollute because they know that it's not the right thing to do.

ii. Charities and Donations

Nonprofit organizations or charitable institutions advocate for good causes such as environmental protection or educational support. Private firms become donors and may receive tax incentives from the government.

iii. Business Integration

Two firms offering complementary products may decide to agree on the optimal level of production, or one may decide to acquire the other to integrate the two businesses. Through integration or contract agreement, an efficient outcome will be achieved and make the parties better off. Some examples of complementary businesses are apple growers and beekeepers, computers and software, and coffee and cakes.

iv. Coase Theorem

According to the Coase Theorem (developed by Ronald Coase), efficient allocation of resources in the presence of externalities can be achieved if private parties can bargain at no cost. However, issues can only be resolved if the property rights are properly defined and understood by all parties involved.

Ronald Coase provides a clear depiction of an externality: a railroad track operating near a farmer's field where the train, at times, causes fire in the field. Between the railroad operator and the farmer, who should address this externality? If property rights are clearly defined, non-owners cannot infringe without paying a fee, and the owner has the legal responsibility to protect their property. If the farmer has ownership rights, then the railroad operator can install a gadget on the train to reduce the sparks that cause fire in the field.

Concept Check 4.1.	
Externality	unaccounted effect of one person's actions on the well-being of a third party
Marginal social cost	the sum of marginal private cost and external cost of a private action or decision to third parties
Marginal social benefit	the sum of marginal private benefit and external benefit of a private action or decision to third parties
Negative externality	an adverse effect of a private action or decision to a third party
Positive externality	a benefit from a private action or decision to a third party
Socially optimal outcome	the efficient market outcome when externalities are accounted for
Corrective tax	a tax imposed by the government to address the market failure due to negative externalities
Subsidy	a grant offered by the government to address the market failure due to positive externalities
Tradable pollution permits	a resource created when the government allows parties to alter the distribution of rights to pollute
Coase theorem	the proposition that if private parties can bargain without cost over the allocation of resources, they can solve the problem of externalities on their own.

B. Public Goods and Private Goods

Can you think of things you consume that you have not paid for? Some examples are the air that we breathe, the parks we stroll along in, or the fireworks display we chance upon. We enjoy and benefit from these things for free.

For most goods, the price mechanism allows the market to allocate the resources efficiently – the consumers pay for what they purchase, and producers are paid for what they sell. However, if goods do not have price tags, the market forces responsible for resource allocation are not present.

In this section, we evaluate the problems associated with goods that are free for consumption or use. Without a price, private markets are uncertain about the optimal level of production and consumption of the good. Given this, the government may intervene and address the market failure brought about by goods without market prices to enhance economic well-being.

Different Kinds of Goods (Excludability and Rivalry)

Different goods have properties and are characterized according to excludability and rivalry in consumption. **Excludability** is a property of a good in which an individual can be prevented from using or

consuming it. **Rivalry in consumption** is a property of a good in which an individual's use or consumption of a good diminishes another individual's ability to use or consume it.

As shown in Figure 4.2.1., these two characteristics form four categories of goods:

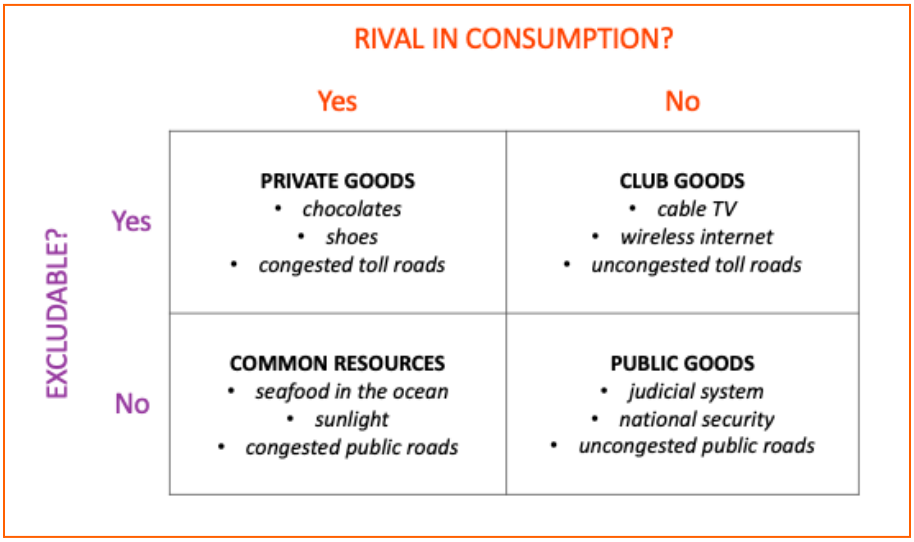
1. **Private Goods** are both excludable and rival in consumption. For example, only those who can pay for a chocolate can consume it; hence, a chocolate is excludable. Once an individual consumes the purchased chocolate, it can no longer be consumed by another individual; therefore, a chocolate is also rival in consumption. Most goods are private in nature. You pay for it, and you are the only one who can benefit from consuming the private good.

2. **Public Goods** are both non-excludable and non-rival in consumption. For example, every citizen has access to national security and defense; thus, it is non-excludable. Also, each citizen is given equal protection and does not compete for it; thus, it is non-rival in consumption.

3. **Common Resources** are non-excludable and rival in consumption. For example, fishermen cannot be prevented from harvesting shrimps in the vast ocean; thus, shrimps in the ocean are non-excludable. However, once that shrimp is caught by a fisherman, it is no longer available for another fisherman to harvest; thus, shrimps in the ocean are rival in consumption.

4. **Club Goods** are excludable and non-rival in consumption. For example, access to wireless internet requires a subscription for a fee, making it excludable. However, an individual's subscription to wireless internet does not diminish another's ability to access it.

Figure 4.2.1. Four Types of Goods.



In the succeeding sub-sections, we focus on non-excludable goods: public goods and common resources, which are available and accessible to everyone without a fee. Analyzing these goods is similar to externalities. A public good produces a positive externality (other people would be better off) due to its non-rival in consumption property, while a common resource produces a negative externality (other

people would be worse off) due to its rival in consumption property. Given these external impacts, private decisions about production and consumption may result in an inefficient resource allocation, which may require the government to step in and alter market outcomes.

Free Rider Problem and Provision of Public Goods

To understand how public goods create a societal problem and cause a market failure, we use fireworks displays as an example. It is non-excludable since no one can be prevented from viewing it, and it is non-rival in consumption since an individual's enjoyment of viewing the fireworks display does not diminish another individual's enjoyment of it.

Suppose the 1,000 NewTown residents enjoy viewing a fireworks display during New Year's Eve in celebration of the coming year. Each resident values the viewing experience for $15; thus, the total benefit of all residents adds up to and equals $15,000. The cost of putting on a fireworks display is $5,000. Since the total benefit is greater than the cost, having a fireworks display on New Year's Eve would be efficient and beneficial for NewTown.

Claire, a NewTown entrepreneur, considered putting on a fireworks display. She thought, though, that the residents would not be willing to purchase tickets to the show when they could view the fireworks from the comfort of their homes for free. Since fireworks are non-excludable, people tend to become free riders. A **free rider** is an individual who benefits from a good without paying for it.

With the free rider problem, the market would fail to reach the socially desirable and efficient outcome. Even with the positive externalities, Claire would not be willing to put on the show because it is not profitable for her. The private market, which Claire represents, fails to provide the fireworks display that the NewTown residents want.

The remedy for this is for the local government to sponsor a New Year's Eve celebration. The town council can increase the residents' taxes by $5 and use the revenue to hire Claire to put on the fireworks display. Everyone in NewTown achieves a net gain of $10 ($15 *value of viewing experience* less $5 *tax*). In this way, Claire can help NewTown achieve an efficient outcome as a public employee instead of as a private entrepreneur.

Common Resources and the Tragedy of the Commons

To understand how common resources create societal problems and cause market failure, we look into the classic parable called the 'Tragedy of the Commons.' Common resources are non-excludable but rival in consumption.

Consider a small town where households raise sheep and sell wool as a source of income. The town has a collectively owned common area where all their sheep graze. No issue arises if every household gets a good grazing spot in the common area and all of them are satisfied with the arrangement. At this point, it is considered a public good since the common area is non-rivalrous.

As time passes by, however, the town's population grows, as well as the number of sheep grazing in the common area. Since the size of the land is fixed, the common area deteriorates, and the land becomes

barren. Issues arise, and the common area is now characterized by rivals in consumption. Eventually, raising sheep becomes difficult and impossible; hence, the households lose their source of income.

This tragedy occurs because social and private incentives are different. If the shepherds acted collectively, they could decrease the number of sheep to a size the common area can accommodate. However, no single household has an incentive to decrease its own flock size because each flock is only a small part of the issue.

Essentially, the Tragedy of the Commons occurs because each household fails to account for the negative externality of owning several sheep and letting them graze in the common area with a fixed size. The problem of overgrazing could have been avoided if the town regulated the number of sheep in each household's flock, internalized the negative externality through taxing the sheep, or by auctioning off a limited number of sheep-grazing permits. As for the land, the town can distribute it among the households. With the land division, each household has the responsibility to protect it from excessive grazing. In effect, the land becomes more of a private good than a common resource.

Concept Check 4.2.	
Excludability	a property of a good in which an individual can be prevented from using it
Rivalry in consumption	a property of a good in which one's use of a good diminishes another's ability to use it
Private goods	goods that are both excludable and rival in consumption
Club goods	goods that are excludable but non-rival in consumption
Common resources	goods that are non-excludable but rival in consumption
Public goods	goods that are both non-excludable and non-rival in consumption
Free-rider	an individual who benefits from a good without paying for it

C. Public Policy to Promote Competition

Among the four market structures, only the perfectly competitive market produces a socially desirable and efficient outcome. Perfectly competitive firms do not have market power and accept price as a given. Competition represses market power and prevents firms from charging a price above marginal cost. For this reason, the government promotes competition and closely monitors the activities of monopolists and oligopolists through public policies.

Antitrust Policy

The **Antitrust policy or law** is enforced by the government to promote competition and monitor collusive practices. These government policies can prevent mergers, separate a large firm into smaller firms, or halt firms from coordinating their uncompetitive activities. The economic objective of antitrust policies is to temper monopoly power and encourage lower-cost production. Table 4.3.1. shows the important Antitrust Laws in the US.

Table 4.3.1. Important Antitrust Laws in the US

Law	Year Enacted	Purpose
Sherman Act	1890	Prohibited "restraint of trade," including price fixing and collusion. This act also outlawed monopolization
Clayton Act	1914	Prohibited firms from buying stock in competitors and from having directors serve on the boards of competing firms
Federal Trade Commission Act	1914	Established the Federal Trade Commission (FTC) to help administer antitrust laws
Robinson-Patman Act	1936	Prohibited firms from charging buyers different prices if the result would reduce competition
Cellar-Kefauver Act	1950	Toughened restrictions on mergers by prohibiting any mergers that would reduce competition

Source: Hubbard et al

In recent years, the government has been more lenient in enforcing antitrust laws because of three interrelated reasons:

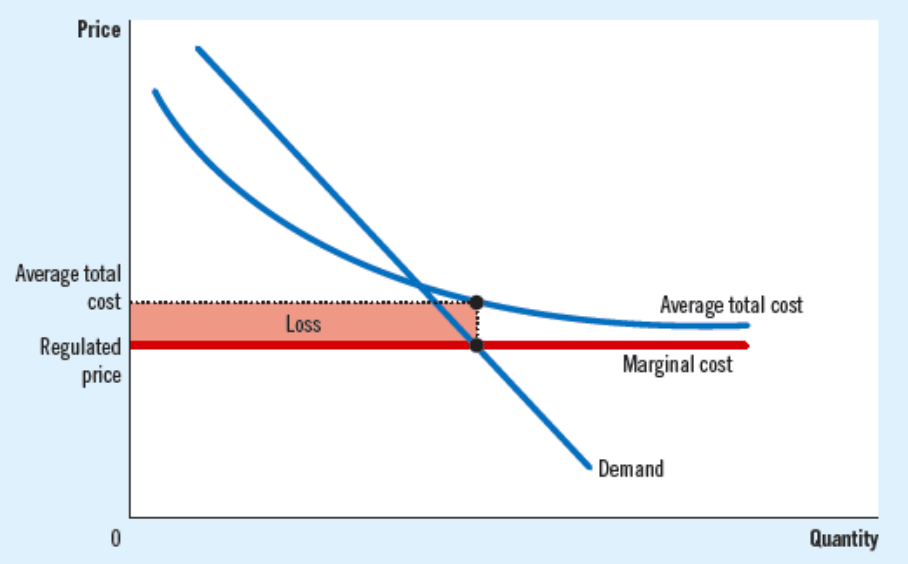
1. The American ideology that big businesses are "bad" have changed since the 1980s and the new ideological framework supports the notion that big businesses can operate in good faith.
2. International competition has become more prominent and important than local competition.
3. Antitrust court cases cannot keep up with fast technological developments. By the time the legal court issues a resolution, the technology in question is no longer relevant.

Regulation

Besides antitrust policies, the government can regulate the price monopolists charge, especially firms that are natural monopolies, such as utility companies. Natural monopolies enjoy economies of scale and are characterized by declining average total cost. As seen in Figure 4.3.1., if the government

regulates the price equal to marginal cost, the natural monopolist would lose money because the regulated price is lower than the average total cost. If this is the case, the firm would discontinue its operations and leave the market.

Figure 4.3.1. Marginal-Cost Pricing for a Natural Monopoly



If the government pushes through with the marginal-cost pricing, it should subsidize the monopolist for the losses it would incur in order for the firm to continue operations. However, the government would need to raise taxes to fund the subsidy, and this would create deadweight losses.

Alternatively, the government can impose a regulated price equal to the average total cost, which will earn the monopolist zero economic profit. However, with the price being above the marginal cost, a deadweight loss would still exist.

In practice, the government may allow monopolists to charge a higher price than the marginal cost but not as high as the price would be when the firm is unregulated. With regulation, the government is able to temper the strong market power of a monopolist and reduce deadweight losses.

D. Income Distribution

Income Inequality

Income inequality refers to the unequal distribution of income among different households in an economy. Households are segregated into five equal groups (quintiles) according to their annual incomes. Table 4.4.1. demonstrates the corresponding income ranges for each quintile. For example, if the household has an annual income of $50,000, it is part of the second quintile.

Table 4.4.1. US Income Distribution (2022)

Group	Annual Family Income
Bottom Quintile	$42,350 and below
Second Quintile	$42,351 - $74,500
Middle Quintile	$74,501 - $114,000
Fourth Quintile	$114,001 - $178,000
Top Quintile	$178,001 and above
Top 5%	Above $334,200

Source: US Census Bureau

To analyze the income distribution over the years, it is useful to present the income data as shares of total income as shown in Table 4.4.1. In 2022, the bottom quintile received 3.7% of total income, and the top quintile received 49.9% of total income. Although each quintile includes the same number of households, the top quintile received about thirteen times as much income as the bottom quintile.

The Top 5% column of Table 4.4.2. presents the share received by the richest households. In 2022, the top 5% of households received 22.3% of total income, which is greater than the combined income shares of the bottom and second quintiles. Historically, we can observe that the income shares have stabilized at their levels.

Table 4.4.2. US Income Inequality (2022)

Year	Bottom Quintile	Second Quintile	Middle Quintile	Fourth Quintile	Top Quintile	Top 5%
2022	3.7%	9.2%	14.7%	22.4%	49.9%	22.3%
2010	3.8	9.4	15.4	23.5	47.9	20.0
2000	4.3	9.8	15.4	22.7	47.7	21.1
1990	4.6	10.8	16.6	23.8	44.3	17.4
1980	5.3	11.6	17.6	24.4	41.1	14.6
1970	5.4	12.2	17.6	23.8	40.9	15.6
1960	4.8	12.2	17.8	24.0	41.3	15.9
1950	4.5	12.0	17.4	23.4	42.7	17.3
1935	4.1	9.2	14.1	20.9	51.7	26.5

Source: US Census Bureau

Sources of Income Inequality

The Changing Composition of American Households

Since the 1970s, more married women have participated in the labor force, which increased the number of earners in a household. Furthermore, two high-income earners marrying each other is becoming a common trend. However, poor households have also shown an increasing trend with the rise of single-parent households. These observed changes in family structure are some of the sources of income inequality in US households.

A Shift in the Distribution of Wages

The distinct earnings differences between high-skilled labor and low-skilled labor have increased since the late 1970s, which contributes to the rising income inequality among households. Technology-related jobs have higher wages than non-tech jobs. Also, there is a premium for workers who have college degrees relative to high school graduates.

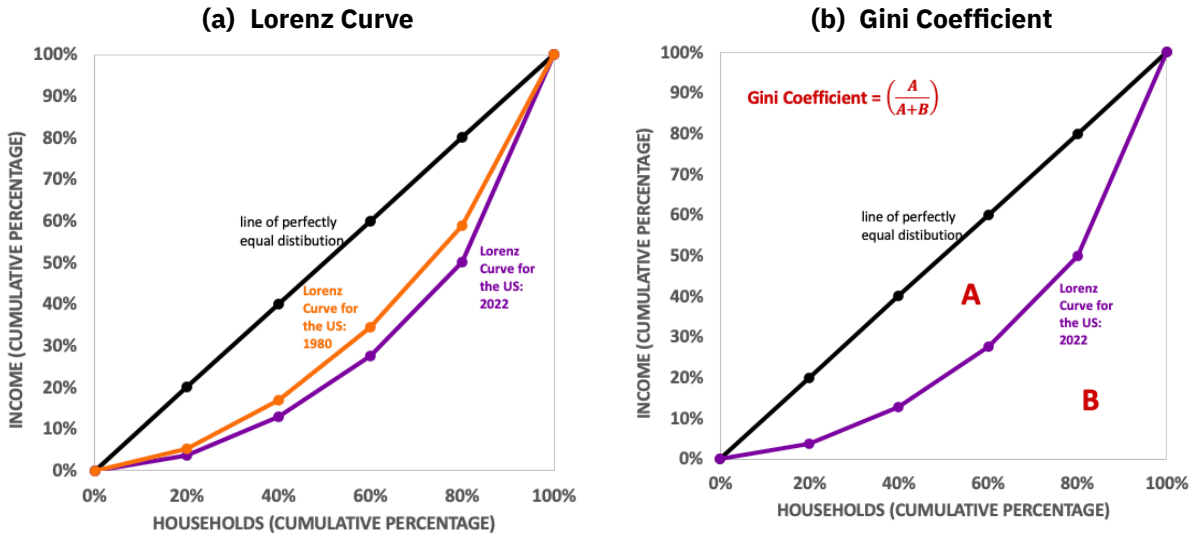
Lorenz Curve and Gini Coefficient

Income distribution can be presented using a **Lorenz curve**, which shows the distribution of income by arranging incomes from lowest to highest on the x-axis and indicating the cumulative income share earned by each fraction of households on the y-axis. If there is equal income distribution, the Lorenz curve would be linear because the first 20 percent of households hold precisely 20 percent of total income, the first 40 percent of households hold precisely 40 percent of income, and so on.

Panel (a) of Figure 4.4.1 presents two different Lorenz curves for the actual income distribution for the US in 1980 and 2022. Given that the Lorenz curve in 2022 is farther than the Lorenz curve in 1980, income inequality has worsened from 1980 to 2022. Panel (b) shows how to compute the **Gini coefficient**, which is one way of interpreting the information provided by a Lorenz curve. The Gini coefficient is equal to the area between the line of perfect income equality and the Lorenz curve (area A) divided by the whole area below the line of perfect income equality (A + B).

The Gini coefficient is equal to zero if area A is zero, which means that there is equal income distribution among households and the Lorenz curve is the same as the line of perfect income equality. The Gini coefficient is equal to one if area B is zero, which means that there is perfect income inequality and only one household owns the share of total income. If the Gini coefficient is between zero and one, a certain degree of inequality exists; the greater it is, the worse the inequality is. The Gini coefficient for the US in 1980 and 2022 are 0.403 and 0.47, respectively. This shows us again that income inequality worsened from 1980 to 2022.

Figure 4.4.1. Lorenz Curve and Gini Coefficient



Concept Check 4.3	
Antitrust policy	enforced by the government to promote competition and monitor collusive practices.
Income inequality	unequal distribution of income among different households in an economy
Lorenz curve	shows the distribution of income by arranging incomes from lowest to highest on the x-axis and indicating the cumulative income share earned by each fraction of households on the y-axis
Gini coefficient	the area between the line of perfect income equality and the Lorenz curve (area A) divided by the whole area below the line of perfect income equality (A + B)

Chapter 4 Review Questions

1. **Which of the following represents an example of a positive externality?**
    A. X trims Y's trees and is paid $50 for the service.
    B. X's tree trimmer emits smoke that Y's neighbor Z has to breathe.
    C. X's newly trimmed trees make her neighborhood more attractive.
    D. X's neighbor Y offers to pay X for keeping their trees well trimmed.

2. **When a good's production generates negative externalities, the social-cost curve is positioned _____ the supply curve, resulting in a socially optimal quantity that is _____ compared to the equilibrium quantity.**
    A. Above; greater
    B. Above; less
    C. Below; greater
    D. Below; less

3. **When the government imposes a tax on a good equivalent to the external cost linked to its production, it _____ the price consumers pay and leads to a market outcome that is _____ efficient.**
    A. Increases; more
    B. Increases; less
    C. Decreases; more
    D. Decreases; less

4. **Which of the following statements about corrective taxes might not always apply?**
    A. They increase the price paid by consumers for a good.
    B. They increase government revenues.
    C. They reduce the quantity sold in a market.
    D. They result in deadweight losses.

5. **The government auctions off 600 units of pollution rights. The rights sell for $40 per unit, raising $24,000 of revenue for the government. This policy is equivalent to a corrective tax of _____ per unit of pollution.**
    A. $6
    B. $40
    C. $400
    D. $600

6. **In what scenarios might command-and-control regulation be preferable over a corrective tax?**
    A. If a corrective tax would impact industries disparately.
    B. When certain polluters can achieve emission reductions more affordably than others.
    C. In cases where the negative externality is substantial enough to warrant zero optimal quantity.
    D. When information on the cost of pollution abatement is widely dispersed and challenging to acquire.

7. **Based on the Coase theorem:**
    A. Private individuals have the capability to resolve externalities without government intervention.
    B. Corrective subsidies represent the most effective policy for addressing positive externalities.
    C. Negative externalities pose societal challenges, while positive externalities do not.
    D. When two private actors amicably solve the problem of externalities, they shift the problem to a third party.

8. **The Coase theorem fails to apply when:**
    A. Substantial externality exists between two parties
    B. The legal system strictly enforces all contractual agreements
    C. Negotiation becomes challenging due to high transaction costs
    D. Both parties possess complete understanding of the externality

9. **Which goods are excludable?**
    A. Private goods and club goods
    B. Private goods and common resources
    C. Public goods and club goods
    D. Public goods and common resources

10. **Which goods are rival in consumption?**
    A. Private goods and club goods
    B. Private goods and common resources
    C. Public goods and club goods
    D. Public goods and common resources

Chapter 4 Review Quiz Answers

1. C
2. B
3. A
4. D
5. B
6. C
7. A
8. C
9. A
10. B

Glossary

Absolute advantage: the ability to produce a good using fewer inputs than another producer

Choice: a decision made between alternatives given the constraints of choosing another

Comparative advantage: the ability to produce a good at a lower opportunity cost than another producer

Explicit cost: direct costs associated with the option chosen

Extrinsic incentive: comes from the individual's environment

Scarcity: refers to the limited availability of resources (i.e., income, time, capital, land, etc.) to satisfy people's wants and needs

Implicit cost: indirect (not obvious) costs associated with the option chosen (i.e., value of the option given up)

Incentive: anything that pushes an individual to act

Intrinsic incentive: comes from the elated feeling of enjoyment after completing a task

Marginal analysis: comparing marginal benefit and marginal cost; a tool used to make decisions regarding alternatives. That is, choosing one alternative relative to another: MB should be greater than or equal to MC.

Marginal benefit (MB): the additional gain from a current state

Marginal change: the additional adjustments from a current state

Marginal cost (MC): the additional cost from a current state

Opportunity cost: the value of what one gives up to obtain something else (explicit plus implicit cost)

Production possibilities curve: a graph that shows the relationship between two goods, X and Y, that the economy is capable of producing given its limited resources or factors of production.

Property rights: enforceable rules of ownership

Specialization: an efficient production that encourages competitive advantage

Trade: exchange of goods or services

Trade-off: the act of gaining something at the expense of something else