MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION OF THE REPUBLIC OF UZBEKISTAN

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The department of "Business and Entrepreneurship"

MICROECONOMICS

LECTURE NOTES

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The main goal of discipline "Microeconomics" the formation of knowledge and skills of students in the subjects of the primary units of the national economy and for the adoption of rational decisions, i.e. the activities of individual companies, individual consumers and individual markets.

The course will focus on contemporary microeconomics and provide a conceptual foundation for analysis of policy. We will learn about the conditions needed for markets to operate successfully and more importantly, analyze when those conditions fail and how intervention can remedy problems. Intervention in markets fall into two main categories: first, it can be imposed voluntarily by market participants or it may be imposed externally by agents of government (e.g. by regulatory authorities). The lecture notes will develop microeconomic theories with the aim of providing students with an analytical ability to understand, interpret and solve practical microeconomic problems using a modeling framework.

The lecture notes was completed in accordance with state educational standards of higher education.

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INTRODUCTION

The main goal of discipline "Microeconomics" the formation of knowledge and skills of students in the subjects of the primary units of the national economy and for the adoption of rational decisions, i.e. the activities of individual companies, individual consumers and individual markets.

Main aim of the course is:

-Basic economic concepts, fundamentals of supply and demand analysis, market equilibrium, the minimum and maximum price elasticity of supply and demand;

-The theory of consumer choice, the income effect and the substitution effect, the market and the risk of firms and their organizational and economic foundations, the theory of production, costs of production;

-Ways of maximizing profits and reducing costs in the short and long run equilibrium competitive firms, factor markets, and ways to ensure they balance, instruments of state regulation of firms.

At the end of each topic, see educational technology and specific recommendations for their use set out in the educational complex (teaching materials) for this discipline.

Whether it is explaining the behavior of consumers, producers or government agencies, microeconomics lies at the heart of decision making. This course will provide students with a thorough grounding in Microeconomics. The course will blend theory and practical relevance and focus on a range of applications including the regulation of firms in competitive markets, consumer behavior and uncertainty, and the role played by non-commercial entities such as government in supplying services. The course will further focus on decision making under uncertainty. Mathematical notation, basic algebra and a little calculus (constrained optimization) is involved. This course will develop the students' existing knowledge base and allow them to gain a broader understanding of the way in which microeconomic theory can be applied to wider policy issues.

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1. Principles of microeconomics

Plan:

1.1. Subject of microeconomics
1.2. Objects of microeconomics
1.3. Goals and objectives of microeconomics. Features of microeconomics.
1.4. Methods of microeconomics

Economics is often defined as something along the lines of "the study of how society manages its scarce resources." The starting point of most such studies is that individuals allocate their resources such that they themselves will get the highest possible level of utility. An individual has an idea of what the consequences of different actions will be, and she chooses that action she believes will produce the best result for her. She is, in other words, selfish and rational. Note that she is also forward-looking. She acts so that she in the future will get the highest possible level of utility, independently of what she has already done. That she is selfish does not have to mean that she is an egoist. However, it does mean that she will only voluntarily share with others if she believes that she thereby will maximize her own utility. We often call this simplification of human beings **Homo Economicus**. **Homo Economicus** is a model of human beings. She is assumed to maximize her own utility.

The **resources** that we are talking about here could be labour, capital (such as machines), and raw materials. **Resources:** Labour, capital and raw materials. The things we use to produce goods and services. That they are scarce means there are not enough resources to produce everything we want. That, in turn, means that one has to weight different things against each other. To get more of one thing, one has to give up something else. If you, e.g., want to sleep an extra hour, it is impossible to do so without giving up something else, such as an hour of studying. There is, consequently, a sort of a hidden cost to sleeping longer. This type of cost is called **opportunity cost** (or **alternative cost**). **Opportunity/alternative cost:** The (hidden) cost of choosing one alternative instead of another. A classical saying in economics is that "there is no such thing as a free lunch." This means that, even if you do not actually pay for the lunch, you always have to give up at least the time when you could have done something else. That is, you always have to pay the opportunity cost.

When we study **microeconomics**, it is primarily individual human beings and individual firms, **agents**, that we study. **Microeconomics:** The study of the economic behaviour of individual human beings and firms. **Agent:** An entity that is capable of making a decision, e.g. a human being or a firm. This is in

contrast to **macroeconomics**, where one studies whole economies, and questions such as unemployment and inflation. **Macroeconomics:** The study of whole economies

Roughly speaking, there are three types of decisions that need to be made in an economy: Which goods and services to produce, how to produce them, and who should get them. Often in economic models, the prices of goods (or services, labour, capital, etc.) automatically coordinate these decisions in a market. A **market** is any mechanism where buyers and sellers meet. **Market:** Meeting place where buyers and sellers are able to trade with each other. That could be, for example, a market square, a stock exchange, or a computer network where one can buy and sell things.

Microeconomics is often based on **models**. **Model**: A simplified description of reality. We try to describe a real phenomenon as simply as possible by only highlighting a few central features. Many economic models can be used for predictions and can therefore be tested against reality. Such models are called **positive**. **Positive economics**: A testable economic model. The opposite kind of models, models that are about values, is called **normative**. **Normative economics**: An economic model that includes values (and therefore is not testable). For example, to decide about an economic policy one would first use positive economics to make assessments about the consequences of different alternatives. Then one would use one's opinions about what is desirable and what is not to choose between the different alternatives. That is then a normative decision.

Before we begin, it is probably wise to make it clear where we are trying to go. We want to develop a number of models that together can describe how an economy works. They should be able to produce clear and testable predictions and be as simple as possible.

• In a market, products and/or services are being bought and sold (or traded). We begin by looking at consumers and producers, and their respective demand and supply in a market. That way, we will see an example of how the market price of a good is determined.

• Consumers and producers, however, have difficult problems to solve before they arrive at their respective demand and supply. First, we look at a consumer's problem in a very simple case: She has to choose between two different goods for which she has different preferences. We show how it is possible to go from her preferences and income to her demand for one of the goods. Then we show how one can derive the demand for the whole market.

• Then we change perspectives and study a producer's problem. We will then discover that the model looks very similar to that of the consumer. The

producer has to produce the good with the help of labour and capital, and different combinations of the two will lead to different quantities of the good. She also has to think about the fact that, different combinations will have different costs. The results will help us to show how the market supply is determined.

• There are usually quite many consumers but substantially fewer producers. This has a large impact on how the market operates, and we therefore continue to study different market forms. We will differentiate between cases where there are one, two, some, and many producers. We also study the welfare effects of different market forms.

• The producers have a demand for labour and the workers supply it. The labour market has some odd features that we will treat separately.

• Equilibrium is a central concept in economics. We show how consumer and producer markets, as well as the market for goods, simultaneously reach equilibrium in a simple and stylized economy.

• Lastly, we relax some of the assumptions we have made so far. We show how undesirable results can arise because of so-called market failures, e.g. because different agents have different amounts of information about a good, or because it is difficult to keep out users who do not pay.

In this unit, we discuss how to define economics and look at what the study of economics is all about.

We study economics to determine how to best increase our nation's wealth. In this definition, wealth includes tangible (cars, houses, food), as well as intangible goods and services (protection from violence, clean air, entertainment, leisure time).

The production possibilities curve in this unit shows us the production choices we face given a certain amount of resources. No matter how abundant our resources, they are limited, and we have to make choices regarding what we want to produce and not produce. In our country and other relatively free-market economies, the decision as to what to produce is made primarily by the buyers and sellers of the products. The government exerts little control over prices of products.

Microeconomics (from Greek prefix mikro- meaning "small" and economics) is a branch of economics that studies the behaviour of individual households and firms in making decisions on the allocation of limited resources. Typically, it applies to markets where goods or services are bought and sold. Microeconomics examines how these decisions and behaviours affect the supply and demand for goods and services, which determines prices, and how prices, in

turn, determine the quantity supplied and quantity demanded of goods and services.

This is in contrast to macroeconomics, which involves the "sum total of economic activity, dealing with the issues of growth, inflation, and unemployment." Microeconomics also deals with the effects of national economic policies (such as changing taxation levels) on the aforementioned aspects of the economy. Particularly in the wake of the Lucas critique, much of modern macroeconomic theory has been built upon 'microfoundations'—i.e. based upon basic assumptions about micro-level behaviour.

One of the goals of microeconomics is to analyze market mechanisms that establish relative prices amongst goods and services and allocation of limited resources amongst many alternative uses. Microeconomics analyzes market failure, where markets fail to produce efficient results, and describes the theoretical conditions needed for perfect competition. Significant fields of study in microeconomics include general equilibrium, markets under asymmetric information, choice under uncertainty and economic applications of game theory.

The supply and demand model describes how prices vary as a result of a balance between product availability at each price (supply) and the desires of those with purchasing power at each price (demand). The graph depicts a right-shift in demand from D1 to D2 along with the consequent increase in price and quantity required to reach a new market-clearing equilibrium point on the supply curve (S).

The theory of supply and demand usually assumes that markets are perfectly competitive. This implies that there are many buyers and sellers in the market and none of them have the capacity to significantly influence prices of goods and services. In many real-life transactions, the assumption fails because some individual buyers or sellers have the ability to influence prices. Quite often, a sophisticated analysis is required to understand the demand-supply equation of a good model. However, the theory works well in situations meeting these assumptions.

Mainstream economics does not assume a priori that markets are preferable to other forms of social organization. In fact, much analysis is devoted to cases where so-called market failures lead to resource allocation that is suboptimal by some standard (defense spending is the classic example, profitable to all for use but not directly profitable for anyone to finance). In such cases, economists may attempt to find policies that will avoid waste, either directly by government control, indirectly by regulation that induces market participants to act in a

manner consistent with optimal welfare, or by creating "missing markets" to enable efficient trading where none had previously existed.

This is studied in the field of collective action and public choice theory. "Optimal welfare" usually takes on a Paretian norm, which in its mathematical application of Kaldor–Hicks method. This can diverge from the Utilitarian goal of maximizing utility because it does not consider the distribution of goods between people. Market failure in positive economics (microeconomics) is limited in implications without mixing the belief of the economist and their theory.

The demand for various commodities by individuals is generally thought of as the outcome of a utility-maximizing process, with each individual trying to maximize their own utility. The interpretation of this relationship between price and quantity demanded of a given good assumes that, given all the other goods and constraints, the set of choices which emerges is that one which makes the consumer happiest.

It is assumed that all firms are following rational decision-making, and will produce at the profit-maximizing output. Given this assumption, there are four categories in which a firm's profit may be considered to be.

A firm is said to be making an economic profit when its average total cost is less than the price of each additional product at the profit-maximizing output. The economic profit is equal to the quantity output multiplied by the difference between the average total cost and the price.

A firm is said to be making a normal profit when its economic profit equals zero. This occurs where average total cost equals price at the profit-maximizing output.

If the price is between average total cost and average variable cost at the profit-maximizing output, then the firm is said to be in a loss-minimizing condition. The firm should still continue to produce, however, since its loss would be larger if it were to stop producing. By continuing production, the firm can offset its variable cost and at least part of its fixed cost, but by stopping completely it would lose the entirety of its fixed cost.

If the price is below average variable cost at the profit-maximizing output, the firm should go into shutdown. Losses are minimized by not producing at all, since any production would not generate returns significant enough to offset any fixed cost and part of the variable cost. By not producing, the firm loses only its fixed cost. By losing this fixed cost the company faces a challenge. It must either exit the market or remain in the market and risk a complete loss.

Opportunity cost is one way to measure the cost of something. Rather than merely identifying and adding the costs of a project, one may also identify the

next best alternative way to spend the same amount of money. The forgone profit of this next best alternative is the opportunity cost of the original choice. A common example is a farmer that chooses to farm their land rather than rent it to neighbours, wherein the opportunity cost is the forgone profit from renting. In this case, the farmer may expect to generate more profit alone. Similarly, the opportunity cost of attending university is the lost wages a student could have earned in the workforce, rather than the cost of tuition, books, and other requisite items (whose sum makes up the total cost of attendance).

Note that opportunity cost is not the sum of the available alternatives, but rather the benefit of the single, best alternative. Possible opportunity costs of a city's decision to build a hospital on its vacant land are the loss of the land for a sporting center, or the inability to use the land for a parking lot, or the money that could have been made from selling the land, or the loss of any of the various other possible uses — but not all of these in aggregate. The true opportunity cost would be the forgone profit of the most lucrative of those listed.

One question that arises here is how to determine a money value for each alternative to facilitate comparison and assess opportunity cost, which may be more or less difficult depending on the things we are trying to compare. For example, many decisions involve environmental impacts whose monetary value is difficult to assess because of scientific uncertainty. Valuing a human life or the economic impact of an Arctic oil spill involves making subjective choices with ethical implications.

It is imperative to understand that no decision on allocating time is free. No matter what one chooses to do, they are always giving something up in return. An example of opportunity cost is deciding between going to a concert and doing homework. If one decides to go the concert, then they are giving up valuable time to study, but if they choose to do homework then the cost is giving up the concert. Any decision in allocating capital is likewise: there is an opportunity cost of capital, or a hurdle rate, defined as the expected rate one could get by investing in similar projects on the open market. Opportunity cost is vital in understanding microeconomics and decisions that are made.

Applied microeconomics

Applied microeconomics includes a range of specialized areas of study, many of which draw on methods from other fields. Industrial organization examines topics such as the entry and exit of firms, innovation, and the role of trademarks. Labour economics examines wages, employment, and labour market dynamics. Financial economics examines topics such as the structure of optimal portfolios, the rate of return to capital, econometric analysis of security returns, and corporate financial behaviour. Public economics examines the

design of government tax and expenditure policies and economic effects of these policies (e.g., social insurance programs). Political economy examines the role of political institutions in determining policy outcomes. Health economics examines the organization of health care systems, including the role of the health care workforce and health insurance programs. Urban economics, which examines the challenges faced by cities, such as sprawl, air and water pollution, traffic congestion, and poverty, draws on the fields of urban geography and sociology. Law and economics applies microeconomic principles to the selection and enforcement of competing legal regimes and their relative efficiencies. Economic history examines the evolution of the economy and economic institutions, using methods and techniques from the fields of economics, history, geography, sociology, psychology, and political science.

The modern field of microeconomics arose as an effort of neoclassical economics school of thought to put economic ideas into mathematical mode. An early attempt was made by Antoine Augustine Cournot Researches on the Mathematical Principles of the Theory of Wealth (1838) in describing a spring water duopoly that now bears his name. Latter William Stanley Jevons's Theory of Political Economy (1871), Carl Menger's Principles of Economics (1871), and Léon Walras's Elements of Pure Economics (1874–1877) gave way to what was called the Marginal Revolution. Some common ideas behind those works were models or arguments characterized by rational economic agents maximizing utility under a budget constrain. This arose as a necessity of arguing against the labour theory of value associated with classical economists such as Adam Smith, David Ricardo and Karl Marx.

Walras also went as far as developing the concept of general equilibrium of an economy.

Alfred Marshall's textbook, Principles of Economics was published in 1890 and became the dominant textbook in England for a generation. His main point was that marginalists went too far in emphasizing utility as an attempt to explain prices over costs of production. To correct that he presented the idea that prices were determined by supply and demand curves. The demand curve could be derived by aggregating individual consumer demand curves, which were themselves based on the consumer problem of maximizing utility. The supply curve could be derived by aggregating individual producer supply curves, which depended first on constructing cost curves and then analyzing how much each producer was willing to sell his goods at a given price level. The cost curves depended on solving a producer problem of minimizing costs under a given production function. He also introduced the notion of different market periods:

mainly short run and long run. This set of ideas gave way to what was latter called perfect competition.

A new impetus was given to field when around 1933. Joan Robinson and Edward H. Chamberlin, published respectively, The Economics of Imperfect Competition (1933) and The Theory of Monopolistic Competition (1933), introducing models of imperfect competition. Although Marshall himself had already considered both the monopoly case and Cournot had built his duopoly model, a whole new set of models grew out of this new literature. In particular the monopolistic competition model results in a non efficient equilibrium. Latter on some market models were built using game theory, particularly regarding oligopolies.

In 1937 The Nature of the Firm was published by Ronald Coase introducing the notion of transaction costs (the term itself was coined in the fifties), which explained why firms have an advantage over a group of independent contractors working with each other. The idea was that there were transaction costs in the use of the market: search and information costs, bargaining costs, etc. which give an advantage to a firm which can internalize the production process required to deliver a certain good to the market. A related result was published by Coase in his “The Problem of Social Cost” (1960) which deals with problem of externalities: the presence of transaction costs prevents agents from bargaining among themselves to arrive at mutually beneficial agreement. This then becomes relevant in context of regulations.

Around the seventies the study of market failures came again into focus with the study of information asymmetry. In particular three authors emerged from this period: George Akerlof, Michael Spence and Joseph Stiglitz. Akerlof considered the problem of bad quality cars driving good quality cars out of the market in his classic “The Market for Lemons” (1970) because of the presence of asymmetrical information between buyers and sellers. Spence explained that signaling was fundamental in the labour market, because since employers cant know beforehand which of the candidates are the most productive, a college degree becomes a signaling device which allows a firm to hire new personnel.

More recently Kahneman and Tversky published their paper "Prospect Theory: An Analysis of Decision under Risk" in 1979 criticizing the very idea of the rational economic agent. The main point is that there an asymmetry in the psychology of the economic agent which gives a much higher value to losses that to gains. This article is usually regarded as the beginning of behavioural economics and has consequences particularly regarding the world of finance.

The Definition of Economics

What is economics all about? Is it the study of money? Is it about trade-offs and scarce resources? Is it about inflation, unemployment, and deficits? Is it about eliminating poverty?

All of the above are important topics in the study of economics. However, the overall objective of economic research is its ability to explain how we can most optimally achieve the highest standard of living for as many people as possible. Thus:

Economics is the study of how we can best increase a nation's wealth with the resources that we have available to us.

Wealth in this definition includes tangible products, such as cars and houses, as well as intangible products, such as more leisure time and cleaner air.

Economics can best be defined as how to increase a nation's wealth. Wealth can be defined in many different ways. We can include tangible goods in wealth, such as cars, houses, food, and so forth, but also non-tangible things, such as leisure time, a healthy environment, a clean environment, better education. So an important question for government politicians, economists, and citizens of a country becomes how can we achieve the optimum amount of wealth? What kind of government programs should we have in place, what kind of tax policies, which monetary policy works the best to achieve this maximum wealth?

How Can We Best Increase Our Nation's Wealth?

There is substantial disagreement over how a country can best achieve optimum wealth. Some economists support considerable government involvement, price controls, and government rules and regulations. Others believe that government involvement should be minimal and limited to tasks including the provision of a legal system, military, police and fire protection, and providing certain public goods. Many believe that a combination of moderate government involvement and private initiative works best.

Among other issues, there is controversy about the role of profits, consumer spending, savings, capital formation, income distribution, and unions. Should we more heavily tax profits to more equally distribute the wealth in our country? Should we encourage spending and discourage saving to stimulate economic growth, or should we do just the opposite? Do unions raise real wages or are they harmful to our economic growth? These are important economic issues, which we will elabour ate on throughout the text. Let's define some important concepts first.

Marginal Benefit and Marginal Cost

Economic decisions are made using marginal benefit and marginal cost comparisons. A person will take action if the marginal benefit is equal to or

greater than the marginal cost of the action. If a business currently employs 10 workers, and the marginal benefit of hiring an eleventh worker is $400, but the marginal cost of hiring this worker is $500, then the business will not hire this eleventh worker. If the marginal benefit of the eleventh worker had been $600, then the business would hire this worker. As a student, assuming you voluntary enrolled in this course, you did so because when you signed up, you believed that the marginal benefit of completing the course is equal to or greater than the marginal cost of taking the course.

When you make choices as a citizen, a business person, a student, or a government official, you make them, assuming you are rational and you make decisions voluntarily, by comparing marginal benefits and marginal costs. You will choose an activity (for example, going to school, accepting a job, or buying or selling a product), as long as you marginal benefit is equal to or greater than your marginal cost. When you choose to enroll in a college, you expect that your marginal benefit (a diploma, better job, or higher earnings) will be at least as great as your marginal costs (the value of your time, your expenses on books, tuition, and other costs). When you buy a car, you make that decision because your expected marginal benefits (freedom to travel without having to rely on others to provide rides, status, and ability to accept jobs further away) are at least as great as your marginal costs (price of the car, gas, insurance, and maintenance). A firm will make a specific number of products based on its marginal benefits and marginal costs. It will choose to increase production as long as its marginal benefit (marginal revenue) is at least as great as its marginal cost.

The Difference Between Macroeconomics and Microeconomics

Macroeconomics includes the study of economic concepts which generally affect the entire - or almost the entire - economy of a country. Inflation, national unemployment, the central government's budget deficit, and monetary policy are typical macroeconomic concepts. Microeconomics includes the study of economic concepts which affect a smaller component of the economy. Price changes of gasoline, housing price changes, industry regulations, profit maximization of a firm, and poverty issues are typical microeconomic concepts. If microeconomics is like looking at the individual trees, macroeconomics is like looking at the forest.

Macroeconomics includes those concepts that deal with the entire economy or large components of the economy or the world. The nation's unemployment rate, inflation rates, interest rates, federal government budgets and government fiscal policies, economic growth, the Federal Reserve System

and monetary policy, foreign exchange rates and the balance of payments are typical topics discussed in macroeconomics.

Microeconomics includes those concepts that deal with smaller components of the economy. Individual demand and supply of goods and services, the price elasticity (sensitivity) of demand for goods and services, production, cost functions, and profit maximization in various industries, income inequality and income distribution, and the effect of protectionism (tariffs, quotas, and other trade restrictions) on international trade are topics generally included in microeconomics.

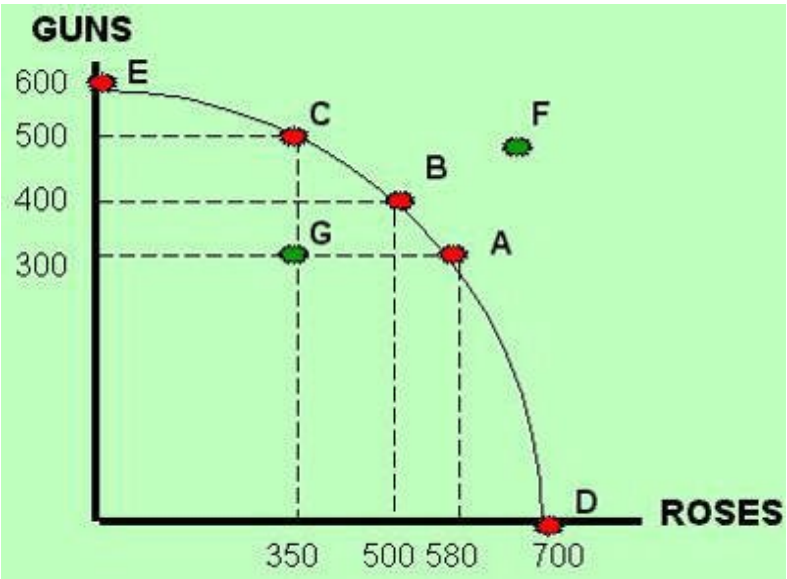
Production Choices

When we study how a country can best increase its wealth, we must look at its production behaviour. In order to produce, a country must use its resources, including land, labour , capital, and raw materials. A production possibilities curve represents production combinations that can be produced with a given amount of resources. For instance, let's say that a very small hypothetical country currently uses 100 acres of land, 20 machines, and 50 workers, and is able to produce two products: guns and roses.

Any country has a variety of resources - or factors of production, as we call them. These factors of production include land, labour , population (people), capital equipment, raw materials, and so forth. With these resources, we can produce a variety of products. In this example, we've chosen to produce guns and roses. You can really think of these two products as representing two categories of products: for example, "roses" stands for the production of all consumer goods. And "guns" stands for the production of all military or defense products. The production possibilities curve is the graph through points E, C, B, A, and D. To come up with these points, let's take a look at, for example, point E. At point E, the country decides to produce all guns or military products and no roses or no consumer products. So we have to look at all the resources that are available to the country and see how many possible military products can be produced with those existing resources at this point in time. This graph says that we can produce 600 of them. Conversely, if we wanted to produce all roses or all consumer goods, the country has enough resources to make 700 units of consumer goods and no guns. Of course, we can make combinations of these products, too, which is what A, B, and C represent. The meaning of G and F are explained in the next section.

You can think of "guns" as representing the category of products including weapons, fighter airplanes, tanks, and other military products. "Roses" represents all consumer products. This country has some choices (possibilities) regarding how it uses its resources. It can produce 500 units of guns and 350

units of roses (point C on the graph below). However, it can also, with the same resources, produce 400 units of guns and 500 units of roses (point B). Or it can produce 300 units of guns and 580 units of roses (point A). Numerous other combinations (for example, points D, E, G), are possible. A diagram representing all possible combinations is graphed in the figure below.



A production possibilities curve represents outcome or production combinations that can be produced with a given amount of resources.

Points on the Curve and Trade-offs

On this production possibilities curve, the red dots indicate points where the economy is at maximum efficiency. In other words, all the resources of that country are used as efficiently as possible. There is no unemployment; all of the machinery, factories, and equipment are used, and nothing is idle. Point G, on the other hand, is inside the curve. At that point, there is unemployment and some of the equipment and factories are idle. Point F is beyond the curve, is not attainable at this point in time. Possibly with economic growth through advances in technology and increases in resources, we may be able to obtain point F sometime in the future.

If an economy is operating at a point on the production possibilities curve, all resources are used, and they are utilized as efficiently as possible (points E, C, B, A, and D). If a country does not use its resources efficiently (unemployment), then it is operating inside the production possibilities curve (point G).

Any point on the curve illustrates an output combination, which is the maximum that can be produced with the existing resources and technology. It follows that output cannot increase if resources and technology remain constant. When economists discuss the concept of scarcity, they mean that resources are

limited and that at any given point in time, production is limited. If an economy is producing on the curve, increasing the production of one good or a category of goods always occurs at the expense (opportunity cost or trade-off) of the production of another good or category of goods.

A point inside the curve, for example 300 guns and 350 roses (point G), represents an output combination that is produced using fewer than the available resources (unemployment), or with all the resources, but with the resources used inefficiently (underemployment).

Point F is a production combination that cannot be achieved with the existing resources. Over time, the economy may grow and realize greater production capacities to produce, and we may get to point F in the future. This will be discussed in the next section.

Increasing Costs and the Concave Shape of the Production Possibilities Curve

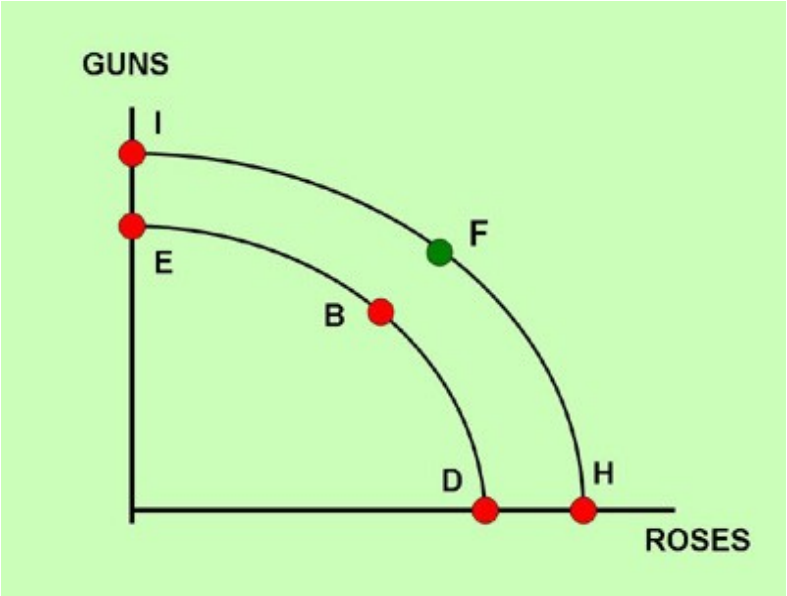
The production possibilities curve graphed above bows outward (it is concave). This is because the production of the last 100 units of output (for example, the production change from 500 units of guns to 600 units of guns) requires more of a trade-off of roses than the production of the first 100 units of output. In any economy, the production of the first few units is usually easier and cheaper, because the resources to produce these products are more readily available. For example, a country that has no orange production and then chooses to produce 100 bushels of oranges per year will find it relatively easy to plant trees in areas that are conducive to growing oranges. However, if total production of bushels of oranges is at one million per year, and we want to produce another 100 bushels, it is more difficult and more costly, because not as much land is available to grow oranges.

Causes of Economic Growth

In the previous section, we talked about the production possibilities curve shifting outward. We call this economic growth. In other words, the production capacity of the country increases. The reason for this increase is twofold. We could have an increase in the actual capital goods or labour , or any other factors of production of a country. In other words, we have more of the things that we need to produce products. Or we could have the same amount of resources, but we could be using those resources more efficiently. In other words, we could have an advance in technology.

Economic growth occurs when the economy realizes greater production levels. In the graph below, the curve shifts outward to the right (for instance, through point F from the graph in the previous section), so that the country's production capacity level rises. For the curve to shift outward, resources (land,

labour , capital, and raw materials) must increase, or we must improve the way we use these resources (technology). Therefore, economic growth is made possible by advances in technology and/or increases in resources, including increases in the labour force and capital goods, such as machinery, equipment, assembly lines, office buildings, factories, roads, highways, and airports.



How does a country increase its capital goods, and how does it achieve these advances in technology? Let's take a look at increases in capital goods first.

Increases in Capital Goods

Capital goods are produced just like other goods, such as cars, televisions, or food. If a country is producing at full employment (operating on the curve), more capital goods can be produced only if the country produces fewer consumption goods. Looking at the diagram in the previous section, this is reflected by a move from a point on the curve from the lower right to the upper left (for example, from point D to point A, or from point B to point C). A government can encourage more production of capital goods by, for example, providing tax breaks for the production of capital goods, or by increasing taxes on the production or sale of consumption goods.

Advances in technology occur because of inventions and improvements in producing goods and services. Inventions and improvements take place when entrepreneurs have incentives to produce more efficiently and lower their costs. When lower costs lead to higher profits and greater rewards, entrepreneurs are motivated to continue to improve their production process. Countries that allow entrepreneurs to keep all or most of these rewards (by limiting taxation and government involvement) have been shown to experience greater rates of technological growth.

Advances in human technology also stimulate economic growth. When people become more productive (for example, by gaining skills and becoming more educated), the production possibilities curve shifts outward.

Economic Growth and Economic Systems

The three most commonly discussed economic systems are capitalism, communism, and socialism. Capitalism is a system in which most economic decisions are made by the free market. By the free market we mean the private sector, which includes households and businesses. Prices, wages, interest rates, etc., are determined by supply and demand. Note that a pure capitalist economy does not mean that there is no government. Even in a pure capitalist economy, the existence of a government is essential. The government must protect private property, provide roads and highways, a legal system and other essential services, which the private sector cannot offer. In a communist economy, a government makes all economic decisions. A socialist economy is a mix of capitalism and communism; most economic decisions are made by the private sector, but a significant number of decisions is in the hands of a government. If you look at all the countries around the world and their average standard of living, you will find that the countries which have a significant capitalist element also have the highest standard of living.

As evidenced by the 2007/2008 recession, we don't have economic growth all the time. However, during most years, industrialized and mostly capitalist countries such as the United States, experience economic growth. Taiwan, Singapore, Brazil, Chile, the United Arab Emirates, South Africa, Russia and several other East bloc countries have increased their production capacities significantly during the past several decades. Recently, China has become more capitalist and experienced record growth. India has also adopted more capitalist elements into its economy and opened its border to increased free international trade. These countries' production possibilities curves have shifted out considerably because of freer markets, increases in capital stock and advances in technology. The four economies with the highest rate of economic growth in recent years are known as the BRIC countries (Brazil, Russia, India and China).

Communist (or command economy) countries, such as North Korea, Venezuela, and Cuba, have experienced far less economic growth than their capitalist counterparts.

In addition, many third-world countries that have struggled with civil strife and governmental corruption have been unable to shift their production possibility curves outward, because the political instability has made it difficult for capitalism and free markets to properly function. For capitalism to succeed, a country needs a stable economic and political climate in which its government

provides essential conditions, such as a just legal system, a just reward system (taxes and regulations that reward work and entrepreneurship), a proper infrastructure, strong national security, and protection of individual and property rights. Even the United States has felt the effects of uncertainty regarding the security of the country. When a country, its citizens, and its property are not protected properly, it can have a devastating effect on productivity and the motivation of its people to work hard. As security and stability improve, the conditions for a positive economic climate improve.

Conditions for Economic Growth

Why are standards of living in many countries so different? A few economic conditions are essential in maintaining a healthy and growing economy. They include strong private property rights. Governments must protect people and their properties. If they don't, the main motivating determinant for progress in capitalism (the profit incentive and the incentive to work hard) becomes irrelevant. Someone who works hard for 10 years accumulates some property (for example, land, a house, or a car). If this property is not protected and there is a significant chance that it can be taken away quickly, then this person loses the incentive to accumulate this property. This takes the incentive away for this person to work hard. In some countries, the government not only doesn't protect private property, but is corrupt itself and steals people's property. Capitalism in these countries cannot thrive and economic growth is unlikely. Other conditions for economic growth include the existence of free, or close to free, markets, minimum regulations and taxation, and, therefore, maximum freedom to produce and consume.

With the economic demise of many non-capitalist and often dictatorial statist countries, it has become clear during the past several decades that certain economic conditions must exist for healthy economic growth to occur. The free and mostly free countries and areas in our world, such as Japan, Taiwan, the United States, Great Britain, Canada, Hong Kong, Poland, Sweden, South Korea, and Singapore, have per capita (per person) earnings, that are much higher than the per capita earnings in statist countries, such as China, Cuba, Iran, and North Korea. The life expectancy in freer countries is higher than in statist countries, and even the large majority of the poor in the freer, capitalist countries live at a level well beyond that of the average citizen in a statist country. Countries with the highest per capita earnings are characterized by all or most of the following:

1. Strong private property rights. Andrew Bernstein in his "Capitalist Manifesto" states that: "Men often understand that an individual's life belongs to him and cannot be disposed of by society, but fail to grasp that his property must

similarly belong to him and be protected against confiscation by society. In fact, men cannot live without an inalienable right to own property. The right to life is the source of all rights - and the right to property is their only implementation. Without property rights, no other rights are possible".

2. Free markets, free international trade, and a stable price level. Free markets are markets in which prices of goods and services, as well as wages, rents, interest rates, and foreign exchange rates, are determined by the interaction of private sector demand and supply. Free international trade requires a free exchange of goods and services and resources between countries. Governments accomplish this by avoiding protectionism (trade obstacles, such as tariffs and quotas). A stable price level is achieved when there is little or no fluctuation in the country's average price level. The country's central monetary agency can accomplish this by keeping its money supply restricted or constant.

3. Essential government regulations and reasonable levels of taxation. Some regulations are useful and necessary as the financial difficulties of the recent past have clearly demonstrated. The government must enforce clear and effective rules in order to safeguard economic and financial stability, product safety, and consumer and worker protection. Taxes must be collected in order for the government to provide its essential functions. But the level of regulations and taxation must be kept reasonable and limited. Reasonable and cost-effective regulations and taxation encourage businesses to start or continue production, with rewards that provide incentives for hard work, innovation, and creativity. High levels of taxation mean that most of a company's or an individual's earnings are given to the government and there is little incentive for hard work, productivity and efficiency. Excessive regulations lead to time consuming and expensive business operations. They discourage business start-ups and can cause businesses to fail or move abroad. An economy can only be productive if the economic environment is conducive to the development of new ideas and innovations. This also requires a strong educational system, and the promotion of research and development.

4. Minimum corruption. A stable and secure environment is a required condition for a free market and a productive society. If the government of a country is corrupt or allows corruption by private groups, and initiates force by taking away citizens' and businesses' private property, then there is no incentive for potentially hard-working and innovative workers to produce and accumulate wealth.

Why Do Statist Countries Continue to Exist?

If economic growth and wealth accumulation are so much higher in capitalist countries than in statist countries, why, then, don't statist countries

change to capitalism? The answer is that capitalism requires freedom (economic and political), and statist rulers and dictators are fearful that with freedom among their citizens, they would lose their position in power.

The Money Supply and the Production Possibilities Curve

The production possibilities curve does not shift outward with an increase in the nation's money supply. If this were the case, all we would have to do would be to print more money all the time. The only causes of an outward shift in the production possibilities curve are increases in resources and advances in technology.

Potential versus Actual Production

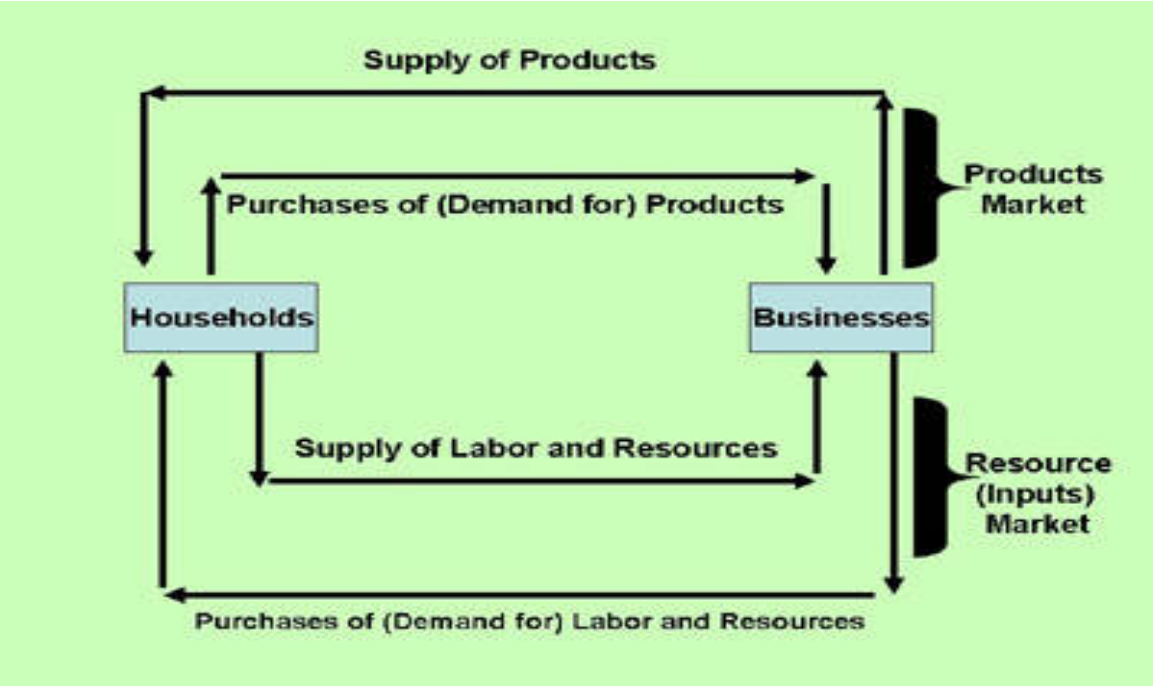
A country that experiences an outward shift of its production possibilities curve will increase its potential to produce. This does not mean that the country will increase its actual production. A country could be at a point inside of the curve and experience unemployment and inefficiency. China, Russia, and other former Soviet states have large amounts of resources. However, due to limited economic and political freedom, these resources are not used at their maximum efficiency. Consequently, China's and Russia's real Gross Domestic Products (a measure of a country's overall productivity) are far less than that of the United States. The good news for these countries is that, as they allow more capitalist elements into their economy, they will be able to shift their production possibilities curves outward, as well as to produce closer to their maximum efficiency level.

The Simple Circular Flow Model

An economy consists of many parties who participate in various economic activities. In its simplest form, an economy consists of buyers and sellers. Sellers are mostly businesses that produce goods and services. Businesses also buy resources, including land, labour , capital goods, and raw materials. Households buy consumer goods and services that are produced by the businesses. Households also provide labour necessary to make these products. Those households that own land, capital (money), capital goods, and raw materials provide these resources for production.

The simple circular flow diagram shown here paints a simplified picture of our private sector economy. The two main groups are households and businesses. In the bottom part, the resource market, households provide businesses with labour and resources, and businesses provide payments for these resources. In the top part, the product market, businesses provide products, and households pay businesses for these products.

In the graph below, a simple circular flow diagram shows the economic interactions between households and businesses. This represents a very simplified picture of how our economy works.



A simple circular flow diagram

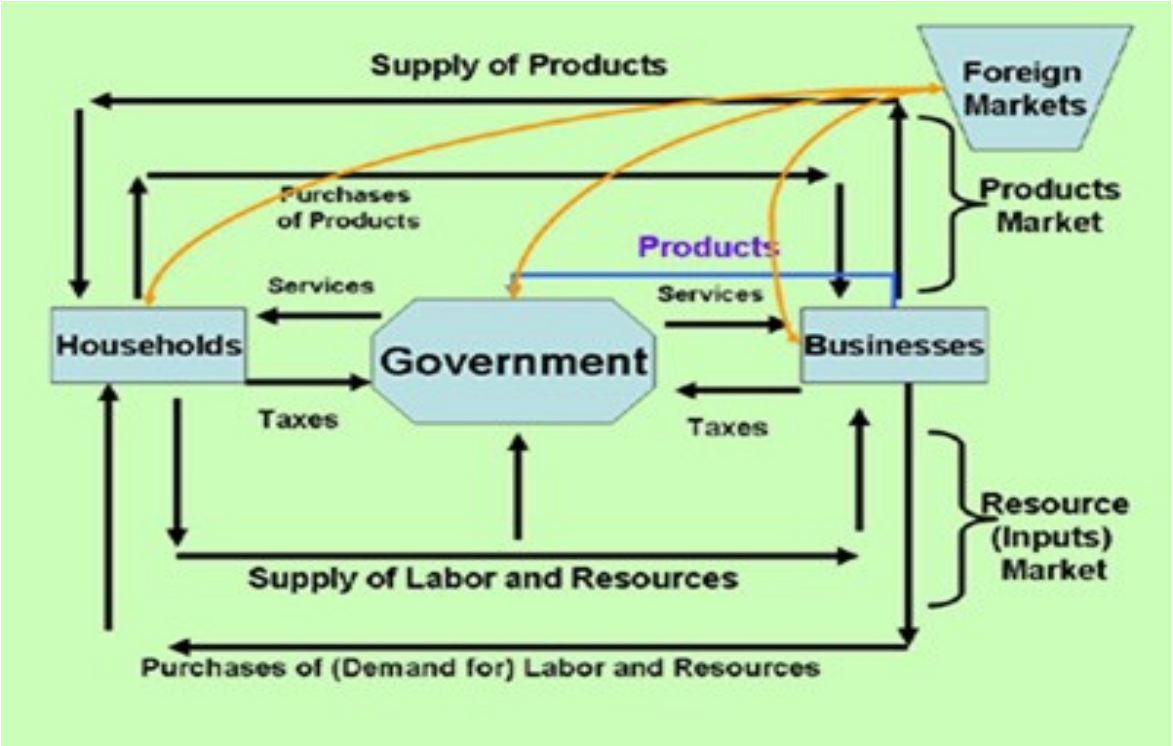
The Circular Flow with Government and Foreign Markets

The circular flow diagram shown here includes the two groups from the simple flow diagram above, and we add the role of the government and foreign markets. The government provides services to households and businesses, and collects taxes in order to pay for these services. Foreign countries buy and sell goods and services from our households, businesses, and government. The circular flow diagram provides a visual picture of the economic relationship between the most important economic agents in our society.

A more realistic picture of our economy includes the households and business activities described above, and also incorporates the economic interactions of two other main participants in our economy: government and foreign markets. This is illustrated in the diagram below.

Governments provide services to businesses, households, and foreign markets, and collect taxes to pay for these. Foreign markets buy and sell goods and services to and from our households, businesses, and governments.

So a typical economy consists of four main groups: households, businesses, governments, and foreign markets. The circular flow model illustrates the interactions between these four groups.



A circular flow diagram with government and foreign markets

Economic Systems

The three most common economic systems are

In a pure capitalist, or laissez-faire, economy, prices of all goods and services are determined by supply and demand. In the United States, prices of most goods and services are determined by supply and demand, but there are some goods and services that are controlled by the government. Such is the case with rent control or the minimum wage. Our government is also involved in various regulations, and taxation policies. We have an active monetary policy, and we have quite a bit of spending on defense programs, infrastructure, education, and other social programs. So in this country, as well as many other industrialized countries, we say that we have a mixed economy.

1. A laissez-faire economy.

Laissez-faire is French for "let do." It represents a pure capitalist system, or a so-called price system, in which the supply and demand behaviour of businesses and households determine prices of goods and services and factors of production.

2. A command economy.

A command economy is a communist system in which a country's government determines prices of goods and services and factors of production. The government is in control of all of the country's economic decisions.

The role which our governments play in economic decision making is crucial. This discussion has been heated for many centuries. Before the 1920s, most economists and politicians felt that a country should be a laissez-faire

economy. In other words, there should not be a whole lot of government involvement, should be limited to a role in defense or education, providing roads and highways. After the 1920s and 1930s, especially with the theories of John Maynard Keynes becoming more popular, people started to change their mind. They thought that a larger government role would be beneficial for the economy. So since the 1920s and 1930s the role of the government began to grow. Today, economists and politicians differ as to how much government should be involved in the economy. Some think that there is too much government involvement; others think the amount of government involvement is just right. The main difference between Republicans and Democrats from an economic point of view is the amount of government involvement in the economy. Democrats tend to favor a large amount of government involvement, and Republicans would like to see a little bit less government involvement in the economy.

3. A mixed economy.

A mixed economy is a combination of the two systems. Most industrialized countries around the world have mixed economies. The exact mix differs depending on the amount of government involvement.

Economic Systems around the World

The United States, Canada, Sweden, England, Norway, Japan, South Korea, Holland, and Germany are examples of mixed economies. The private sector (businesses and households) plays a significant role, but so does the government, in the form of various types of government spending, taxation, regulations, price controls, and monetary policies.

During the latter part of the nineteenth century and the beginning part of the twentieth century, the United States had a laissez-faire economy. In this system, households and businesses have maximum economic freedom. There is very little government involvement, minimal regulations, and free banking. The government is only in charge of the most essential economic and political functions, such as providing defense and national security, providing a legal system, and providing public goods, such as roads, highways and other infrastructure. The government collects taxes merely to pay for these essential functions. Prices, wages, interest rates, and other economic variables are determined by the economic decisions of private businesses and households.

In the 1920s and 1930s, due to influences from economists such as Karl Marx, Friedrich Engels, and John Maynard Keynes and the events of the Great Depression, industrialized countries experienced a dramatic change in economic beliefs about the role of the private sector and a country's government. Since this time the role of governments around the world has increased considerably.

In 1913, the United States Federal Reserve System was created. Central banks took control of the country's monetary system. Throughout the 1920s and 1930s, labour unions, supported by government legislation, gained in influence. Regulations about worker safety, anti-discrimination and anti-trust laws grew significantly. In 1934, the Federal Deposit Insurance Corporation was formed. Social programs, such as Social Security, Unemployment Compensation, various welfare programs, minimum wage laws, and farmer support programs became indispensable. New Deal types of government spending to create jobs, such as the Tennessee Valley Authority project, became commonplace. To fund these expenses and to pay for the growing number of government employees, taxes on individuals and businesses increased considerably.

During the 1960s, the war on poverty added new government programs. During the 1970s, environmental concerns increased government regulations to fight pollution. The Reagan administration supported limited growth and favored a smaller role for the government (except in the area of national security). The George W. Bush administration supported a strong build-up of the military and homeland security in the aftermath of 9/11. Bush also supported corporate bailouts and government stimulus packages (increased government spending) during the 2007/2008 recession. This increased our already large budget deficits. The Obama administration further increased the government presence in our economy, especially in the areas of national health care, energy, education and even in traditionally private sector industries such as banking, housing, and auto manufacturing. The Obama administration is currently struggling to find ways to reduce record setting budget deficits and a potentially disastrous national debt.

Today's economy is truly a mixed economy. Significant government involvement accompanies a strong private sector. What the ideal mix is of these components is the topic of many controversial debates.

2. Basic economic concepts

Plan

2.1. Main economic consepts
2.2. Cetiris paribus
2.3. Henry Hazlitt's Broken Window Fallacy

In economics we distinguish between nominal values and real values. Later on in the course, we will look at, for example, nominal GDP and real GDP, or nominal incomes and real incomes. We also have nominal prices and real prices. Nominal values usually represent the actual or current value of a product or an income and so forth. The real value is always the value relative to or compared to another year. Next year, for example, your income may rise by 10 percent, so your nominal income has gone up by 10 percent. However, if prices also go up by 10 percent, your real income doesn't really change, because really you have not increased your purchasing power. So your nominal income has increased 10 percent, but your real income for next year has remained constant.

Positive economic statements are usually statements that are facts, or relationships which you can prove or disprove. Even if you disprove a statement, it would still be a positive statement. It would just be a false positive statement. Normative statements are purely opinions, and it's certainly fine to have opinions in economics, as long as you eventually support them. If you were to write a position or opinion paper, you take a position on a controversial economic issue (this is the normative part), and then throughout the paper you will want to support this opinion. These supportive arguments are usually positive economic statements.

Nominal and Real Values

Nominal values, such as nominal prices, nominal earnings, nominal wages, nominal interest rates, and nominal Gross Domestic Product, refer to the actual dollar value of these variables. A person who earns $10 per hour in today's dollars earns a nominal wage of $10. Real values are values in comparison, or relative, to price changes over time. You may earn $10 this year and you may earn $10 five years from now. Your nominal income remains the same, but $10 five years from now is not worth as much as $10 now. The real value of $10 five years from now is less than $10 in today's dollars.

We also distinguish between real and nominal when we discuss interest rates. Real interest rates are nominal rates adjusted for inflation. If you pay your

bank 12% in nominal interest, you are only paying 2% in real interest, if prices are rising by 10%.

Positive and Normative Economic Statements

Positive economic statements are facts, or statements, which can be proven. Normative economic statements cannot be proven. They are opinions or value judgments.

A positive statement does not have to be a true statement. The statement could be proven false, in which case, it is a false positive statement.

Predictions are neither positive nor normative statements. Predictions, such as "The New York Mets will win the World Series next year," or "Unemployment will fall below 4% next month," are neither normative nor positive statements. They are predictions unrelated to facts or value judgments.

Examples of positive economic statements are

The federal government experienced a budget surplus this past year.

When the value of the dollar falls, Japanese products imported into the United States become more expensive.

Legalizing drugs will lower the price of drugs and reduce the crime rate among drug users.

The United States does not have a federally mandated minimum wage (this is a false positive statement).

Examples of normative economic statements are

The government should raise taxes and lower government spending to reduce the budget deficit.

We need to try to lower the value of the dollar in order to discourage the importation of Japanese goods into this country.

Our government should legalize the use of drugs in this country.

The minimum wage should increase to $7.50.

Ceteris Paribus

This Latin term means "if no other things in the economy change." For example, when college tuition increases, our chapter on supply and demand predicts that student enrollment (the number of course sign-ups) will decrease. Economists, indeed, predict this with the condition of "ceteris paribus," or if no other things in the economy change. But if students' (or their parents' or guardians') real incomes increase, then college enrollment may increase, despite the tuition increase. Tuition increases are still predicted to decrease college enrollment, but in this case, other things in the economy (incomes) did change, and the "ceteris paribus" condition was violated.

The Fallacy of Composition

You are subject to the fallacy of composition if you state that what is good for one is necessarily good for the entire group. If a college has a shortage of parking spaces for its students, it may be beneficial for a number of students to arrive very early and secure a parking space. However, if everyone arrives very early, the parking problem remains an issue.

What benefits one or more groups in our society is also automatically beneficial to the entire economy. This is the fallacy of composition. Sometimes what benefits one or more groups can be beneficial to the entire economy. But we cannot automatically conclude that, because in the case of special interest groups in our society, it may be beneficial for one or more groups to benefit from a particular policy action, but that could go against the interest of the country as a whole.

The Broken Window Fallacy

The economist Henry Hazlitt, in his book Economics in One Lesson, provides another good example of the fallacy of composition. The "Broken Window Fallacy" he describes that when a person throws a brick through a baker's window, it may seem that this stimulates the economy, because it provides a job for a glazier (window repair person).

Henry Hazlitt in his book Economics In One Lesson describes his Broken Window Fallacy. It is a story of a boy who breaks a baker's window. The baker then asks the glazier to repair the window. And because the baker has to repair his window, he now cannot buy the suit which the tailor was supposed to make for him. The story concludes that even though the glazier gains a job and contributes to rising employment, the tailor (oftentimes the invisible party in our economy, because he is involved with what would have happened and not what really happened) loses a job, and contributes to falling employment. The glazier and the tailor cancel each other out in terms of total employment. However, the baker is without a suit, so overall wealth in the economy actually decreases. The moral of the story is that any form of destruction leads to a decrease in a nation's wealth and is not beneficial for an economy.

According to Hazlitt, the fallacy occurs when we do not take into account the additional expenditures due to the replacement of the window. This expense lowers the baker's spending on other goods and services. If the baker would have bought a suit from the tailor without the expense of repairing his window, then the tailor loses a job compared to if the window had not been broken. So if the window is broken, the glazier gains a job, but the tailor loses one. Overall, there is no gain in employment if someone throws a brick through a window. Additionally, the baker loses, because he is without a suit compared to if the window had not been broken. Analogously, hurricanes, floods, and wartime

activities do not provide a net gain in employment. They create jobs in one area of the economy, but take away jobs in another. Overall, they destroy wealth and are harmful to the economy.

"It is difficult to predict the impact of serious hurricanes on the U.S. economy, but there are a few things we can conclude. A lot of money and activity that might ordinarily travel to the hurricane affected areas will go to other areas of the country or the world. For instance, just consider the impact that these storms have had on the conference and meeting industry, vacations, sporting events, etc. Many of these expenses are being diverted to other locations. On the other hand, lots of government spending, insurance claim payments, and private construction money go to the hurricane-affected areas, mostly to cover reconstruction and rebuilding expenses.

In 2005 all of our pocketbooks were affected by Katrina and Rita — especially at the gas pumps. These increased costs slowed the economy a bit. Fuel, heating, and transportation costs all rose, causing a reduction in output. Of course, reconstruction of the devastated areas provided a bit of uplift to the construction industry and supply lines of repair items, wood and other building supplies, furniture, etc. Dollars spent on the reconstruction effort is money that will have to be diverted from money which would have been spent in other areas and with other goals.

This line of thinking provides us with an opportunity to talk a bit about the "Broken Window Fallacy," a fascinating economic theory. It goes like this: If someone throws a stone through a shop window, the owner needs to fix it.

The cost to do so is, hypothetically, $250, selected to fit with Hazlitt's example below. The repair puts people to work and increases total output. Since this creates jobs, might we do well to break lots of windows and repair them? Most folks think this is nonsense since, although it would employ labour, there would be no benefit to the society at large. Yet there are many similar schemes, promoted by politicians and supported by the general public in the name of JOBS. Long ago, this fallacy was exposed by the French economist Frederic Bastiat in an essay entitled "What is seen and what is not seen." Bastiat teaches us to understand the economic reality beneath the superficial appearance of everyday economic life. What is seen is the broken window repaired, the workers working and the money they spend. What is not seen is that these workers and resources would have been employed in something else if not for the broken window. What ultimately benefits society is not jobs, but goods. In this instance, the glass store gains, but the broken window store owner loses (she probably would have spent the money on something else) – and the person that owns the shop that sells what she would have bought has a loss.

According to the late Henry Hazlitt in Economics in One Lesson, “Instead of [the shopkeeper] having a window and $250, he now has merely a window. Or, as he was planning to buy [a] suit that very afternoon, instead of having both a window and a suit he must be content with the window or the suit. If we think of him as a part of the community, the community has lost a new suit that might otherwise have come into being, and is just that much poorer.”

The Broken Window Fallacy endures because of the difficulty of seeing what the shopkeeper would have done. We can see the gain that goes to the glass shop. We can see the new pane of glass in the front of the store. However, we cannot see what the shopkeeper would have done with the money if he had been allowed to keep it, precisely because he wasn’t allowed to keep it. We cannot see the new suit foregone. Since the winners are easily identifiable and the losers are not, it’s easy to conclude that there are only winners and the economy as a whole is better off. Overall, the economy will suffer due to the hurricanes, not benefit as some media pundits have suggested, although the intensity and duration of the suffering is up for grabs."

From one of Bob Russell's newsletters (reprinted with permission).

What is Good for One Industry is not Necessarily Good for the Country is a law that benefits farmers automatically also beneficial to the entire country? Not necessarily. Farmers may benefit from subsidies and other farm support programs. However, these programs increase taxes and some also increase the price of certain agricultural products. The disadvantages of higher taxes and higher prices may be greater than the benefits bestowed upon farmers. So what is good for farmers is not necessarily good for the country as a whole.

Let's look at the farming industry as an example of the fallacy of composition. Currently, the United States government (and governments of many other industrialized countries) supports farmers in the form of direct subsidies and other programs. These subsidies benefit most farmers and seem to be beneficial for the farming industry. Many people believe that what is good for the farming industry must automatically also be good for the entire country. It is certainly possible that this is the case. However, to automatically conclude this is to suffer from the fallacy of composition. Farm subsidies and other farm support programs costs the government money. This increases taxes and hurts citizens. Furthermore, some farm programs (price supports) increase the price of certain agricultural products to consumers. Some economists also claim that the subsidies to farmers do not even benefit farmers themselves because it makes them weaker and less competitive in the long run. The subsidies may help the farmers in the short run, but not in the long run.

Does a Demand Increase Stimulate the Economy? George Reisman, in his book Capitalism, discusses another example of the fallacy of composition. He states that an increase in the demand for one product causes a price increase for that product. Assuming the cost of making the product does not increase, the product's profitability increases. Does this mean that if aggregate demand (demand for all products) increases, profitability of all products increases? Well, it depends. If a nation's total nominal income is constant, it is actually not possible for demand of all products to increase. Demand for one product may increase, but then the demand for other products must, mathematically speaking, decrease. So prices of some products increase, but prices of others decrease. The only way for demand of all products to increase is if total nominal income increases. This is only possible if the nation's total money in circulation increases. This is possible if the nation increases its money supply. But in this case, prices increase, and if profits increase, it means merely that nominal profits increase and not real profits. An important implication of this realization is that if the government decides to "stimulate" the economy by encouraging people to spend more on consumer goods (by printing more money, or by distributing money through social programs, creating public works jobs), it does not really increase total aggregate demand. The demand for one particular good or category of goods (those bought by the elderly, for example, in the case of higher Social Security paychecks for the elderly) may rise, but the demand for other goods will have to fall. Nominal (the monetary amount of) spending may increase, but real spending will not. The only way to increase real profits is to increase productivity. This lowers costs and decreases prices, which allows increases in real profits and real demand.

The Fallacy of Cause and Effect

When one event occurs before the other, we are tempted to say that the one event has caused the other. This is the cause and effect fallacy. The one event could have caused the other, but we cannot automatically conclude that. We have to look at the reasons why the other event occurred and whether the one event that preceded it really did cause it.

Cause and Effect Fallacy

Because A happens before B, A must necessarily be the cause of B.

It is tempting to conclude that if one event occurs right before another, the first event must have caused the second event. Let's say your basketball team wins its first three games while you are out with an injury. The fourth game, you are back, and your team loses. You conclude that it is your fault. Of course, your presence could have something to do with it, but you cannot automatically conclude this. Other variables may have played a role: the game conditions, the

referees, the opponent, your other teammates' performance that day, the coach's performance (even though the coach is always right :), or bad luck.

Similarly, in economics, people sometimes conclude that if one event follows another, the other must have caused the one. The period following World War II has seen a rising standard of living in industrialized countries around the world. This period has also been accompanied by much greater government involvement in these countries. Can we conclude that greater government involvement has caused higher standards of living? It may have contributed, but it would be a fallacy to automatically conclude this. We must also look at all other variables, such as technology changes and political and socio-economic changes.

Economics and Critical Thinking

Question Everything

Critical thinking has taken on increased importance, especially in our information society, in which it is difficult to weed through the multitude of sources of information and opinions. This section provides helpful guidelines when evaluating an article or news report. We must question the source, because the author may have a vested interest in supporting his or her opinion. We must also question the assumptions of an article's conclusion. Gasoline is usually inelastic (this concept is discussed in microeconomics). If a product is inelastic it means that when the price of gasoline changes, people will not change their quantity purchased of gasoline as much as the price change. Based on this knowledge, you may conclude that it is fine for politicians to raise taxes on gasoline in order to raise tax revenue. But what if the assumption is incorrect? What if you assume that an increase in the minimum wage raises productivity, but the assumption turns out to be false? Other things to keep in mind when thinking critically are to question how the variables used in a study are defined. The number of people working and the number of hours worked are two different things. The number of people working may be going up, but the number of hours worked may be going down if people are forced to switch from full-time work to part-time work. Watch out for fallacies: common fallacies include the fallacy of composition, and the fallacy of cause and effect. And, in general, question statistics used in any study. Do the poor get poorer? In the United States, relative to the rich, they do get poorer. But in absolute and real incomes (absolute level of standard of living), they get richer. Which statistics are used to prove the point the author is making? Be careful with statistics. For every study that proves A, another study proves the opposite of A. The thing to do is to use common sense, analyze and question all the data, definitions and

assumptions, and use proven economic principles, such as the laws of demand and supply.

Critical thinking is particularly important in today's Internet society and world of information overload. Authors, journalists, economists, politicians, talk-show hosts and even Hollywood celebrities and famous athletes make controversial and sometimes contradictory statements and express their opinions about social, political, and economic issues. It is useful to read their statements and to listen to their opinions. However, as educated citizens and critical thinkers, we must question everything. If we don't, we could end up with laws, regulations, and economic policies that harm our economy and our country.

When we evaluate a normative statement (for example, we should lower taxes) or question a positive statement (for example, if we lower taxes, then the government's deficit will increase), what do we look for? Below are some guidelines.

Critical Thinking Guidelines

When evaluating a statement we must

1. Question the source.

Study the background of the person making the statement. If a union leader provides arguments and statistics to support her/his claim that trade restrictions are beneficial to the American economy and that free trade leads to increased unemployment, we need to consider the source. The union leader's objective is to represent her/his constituency (union workers). Therefore, (s)he is biased and will make arguments to support her/his union agenda. This doesn't necessarily mean that the union leader is incorrect. However, when a person is biased, we must be prepared to question the validity of the arguments. This also doesn't mean that we should not question statements from people who are not biased. We should, of course, evaluate all statements, but in particular from people who have an apparent bias.2. Question the assumptions. An assumption is information you presume to be true. When in the 1990s Washington, D.C., Mayor Marion Barry wanted to raise more revenue for his city, he and his city council decided that imposing a higher tax on gasoline would do the trick. They made the assumption that gasoline is a necessary good and, therefore, "inelastic." In microeconomics we learn that buyers of an inelastic product will not change their purchases of this product much when the price changes. Let's say that, for example, the tax was 30 cents before the tax increase, and people were buying 1 million gallons per month. Then the tax revenue to the city was 1 million times 30 cents, or $300,000. The mayor and his council raised the tax by 10 cents, and they expected buyers to purchase approximately the same amount of gasoline after the tax increase. If so, this would mean that the city's total tax

revenue would now be 1 million times 40 cents, or $400,000. However, after the tax increase, the city discovered that total tax revenue actually decreased (to less than $300,000). It turned out that their assumption about the inelastic nature of gasoline was wrong. After the tax increase, many buyers decided to purchase gasoline in neighboring Virginia and Maryland.

Far fewer buyers bought gasoline in Washington, D.C. In other words, whereas gasoline in the entire United States market may be inelastic, gasoline in the Washington, D.C., area alone is elastic. Several months after the tax increase, Mayor Barry and his council rescinded the 10 cent tax increase.

3. Question how the variables are defined. Economists Card and Krueger conducted what is now a well-known study about the effects of a minimum wage increase in New Jersey. New Jersey, several decades ago, had increased its minimum wage by $1. Card and Krueger had noticed that within a brief period of time following the increase, employment in New Jersey had gone up, despite the higher wage. Card and Krueger concluded that an increase in minimum wage increases employment and decreases unemployment. But when other economists questioned this study, they found that Card and Krueger had used a definition for "employment" that was questionable. Card and Krueger defined "employment" as the number of people, full-time as well as part-time, employed. After the minimum wage increased, many businesses, in order to cut costs and compensate for the higher wage, decided to increase their hiring of part-time workers at the expense of hiring full-time workers. The following example illustrates the flaw in the definition Card and Krueger used. When 500 full-time workers are employed, they work a combined 20,000 hours (500 times 40 hours). When 300 full-time and 300 part-time workers are employed, they work a combined 12,000 (300 times 40) plus 6,000 (300 times 20), or a total of 18,000 hours. Even though Card and Krueger's "employment" increased (from 500 to 600 workers), the total number of hours worked decreased (from 20,000 hours to 18,000 hours). If Card and Krueger had defined employment as the total number of hours worked, they would have concluded that an increase in the minimum wage decreases employment.

Another example of how defining a variable can lead to incorrect conclusions involves the definition of Gross Domestic Product. Gross Domestic Product is defined as the sum total of a country's production of final goods and services. Because of the inclusion of only final goods and services, most products included in GDP are consumption goods. Intermediate goods are excluded. These are typically goods exchanged between businesses and include the flour sold by the miller to the baker, and the screws and machinery parts sold by the parts factory to the car manufacturer or furniture maker. The sale of

intermediate goods, spare parts, and raw materials is an important component of our economy, and provides millions of people with jobs. However, this economic activity is ignored in the definition of GDP. To conclude that a country's total economic activity is made up of mostly consumption is, therefore, false. It is true that GDP is mostly consumption. However, a country's economic activity is more than the items included in GDP. Thus, when economists and politicians claim that in order to stimulate our economy, we should primarily focus on stimulating consumption, this is a dangerous conclusion.

4. Question the validity of the statement. A statement's validity often breaks down because of two common fallacies. These fallacies are the fallacy of cause and effect, and the fallacy of composition. The latter is also called the "fallacy of what you cannot see", or the "broken window fallacy" (see Henry Hazlitt's Economics In One Lesson, Chapter 2).

People suffer from the fallacy of cause and effect when they conclude that just because event A occurs before event B, that A must have caused B. Event A could have caused B, but it is incorrect to automatically conclude that A causes B just because A precedes B. For example, European economists have observed growing technology during the past several decades. They have also observed growing average unemployment rates in most European countries during the past decades. Many economists have therefore concluded that growing technology causes greater unemployment. The fallacy is that they are omitting other variables, which may have caused the increase in unemployment. Perhaps increases in tax rates, or increases in protectionist measures, regulations, generous welfare programs, etc., contributed to the rise in unemployment.

People suffer from the fallacy of composition when they conclude that just because something is good for one group or industry, then it must be good for the entire country. Henry Hazlitt's Broken Window Fallacy illustrates that when a boy breaks a baker's window, it doesn't stimulate the economy. Hazlitt admits that the glazier (window repair person) gains a job, just like construction companies gain jobs from natural disasters, such as hurricanes and floods. However, the baker loses money, because he has to spend $250 to repair the window. He subsequently cannot buy a $250 suit from the tailor (this is foregone economic activity that you cannot see when the baker has to repair the window). Analogously, citizens struck by a hurricane (or their insurance companies) now have less money to spend on goods and services they would have otherwise bought (for example, vacations, a new car, etc.) had they not needed to repair their houses. Hazlitt reminds us that one of the keys to

economic thinking is to study the effects of economic action on all groups (the glazier, the baker, and the tailor), and not just one group (the glazier).

5. Question the statistics. Be careful when analyzing statistics. Let's look at the following example. A business earns a profit of $100 in year 1, and a profit of $120 in year 2. It reports to the media that its profits increased 20% (a $20 increase as a percentage of the $100 first year profit). In year 3, profit declines again to $100, and the business reports a decrease in profit of 16.7% (a $20 decrease as a percentage of the $120 profit in year 2). Looking at the percentage changes, it appears that the business is better off in year 3 compared to year 1 (a 20% increase and a 16.7% decrease). However, in looking at the absolute dollar changes, we know that the profit is the same in year 3 compared to year 1. Statistics can be deceiving if incorrect formulas are used or the wrong calculations are made. For your information, in the above example, a better method of calculating the percentage change for this business is to apply the so-called arc formula. This formula takes the change in the profit divided by the average of the two years' profits. In the above example, using this formula, the percentage change is $20 (the change) divided by $110 (the average of $100 and $120), or 18.18%. Notice that the percentage change is the same whether the profit increased (year 1) or decreased (year 3).

Another example of deceiving statistics arises when looking at changes in income inequality. Let's say that in 1985 the richest 20% of the income earners in our country earned 49% of the total income, and that the poorest 20% earned 5%. Let's say that we noticed that the numbers for the year 2006 changed to 50% and 4%, respectively. Can we conclude that the rich have gotten richer and the poor have gotten poorer? Looking at the percentage earnings only, this is a correct conclusion. However, looking at real dollar earnings, or standard of living, the conclusion may be different. The reason for this is that in 2006, the total income of the country is bigger than in 1985. For example if the country's total real income in 1985 is $100 billion (hypothetically), and the total real income in 2006 is $200 billion, then the poor are making $5 billion (5% times $100 billion) in 1985, and $8 billion (4% times $200 billion) in 2006. In absolute real dollars, the poor have gotten richer, not poorer.

6. Think like an economist. Thinking like an economist includes doing everything described in 1 through 5 above. Furthermore, economists use marginal benefit and marginal cost analysis. For example, does it make sense to eliminate all pollution in our society? It would be far too costly to eliminate every single instance of air, water, or noise pollution. However, the marginal benefit may equal the marginal cost (the optimum point) when we eliminate, say, 50% of the existing pollution.

When giving the solution to a problem, consider alternative solutions, pros and cons, pluses and minuses. It is not enough to support an economic program just because it adds benefit to our society. We also have to ask if the program is the best alternative. In other words, does it add the most benefit? The United States Social Security program has undoubtedly benefited many people, including the elderly, widows, disabled, and orphans. However, to ask whether we should support this program, we must also ask if this program is the best program. Can another program (for example, a privatized program or a reformed government-controlled program) deliver even more benefits? In another example, when the government bailed out Chrysler in the 1980s, it prevented Chrysler from laying off thousands of people, and it appeared to be a success. The real question, however, is not whether the government bailout was beneficial, but what would have happened if the government had not spent this money and how many alternate jobs this would have created. Could this have made the economy even better off?

Proper economic thinkers know to analyze the effects of a policy not just for one group, but for all groups (a technology improvement usually eliminates some jobs, but overall it creates jobs). And they know to consider not just the short run, but also the long run (restricting money supply growth may increase unemployment in the short run, but decrease unemployment in the long run).

Economic thinkers know to use common sense. Does the conclusion of a study violate the general principles of economics? If the minimum wage increases and employment increases, does this make sense? Applying the law of demand, it does not. If we do observe an increase in employment in the real world after a minimum wage increase, what is the reason? Were the definitions of the variables applied properly? Were the assumptions correct? Was the minimum wage below the market wage before and after the increase (in which case, an increase in the minimum wage does not change the actual wage – see Unit 2)? Furthermore, economic thinkers do well to be open-minded and non-judgmental. Look at all the numbers from an unbiased perspective and consider that anything is possible, regardless of any political agendas you may support, and regardless of what the majority of the population believes (the majority is not always correct).

3.Demand and supply

Plan

3.1. Definition of demand, demand curve, the law of demand

3.2. Definition of supply, demand curve, the law of supply

3.3. Market equilibrium

Why do prices of houses, cars, gasoline, and food fluctuate? Why do prices of stocks and bonds change all the time? Why do interest rates vary? Why do teachers and nurses make modest incomes and television celebrities make millions of dollars? What explains the increases and decreases in the foreign exchange value of the dollar?

In a free market economy, the answer to all these questions is this: "It is because of changes in supply and demand." When the demand for a product increases, then the price increases in the short term, and vice versa. When the supply increases, then the price decreases, and vice versa.

The mechanism of changing prices in a free market economy is powerful. When buyers want more of a product, and are willing to afford it, they communicate this by buying more of the product. This increases the product's price. The higher price gives producers an incentive (and the financial ability) to make more of the product. The subsequent greater supply satisfies the greater need. The greater supply eventually also brings the price back down. Overall satisfaction and the nation's wealth increase.

The free market system described above has many advantages and has led to high standards of living in many industrialized nations. It has some disadvantages, as well. Most economists agree that the advantages of a free market outweigh the disadvantages.

The Law of Demand

Price and Quantity Changes

Supply and demand is very important in economics because many economic variables are determined by supply and demand in a relatively capitalist economy such as ours. There are two sides to each market in which goods are traded freely. One is the buyers' side and the other is the suppliers' side. We start here with the buyers' side. We notice that the law of demand predicts that if prices are high, buyers will not buy as much of the product, and vice versa. You are very familiar with this of course, because if something is much more expensive, you probably will not buy as much of this item, whereas if something decreases in price, you will probably buy more of this item.

The law of demand states that buyers of a good will purchase more of the good if its price is lower, and vice versa. This assumes that no other economic changes take place. If the price of apples decreases from $1.79 per pound to $1.59 per pound, consumers will buy more apples.

The law of demand assumes that no other changes take place. This assumption is called "ceteris paribus." If we don't make this assumption, then it is possible that the price of apples decreases from $1.79 per pound to $1.59 per pound, and that fewer, not more, pounds of apples are purchased.

One explanation for this may be that the price of oranges, a substitute product, has decreased more than the price of apples, so that consumers will substitute oranges for apples. Does this violate the law of demand? The answer is no. If we had not changed anything else (ceteris paribus), then we would have noticed an increase in the quantity purchased of apples as a result of a decrease in its price, and this conforms to the law of demand.

Substitution and Income Effects

When a product's price decreases, then quantity demanded increases. This is the law of demand. Consumers behave this way for two reasons. One is the substitution effect. The substitution effect is when the lower price, of let's say, apple juice, makes apple juice more attractive relative to a substitute or competing product, such as orange juice. Because apple juice becomes cheaper than orange juice, people purchase more apple juice. The other effect is the income effect. Consumers will buy more apple juice, even if the price of orange juice were to go down as well, which would cancel out the substitution effect. Because the price of apple juice is lower, people have more relative income to spend, and it allows them to buy more apple juice. Let's say that the price of apple juice was $2 per bottle and you buy 5 bottles and therefore spend $10. Tomorrow, the price of apple juice decreases to $1 per bottle. If you were to still buy 5 bottles, then your spending would decrease to $5. This would leave you an extra $5 in income compared to when apple juice was at the higher price. This extra income allows the consumer to buy more apple juice.

There are two primary reasons why people purchase more of a product as its price decreases. One is the "substitution effect." The substitution effect states that as the price of a product decreases, it becomes cheaper than competing products (assuming the other products don't decrease in price). Consumers will substitute the cheaper product for the more expensive product, and vice versa. For example, if apple juice decreases in price, then "ceteris paribus," more people will purchase apple juice. Note also that fewer people will purchase orange juice, assuming that these products are substitutes.

The other effect is the "income effect." The income effect states that as the price of a product decreases, buyers will have more income available to purchase more products, and vice versa. For example, if someone purchases 4 DVDs per week at $15 per DVD, this buyer's total expenditure on DVDs is $60. If the price of the DVD falls to $10, the total expenditure for 4 DVDs now equals $40. This means that this buyer now has $20 more income compared to when the price of the DVD was $15. In essence, this buyer's real income has increased. This allows the buyer to purchase more DVDs.

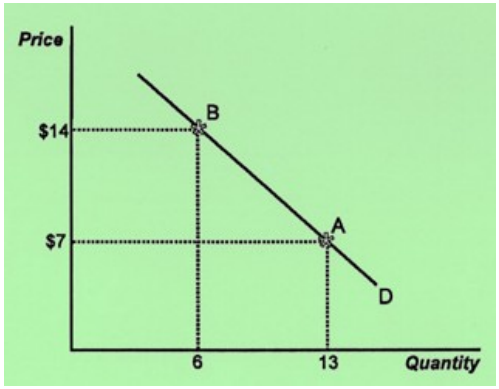
Graphing the Demand Curve

You can graph the law of demand in a diagram. On the vertical axis, we put the price of the product or service, and on the horizontal axis we graph the quantity of the product supplied or demanded. In this case, we look at the law of demand or the demand curve. So we graph price against quantity demanded, and then we notice that at very high prices, people will not buy as much of the product, so the point appears in the upper left part of the diagram. And at lower prices, when we work our way down the vertical axis, we connect up to a point that is to the right on the quantity axis. So low prices are related to higher quantity demanded. We then get a downward sloping demand curve, which is a very typical demand curve. Any time we graph a demand curve now, we make sure it's from upper left to lower right.

We can graph demand data in a diagram. The two variables we consider are the price of the product (P) and the amount of the product purchased during a certain period of time (Q). Economists usually measure the price of the product on the vertical axis and the quantity on the horizontal one.

A demand schedule and a corresponding demand curve represent the buyer's willingness and ability to purchase the product. For demand to exist, the buyer cannot merely desire the product, but (s)he must also be able to afford it.

In the diagram below, two points are plotted for a hypothetical product. At a price of $7 per product, 13 units are sold. At a price of $14 per product, only 6 units are sold. Other points can be plotted and a line or curve can be connected through these points to arrive at the demand curve. A demand curve usually extends from the upper left to the lower right. It is "downward sloping."



The above diagram shows that on demand curve D, consumers buy 13 units at a price of $7 (point A) and 6 units at a price of $14 (point B).

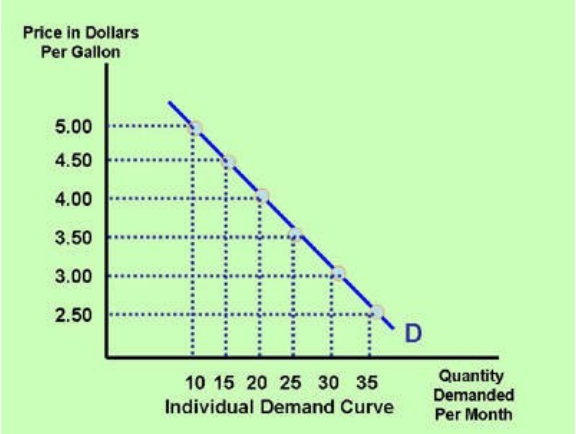
Your Own Individual Demand Curve

You can graph your own individual demand curve for a certain product. Let's say that you look at your demand for gasoline. If the price of gasoline were $5, how many gallons would you be interested and able to buy each month? The table in this section assumes that for this individual, the quantity demanded is 10 at a price of $5. If you do the same for the other prices, you have your own individual demand schedule. You can then plot these points and come up with your own individual demand curve for gasoline.

The graph in the previous paragraph shows the market demand for one product. Market demand is the total demand for a product by all consumers. Total demand is the sum of all individual buyers' demand. Below we look at one individual buyer's demand curve for gasoline.

Price per Gallon	Total Number of Gallons Purchased Per Month (Quantity Demanded)
$5.00	10
$4.50	15
$4.00	20
$3.50	25
$3.00	30
$2.50	35

A graph of this buyer's demand schedule for gasoline looks like this:



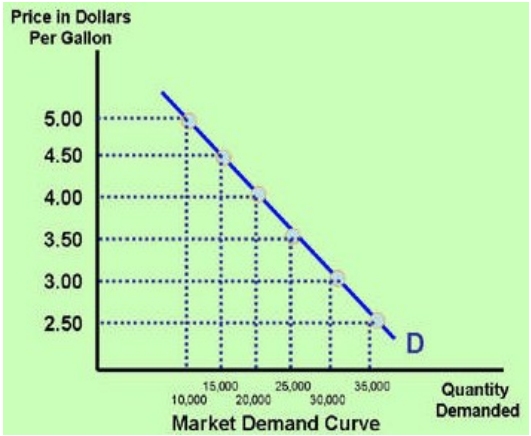
The Market Demand Curve

The market demand curve represents the sum of all the individuals' demand. If there are 1,000 buyers and let's assume for simplicity that they all have the same demand as indicated in the table above, then the demand schedule looks the way it does in the table in this paragraph. You can also plot these points in a diagram and draw the market demand curve.

To arrive at the market demand curve we add every individual buyer's demand schedule. For example, if the market for gasoline consists of 1,000 buyers, then the market demand schedule looks like the following table (for simplicity, we assume that every buyer's demand schedule is identical to the individual in the previous paragraph).

Price per Gallon	Total Number of Gallons Purchased Per Month (Quantity Demanded)
$5.00	10,000
$4.50	15,000
$4.00	20,000
$3.50	25,000
$3.00	30,000
$2.50	35,000

Based on the numbers in the table above, the graph of the market demand schedule for gasoline looks like this:



The Law of Supply

Price and Quantity Changes

On the firms' or the suppliers' side of the market, we have what we call the law of supply. The law of supply states that at high prices, firms will want to supply a lot of the product and vice versa. The reason why they do that is because they can get a high price, assuming that buyers will buy that product at the high price. If they can get the high price, they make more profit, and they have more of an incentive to supply the product. If they can only get a low price for the product in the market, so the market price of the product is very low, then they will not have much of an incentive to produce the product. In fact, if the price is so low that it doesn't even cover the cost of production, then firms may not want to supply anything at all, so that the supply could be zero at one point. The supply curve, therefore, is an upward sloping supply curve, again noticing that at high prices there is a lot of quantity supplied and at low prices there is very little quantity supplied.

The law of supply states that, ceteris paribus, product suppliers offer more of a product at higher than at lower prices. If the product price is high, the supplier can make greater profits by selling more (assuming the cost of production is constant and there is sufficient demand). A video game, for which the demand is high and therefore the price as well, will be supplied at greater quantities because the higher price makes firms willing and able to supply more.

Income and Substitution Effects

Analogous to the substitution and income effects for the law of demand, we have substitution and income effects for the law of supply. The income effect represents the idea that as the price of a product increases, then a firm will earn more income per product. This is like earning more money per hour. This provides the firm an incentive to make more products and make more profits. If a stuffed animal increases in market price, then firms will want to supply more stuffed animals, because they can make more profits. The substitution effect on the supply side states that producers will make more of a product if the price increases, because it is more profitable to make this product compared to other, lower-priced products. If the market price for Grover, the Sesame Street stuffed animal, increases in price, but Big Bird does not increase in price, then suppliers will want to make more Grovers, because they are more attractive and more profitable to make compared to the Big Bird stuffed animals.

Suppliers produce more products at a higher market price (and vice versa) for two reasons. One is the "income effect." The supplier's income effect states that as the market price of a product increases, a supplier will earn more income (make a greater profit). The supplier has more incentive and greater means to

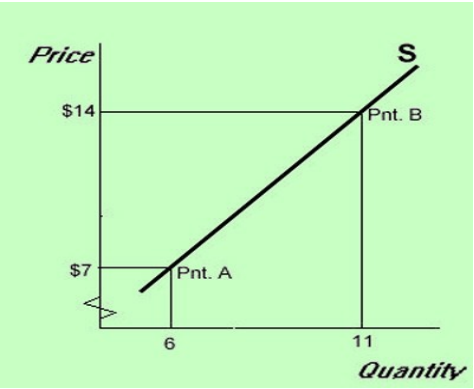
increase production. If a stuffed animal increases in market price, then firms will want to supply more stuffed animals, because they can make more profits and earn more income.

The other effect is the "substitution effect." The supplier's substitution effect states that as the market price of a product increases, other competing products, ceteris paribus, will become less attractive to produce. Suppliers will substitute the higher priced product for the less expensive product (and vice versa). If the market price for Grover, the Sesame Street stuffed animal, increases in price, and Big Bird does not increase in price, then suppliers will want to make more Grovers. They are more attractive and more profitable to make compared to the Big Bird stuffed animals.

Graphing the Supply Curve

The law of supply can also be graphed in a diagram. And we notice that again the price is on the vertical axis and the quantity supplied is on the horizontal axis. With the law of supply, we notice that at low prices, at which point the firm's profits are not very high, there will not be a whole lot of quantity supplied. Whereas at higher prices, which also means that there is more demand for the product, the firm will have more of an incentive to make products because profits are greater there, so that the supply curve is upward sloping from lower left to upper right. Again at low prices, quantity supplied is low, and at high prices, quantity supplied is high.

A supply curve slopes upward from the bottom left to the upper right of the diagram. At higher prices, firms are willing and able to sell more than at lower prices. We say that there is a direct relationship between price and quantity supplied.



The above diagram shows that on supply curve S, suppliers supply 6 units of this product when the price is $7 (point A) and 11 units when the price is $14 (point B).

An Individual Firm's Supply Curve

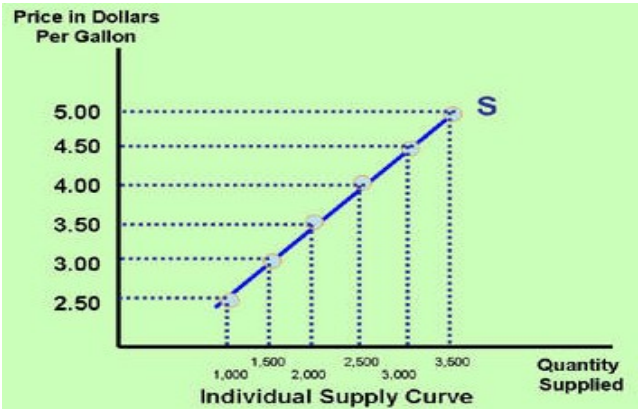
How much gasoline will one firm want to supply at various market prices? The firm in this example will want to produce and supply 3,500 gallons of

gasoline at a price of $5, whereas it would want to only produce and supply 1,000 gallons of gasoline at a price of $2.50.

The graph in the previous paragraph illustrates a product's market supply curve. A market supply curve is the sum of all individual suppliers' supply preferences for that product. Below is an example of one supplier's supply schedule for gasoline. The supplier is willing and able to sell the quantities at the respective prices.

Price per Gallon	(Quantity Supplied)
$5.00	3,500
$4.50	3,000
$4.00	2,500
$3.50	2,000
$3.00	1,500
$2.50	1,000

A graph of this individual supplier's demand schedule for gasoline looks like this:



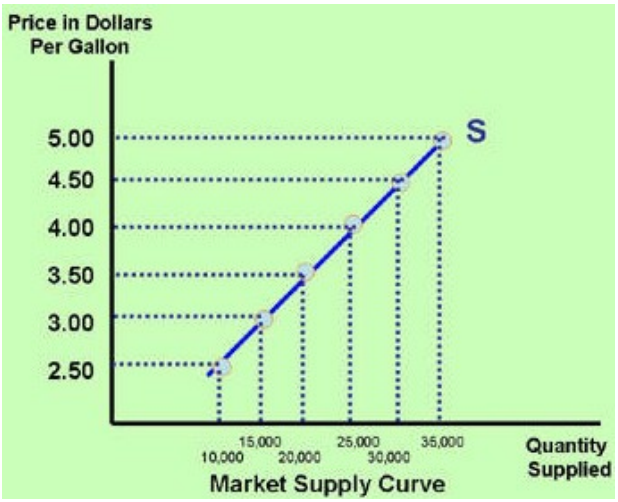
The Market Supply Curve

If we assume that we have 10 identical suppliers, we can add their total supply at each price and come up with the market supply schedule. We can then plot the points and draw the market supply curve.

A supply curve for the entire market of this product is simply the sum of every individual supplier's supply schedule. For example, if the market for gasoline consists of 10 suppliers, then the market supply schedule looks like the following table (for simplicity, we assume that every supplier's supply schedule is identical to the individual supplier in the previous paragraph).

Price per Gallon	(Quantity Demanded)
$5.00	35,000
$4.50	30,000
$4.00	25,000
$3.50	20,000
$3.00	15,000
$2.50	10,000

Based on the numbers in the table above, the graph of the market supply schedule for gasoline looks like this:



4. **Market equity minimum and maximum prices**

Plan

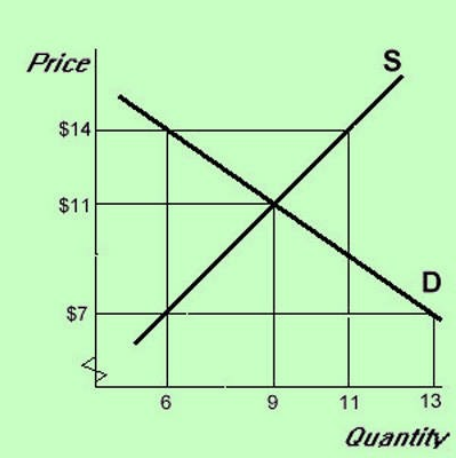
4.1. Market equilibrium. Equilibrium market price and quantity

4.2. Change in market equilibrium and factors influencing it.

4.3. Price ceiling and price floors

The Market Price and Quantity

So we notice the consumers really prefer low prices so that they can buy more of the product, whereas firms would like high prices so that they can profit more. Now what exactly will be the price, then, that is going to be determined in the market if there's that seeming conflict? Is there going to be a low price or a high price? Well if the price is too low, then there's not going to be as much quantity supplied as consumers are wanting to buy. So there would be a shortage. If the price is too high, then the firms are making a lot of the product, thinking they can sell it and make a lot of profits. But there's not a lot of quantity demanded, so there will be a surplus of the product. Either situation is not good, and the price that will be the best price - where the market actually clears so that there's no surplus or shortage - is at the intersection of the two points. We call that the equilibrium price, or the market price. Notice that the market price is actually not a necessarily desirable price; it just merely states that at that particular price the quantity demanded by buyers equals exactly the quantity supplied by firms. It doesn't also mean that the firms are making a profit. That equilibrium price can be very low if consumers are just not wanting to buy the product. Or it could be high and could mean a lot of profits. So the equilibrium price is a fairly neutral determination of what the price is, based on what buyers want and what suppliers are willing to supply.



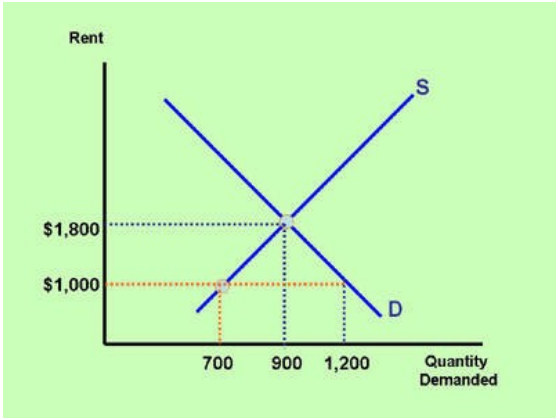
In the graph above, the market is at equilibrium at a price of $11 and a quantity of 9. If the price were set at $7, a shortage of 7 products results. At $7 the quantity demanded is 13 (from $7 go straight over to the demand curve) and the quantity supplied is 6 (from $7 go straight over to the supply curve). Similarly, if the price were set at $14, a surplus of 5 units (11 minus 6) results.

Below are some supply and demand applications, in which we study what happens when the government, instead of the free market, determines the price.

The Case of Rent Control

In the case of rent control, a city government decides to require landlords to charge tenants rent below a certain dollar amount. This is called a price ceiling, because landlords are not allowed to charge a price higher than this amount. Rent control prices, if they are set below the market equilibrium, lead to shortages of the product. In the graph in this section, the market rent is $1,800. This is the rent that landlords can charge, based on market supply and demand. However, the government requires landlords to charge $1,000. At $1,000, the quantity supplied drops to 700, and the quantity demanded increases to 1,200. This results in a shortage of housing units of 1,200 minus 700, or 500.

Rent control is an example of a price set below the equilibrium point. This is called a price ceiling. In the graph below, the equilibrium (market) price of a rental unit is $1,800 per month. The city government wants the rental units priced at no more than $1,000 per month, so that more tenants can afford to live in the inner city. The lower-than-equilibrium rent causes the quantity supplied of rental units to decrease to 700 units, because suppliers have less incentive to build and own rental units at the lower price. The quantity demanded increases to 1,200, because the lower price encourages more buyers. This results in a shortage of 500 rental units (1,200 minus 700).



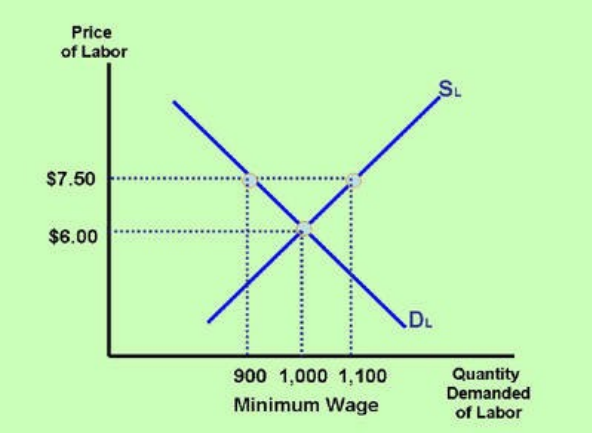
In addition to the shortage, there are other consequences of the government's price ceiling. Landlords have less incentive to maintain the rental properties, because profits are lower due to the decrease in the rent. This usually leads to a deterioration of the rental units. Furthermore, due to the shortage of rental units in the inner city, the demand for properties not subject to rent controls increases. This increases the price of non-rent-controlled properties. Rent control also makes discrimination more likely. Hopefully, landlords don't discriminate when they accept tenants. However, when landlords have a waiting list ofpeople applying for the lower-rent units, landlords who want to

discriminate can more easily do so. At market prices, this is less likely to be the case. As rents are higher, there are no waiting lists, and landlords are more likely to accept tenants based on their ability to pay, rather than on their race, ethnic origin, and lifestyle. Despite these disadvantages, rent controls are still in existence in various big cities around the industrialized world. Politicians often focus on the short-term social benefits of helping the poor, but are not always aware of the long-term economic disadvantages. Furthermore, they receive pressure from tenants, who ask for lower rent and more-affordable housing. Politicians are tempted to oblige tenants' wishes, because there are far more tenants than landlords.

The Case of the Minimum Wage

Let's say that the market wage for a certain type of labour is $6. If the government requires employers to pay at least $7.50, then the quantity supplied of labour increases to 1,100, and the quantity demanded of labour decreases to 900. This leads to a surplus of labour of 1,100 minus 900, or 200. This creates unemployment of 200.

The minimum wage is an example of a price set above the equilibrium point. This is called a price floor. In the graph below, the equilibrium price of labour (the market wage) is $6.00 per hour. The government determines that it wants firms to hire workers at a minimum of $7.50, so that workers can earn more money per hour and better afford their daily expenditures. The higher-than-equilibrium wage causes the quantity supplied of labour to increase to 1,100 workers, because workers have more incentive to work at a higher wage. The quantity demanded of labour decreases to 900 workers, because the higher wage discourages firms from hiring workers. This results in a surplus of workers (unemployment) of 200 workers (1,100 minus 900).



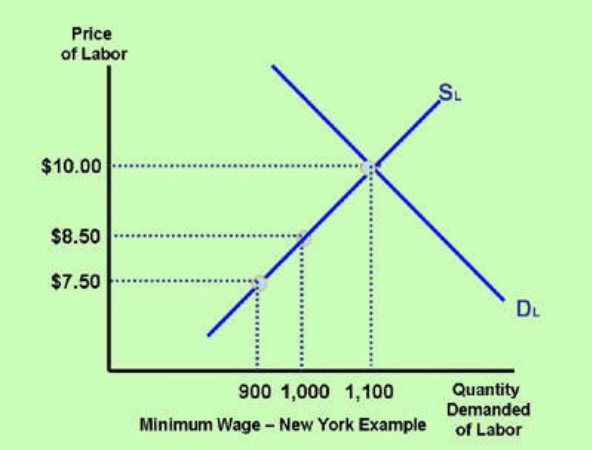
Minimum wage is a hotly debated topic. The graph above predicts that an increase in the minimum wage causes unemployment. Some studies, however, claim that an increase in the minimum wage has no significant effect on unemployment. Both studies can be correct, depending on the market

conditions. Below is an example of a case study in which the minimum wage increases, but there is no effect on employment or unemployment.

The Case when the Market Wage is above the Minimum Wage

In some areas of our country (for example, New York), the market wage is already very high. If the minimum wage is set at $7.50, and let's say that the government increases the minimum wage to $8.50, what happens? The answer is: not much. Because the minimum wage is below the market wage, even after the increase, employers will continue to pay higher wages, merely because of the fact that the market wage is already higher. The minimum wage in this case is ineffective and irrelevant. If the minimum wage were to increase above the market wage, then it would have an effect on the quantity demanded and quantity supplied. So as you can see, a change in minimum wage can or cannot have an effect on employment and unemployment, but it depends on where the minimum wage is relative to the market wage.

Let's say that the equilibrium (market) wage in the New York metropolitan area for a certain type of worker is $10.00 per hour (see graph below). If the state government of New York raises the minimum wage from $7.50 to $8.50, the minimum wage will still be below the market wage. Therefore, there is no effect of an increase in the minimum wage on employment.



The Case when the Market Wage is below the Minimum Wage

If in another state the equilibrium (market) wage is $4.50 per hour, and the state government increases the minimum wage to $6.50 per hour, then businesses are required to pay many workers more per hour compared to what they were paying at the market wage. This will increase the incomes of workers who are able to keep their jobs. And it will lead to unemployment of workers, because the higher wage decreases the quantity demanded of labour and increases the quantity supplied.

Critically Analyzing Minimum Wage Studies

As you can see, the effect of an increase in the minimum wage differs, depending on whether the market wage is above or below the minimum wage.

Another reason for discrepancies in studies on the minimum wage is that employment definitions vary. Economists Card and Krueger concluded in their study on the minimum wage that after the minimum wage increased in New Jersey, employment actually rose. The measure of employment they used was "the number of jobs held by people." However, another measure of employment, which they did not use, is "the number of hours worked by people." Using the latter definition, employment decreased. To illustrate this difference, consider the following example.

Let's say that as a result of an increase in the minimum wage, the number of full-time jobs decreases by 400, and the number of part-time jobs increases by 500. This can be expected as businesses, faced with a higher wage, decide to replace full-time workers with part-time workers in order to save money on benefits and reduce the total hours worked. Assuming that full-time workers work a 40-hour week, and part-time workers work a 20-hour week, the total number of hours worked declines by 16,000 (400 workers times 40) hours, and increases by 10,000 (500 times 20) hours. On balance, the numbers of hours worked decreases by 6,000. However, the total number of jobs increases by 100. Measuring employment by the total number of jobs (this is how our nation's unemployment rate is calculated and this is the definition Card and Krueger used) is deceiving, though.

Demand Determinants

Reasons for a Shift in the Demand Curve

At the equilibrium (or market) price, there are no shortages and no surpluses. We say that at this price the market clears. Does this price ever change over time? Of course, as we know, equilibrium prices change all the time. Prices of gasoline, cars, houses, and food products increase or decrease frequently. What makes those changes happen? The answer is, well, demand or supply changes, or both change. This means that the curves shifts either to the right or to the left, and the equilibrium point at the intersection of those two curves will also change. This is what makes the equilibrium prices as well as the equilibrium quantities change over time. Section 8 of this Unit discusses reasons why supply changes. This section shows us the determinants or the reasons why demand changes; in other words, why the demand curve shifts to the right, or to the left (respectively, a shift to the right, and a shift to the left of the demand curve). For example, if your income increases, you will probably buy more of some products. In this case, we say that the demand for the product goes up, and the demand curve shifts to the right. In the short run this results in higher prices and higher quantities bought and sold at equilibrium.

Demand can increase or decrease. In this case, the demand curve shifts to the right or to the left, respectively. The following are reasons:

1. A change in buyers' real incomes or wealth.

When buyers' incomes change, we distinguish between two products: normal products and inferior products.

The demand for a normal product increases if buyers experience an increase in real incomes or wealth. If buyers' real incomes increase, they can afford to purchase more electronic devices, clothes, food, and other products. Consequently, the demand for these products increases.

However, some products may experience a decrease in demand as buyers' real incomes increase. These products are called inferior products. A person who is forced to eat macaroni and cheese each day on a minimal budget may choose to buy steak when her/his income increases. This means that the demand for macaroni and cheese decreases as this buyer's income increases. In this case, macaroni and cheese is considered an inferior product, and steak is considered a normal product. Another example of an inferior product is public transportation. Typically, as buyers' incomes increase, the demand for public transportation decreases (and vice versa).

2. Buyers' tastes and preferences.

As a product becomes more fashionable or useful, its demand increases. DVD rentals, cell phone features, fat-free mayonnaise and ice cream, online products, and virtual reality games have gained in popularity and have experienced increases in demand. As some products gain in popularity, others lose. The demand for these products decreases.

3. The prices of related products or services.

Consider the market for potato chips. The demand for it will go down (assuming no other changes) if the price of a related good, for example, pretzels, decreases. Potato chips and pretzels are so-called substitutes. If the price of a substitute decreases, then the demand for the other product decreases (and vice versa). A related good can also be a complementary product. This is a product consumed not in place of, but along with, another product. A decrease in the price of potato chips increases the demand for potato chip dip. If the price of a complementary product decreases, the demand for the other product increases (and vice versa).

4. Buyers' expectations of the product's future price.

If a supermarket announces that toilet paper will become more expensive in the near future, more people will buy the product now (and vice versa). This increases current demand, and shifts the demand curve to the right. This will have the eventual effect of actually increasing the real price in the short run (an

increase in demand increases the price). It is a self-fulfilling expectation, a common phenomenon in economics.

5. Buyers' expectations of their future income.

When buyers expect their income to increase, they will increase their demand for normal products and decrease their demand for inferior products. Many people anticipate their future increased (or decreased) incomes by changing their consumption habits now.

6. The number of buyers (population).

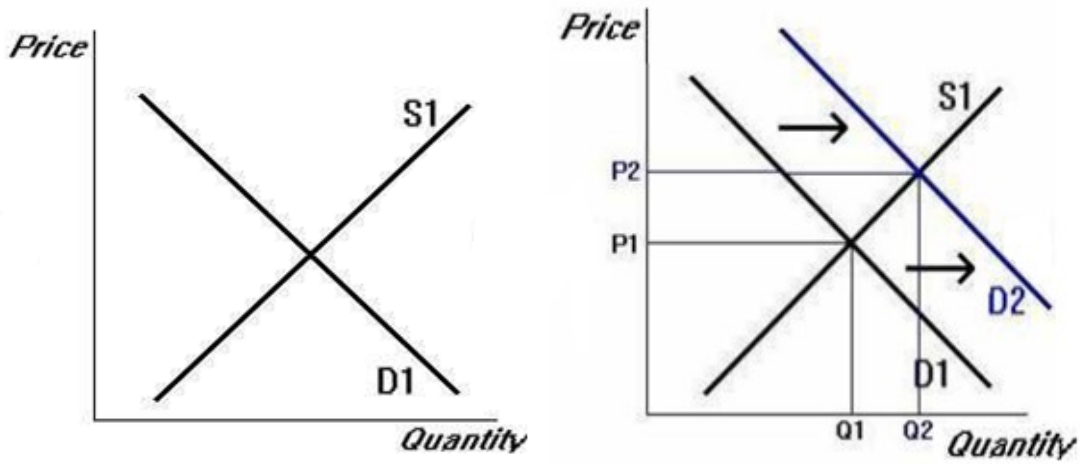
If the population of buyers of a certain product increases, we experience an increase in the demand for that product. With the aging of the Baby Boomers we can anticipate a rise in the demand for products that senior citizens typically purchase (insurance, health care, travel, nursing care). If we experience another baby boom, the demand for baby products will increase.

The Effect of a Change in Demand on Equilibrium Price and Quantity

An Increase in Demand

In the short run, as people demand more of a product (which is graphed as a rightward shift in the demand curve), we will find that the equilibrium or market price of the product will increase. The equilibrium quantity will go up as well. If there is less demand for the product (which is a leftward shift in the demand curve), both the equilibrium or market price and equilibrium quantity will go down.

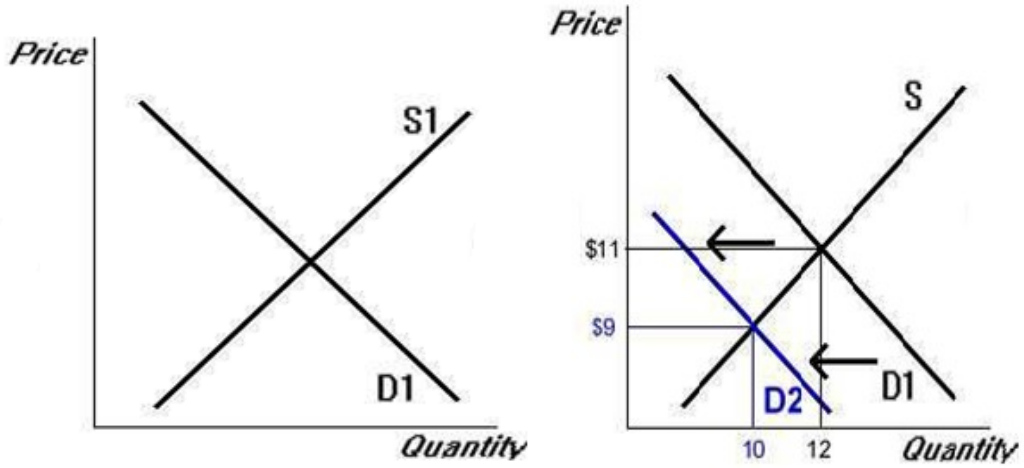
Demand changes for any of the six reasons listed in the previous section. Below you see what happens to the equilibrium price and quantity (the intersection of the curves) when demand increases.



When the demand curve shifts to the right, demand increases. The market price increases, as does the equilibrium quantity (in the short run).

A Decrease in Demand

Below you see what happens to the equilibrium price and quantity (the intersection of the curves) when demand decreases.



When the demand curve shifts to the left, equilibrium price and quantity decreases (in the short run).

Supply Determinants

Reasons for a Shift in the Supply Curve

The market price of a product may also change because of changes that take place on the supply side of the market. There are four determinants listed here on this section. The first - advance in technology - usually means that it's cheaper and more efficient to make the product. This leads to an increase in supply and will lead to a lowering of the equilibrium price. Inputs to prices include labour , raw materials, capital equipment, and machinery. If they become cheaper to buy for the company, it also leads to an increase in the supply, and, eventually a lowering of the price and vice versa. Taxes can go up, the government can increase taxes on the production, or it can impose additional regulations, which also make it more expensive to make the product, and that would lower the supply and vice versa. Subsidies will do the opposite. You can also have an increase in the number of firms, which will increase the supply, and vice versa.

Supply can increase or decrease. In this case, the supply curve shifts to the right or to the left respectively. The following are reasons:

1. An advance in technology.

An advance in the technology of making the product will lower the cost of producing it. This means that the firm increases its profits, and it has more incentive to increase its supply.

2. A change in the price of an input used to make the product.

When the price of an input, such as labour , raw materials, machinery, or land, decreases, the firm makes more profit per product and is willing and able to increase the supply of the product (and vice versa).

3. A change in taxes, subsidies, or regulations.

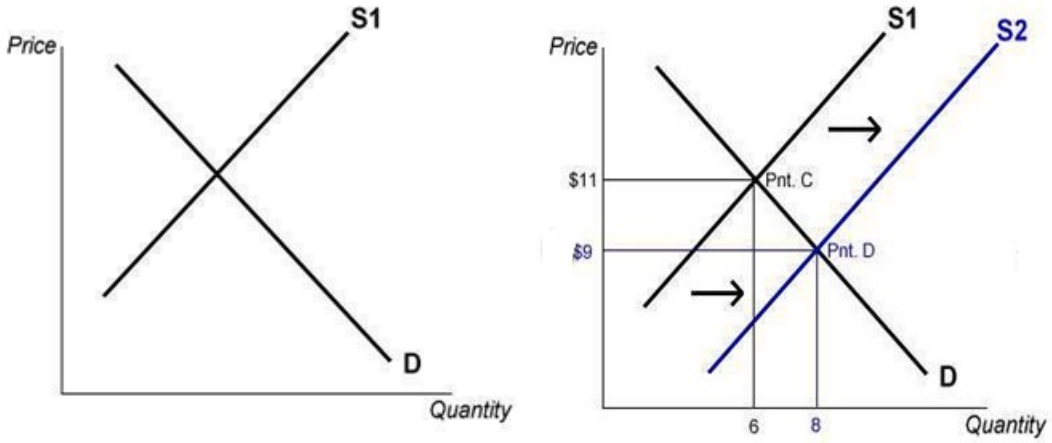
Taxing or imposing additional regulations on the manufacturing of a product lowers the supply, because the total cost of making the product increases. A subsidy, a government grant to a business or individual, or a reduction in regulations increases supply. Public schools, community colleges, and public universities receive subsidies from local and state governments. These additional funds allow schools to supply more courses and hire more teachers and professors than would be the case if they did not receive government funds.

4. The number of suppliers.

When more firms decide to enter the market, the supply of the product increases (and vice versa). In some industries, the number of suppliers is controlled by industry agencies, which require licenses, permits, diplomas, etc. The American Medical Association sets strict requirements regarding the entry of doctors into the industry. This safeguards a certain level of quality and protects consumers, but also restricts the number of suppliers, and keeps doctors' prices higher than otherwise would be the case. These changes shift the supply curve (see next section). A shift in the supply curve is called an increase in supply (not quantity supplied).

The Effect of a Change in Supply on Equilibrium Price and Quantity

An Increase in Supply Demand changes for any of the four reasons listed in the previous section. Below you can see what happens to the equilibrium price and quantity (the intersection of the curves) when supply increases.

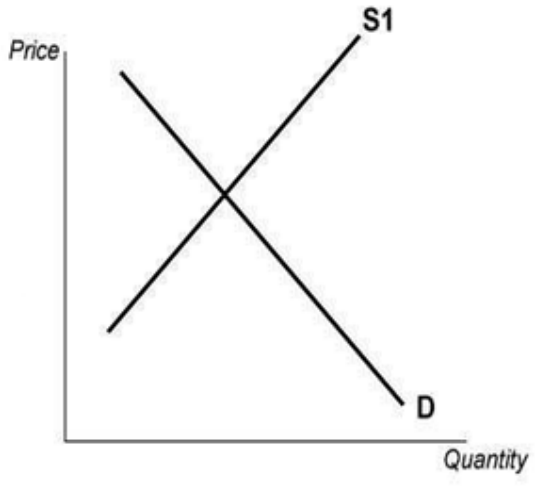


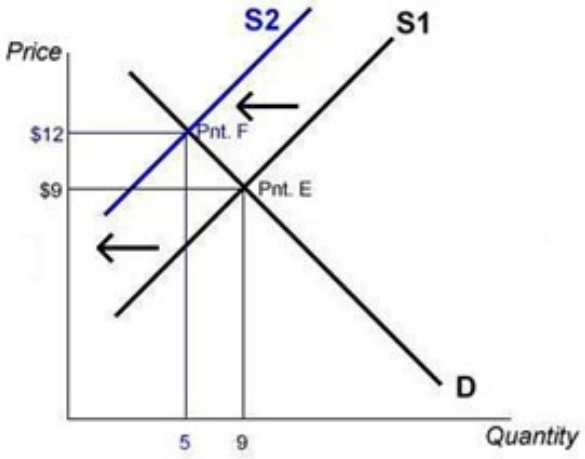
Let’s take a look at shifts in the supply curve. The reasons for the shifts were discussed in the previous section. If we have an increase in supply, it is illustrated by a rightward shift in the supply curve. This actually looks like the curve is going to go down a little bit. But it’s a rightward shift, indicating higher quantity, and that is an increase in supply, which leads to a lowering of the market price and an increase in the equilibrium quantity. When supply

decreases, the curve shifts to the left, which actually looks like it's going up a little bit, but it's a leftward shift. In other words, it's a decrease in supply, and this will increase the market price and lower the equilibrium quantity.

An increase in supply is illustrated by a rightward (or downward) shift of the supply curve. This decreases the price and increases the quantity sold.

A Decrease in Supply Below you can see what happens to the equilibrium price and quantity (the intersection of the curves) when supply decreases.





A decrease in supply is illustrated by a leftward (or upward) shift of the supply curve. This increases the price and decreases the quantity sold.

The Effect of Changes in Both Demand and Supply on Equilibrium Price and Quantity A Simultaneous Increase in Demand and Supply

From the previous sections, we know that an increase in demand increases equilibrium price and quantity (and vice versa), and an increase in supply decreases equilibrium price and increases quantity (and vice versa). What happens if both demand and supply change at the same time?

Let's analyze the following examples.

Here's an example of two determinants, one demand determinant and one supply determinant changing. See if you can figure out what would happen to the market price and equilibrium quantity of this particular product when incomes rise, and the technology to make this particular product improves. The answer is in the next paragraph.

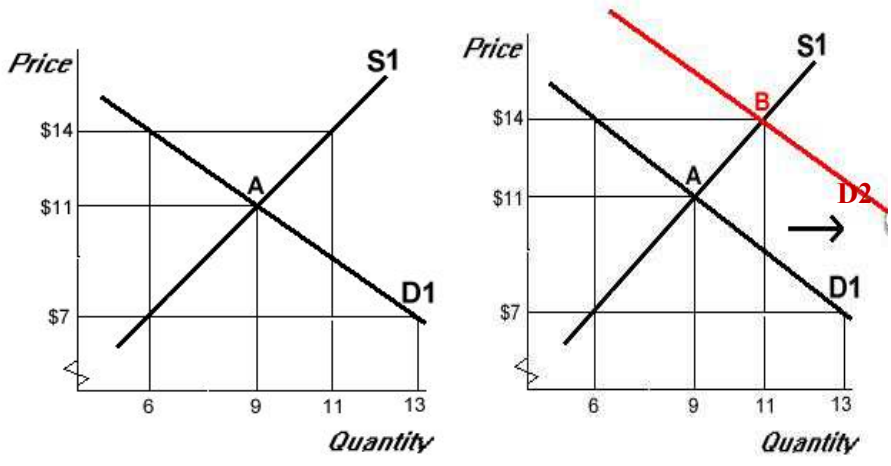
Example 1

Problem: Suppose that you know that consumers' incomes have gone up, and that an advance in technology has lowered the cost of making computers. Assuming that a computer is a normal good, what will happen to the equilibrium price and quantity of computers as a result of these two simultaneous changes?

If your answer is that the equilibrium quantity - in other words, the amount bought and sold at equilibrium - is increasing, and the market price is

indeterminate, you are correct. The increase in incomes means that the demand will increase. We are assuming here that we are looking at a normal product, such as a car, a house, clothing, or a VCR, as opposed to an inferior product. An inferior product would be one for which the demand increases as incomes go down, and vice versa. Generic brand products, or public transportation would be ones where if incomes go up - in other words, when people become wealthier - they would buy fewer of these cheaper substitutes. In this case, as demand increases, we will find that the price of the product increases the market price, and the equilibrium quantity increases, as well. The second indicated change, the advance in technology means that it's cheaper for the company to make the product and, therefore, it will supply more. This increase in supply will lower the market price and will raise the equilibrium quantity. As you combine the two effects - in other words, the increase in demand which leads to higher prices and higher quantities and the increase in supply leading to lower prices and higher quantities - we will conclude that the equilibrium quantity will definitely go up because it goes up in both instances. But the price is unknown. In one case it goes up, in the other case it goes down. We don't know the exact magnitude of the increase or decrease, so we say that the change in the market price is indeterminate (unknown).

Solution: An increase in consumers' incomes increases the demand for computers (click next in the diagram below; D shifts to the right). An advance in technology increases the supply (click next again; S shifts to the right). Consequently, the equilibrium quantity increases because the equilibrium quantity increases in both instances. The market price will either increase, decrease, or stay the same, depending on the size of the shifts in the curves. If demand increases more than supply, then the price increases, and vice versa. If we don't know the magnitude of the shifts, we say that the price is indeterminate.

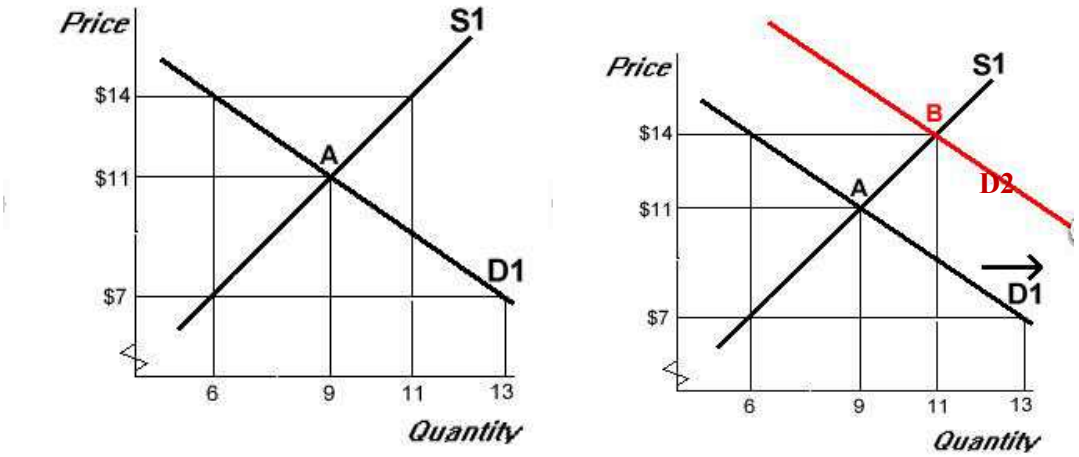


The higher anticipated price of videotapes increases the current demand for videotapes. Consumers prefer to buy more tapes now rather than later, when the price is higher. The demand for videotapes increases and, therefore, in the graph, D1 moves to the right to D2. The higher government tax increases the cost of producing videotapes and this makes it less attractive to produce tapes and decreases the supply. S1 moves to the left to S2. The combined effect of the two changes is that equilibrium price increases and equilibrium quantity is indeterminate.

Example 2

Problem: Buyers expect videotape prices to increase in the near future, and at the same time, the government decides to tax the production of videotapes. What effect does this have on the market price and output of videotapes?

Solution: Current demand increases because buyers expect the price to increase in the future. Supply decreases because the increased tax makes it less attractive for firms to supply the product. Therefore, the price of videotapes increases, and the equilibrium quantity is indeterminate. When both demand and supply shift, one variable (price or quantity) experiences a definite change, and the other is indeterminate (unless you know the magnitude of the shifts). When only one curve shifts, both equilibrium price and quantity experience a definite change.



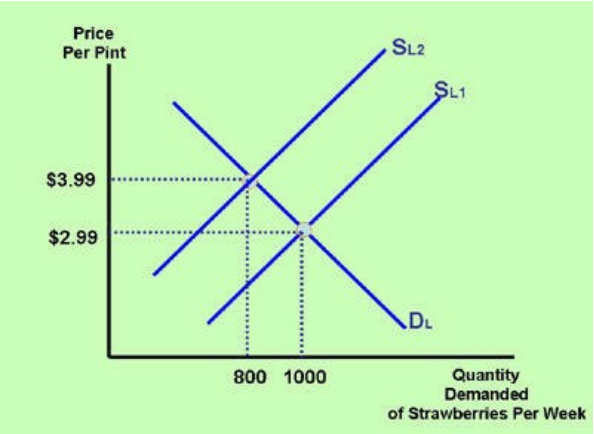
Let's take a look at the difference between demand and quantity demanded. They sound alike, but have a different meaning. The difference has to do with the reason why people buy more or less of a product. What makes buyers buy more of a particular product? As we have seen, one obvious one is that if a price goes down, people will buy more of it. This is the law of demand. And we say that if buyers buy more of a product because the price of the product itself goes down, there is an increase in quantity demanded. Because this is the law of

demand, we notice that as a result of the law of demand, we graph the demand curve downward sloping. We move along the demand curve from a higher price to a lower price and from a lower quantity to a higher quantity purchased. But there are other reasons why people will buy more of a product. For example, when buyers' incomes rise, the amount purchased goes up, as well. Or when buyers' tastes or preferences or prices of related products change, we may also see an increase in the demand for the product. Notice that we do not call this an increase in quantity demanded. By definition, quantity demanded only changes when the price of the product itself changes, and demand changes when one of the demand determinants, such as incomes or tastes and preferences or prices of related goods, changes. The demand change is accompanied by a shift in the entire demand curve, whereas a quantity demand change is always graphed as a movement along the demand curve. When either the demand or quantity demanded increases, the amount that people buy goes up. So in terms of that, the effect is the same. But the reason why this happens is different, and that's why we give it a different name. The reason why demand increases again is because of one of those five determinants indicated in a previous section. The reasons why quantity demanded increases is because the product price itself changes, which is graphed by a movement along the curve.

We learned in an earlier section that as the price of a product increases, the amount purchased by buyers decreases. This is the law of demand. In a more recent section, we noticed that as demand increases, the price of a product increases. When you look at these two statements together, it may appear confusing and contradictory. However, the two statements are both valid. It is merely a matter of what causes what, and which is the cause and which is the effect. To understand the difference more clearly, we need to study the difference between demand and quantity demanded.

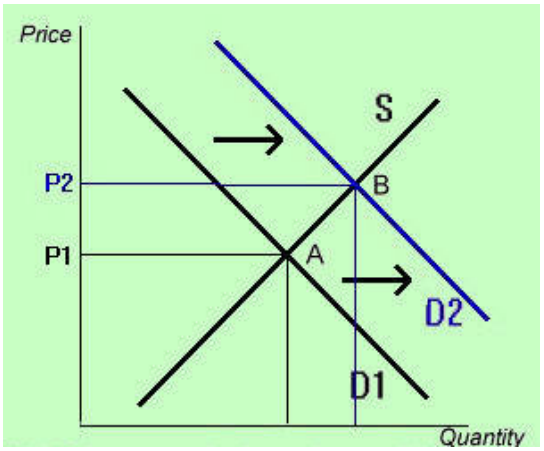
Quantity Demanded

If the market price of a product decreases, then the quantity demanded increases, and vice versa. For example, when the price of strawberries decreases (when they are in season and the supply is higher; see graph below), then more people will purchases strawberries (the quantity demanded increases). A quantity demanded change is illustrated in a graph by a movement along the demand curve.



When one or more of the six demand determinants listed in Section 6 changes, then demand changes. For example, when buyers' incomes increase, the demand (not quantity demanded) for a normal product increases. Or when the price of a substitute product decreases, then the demand for the product in question decreases. Or when the number of buyers increases, the demand increases, and the price of the product increases. An increase in demand is illustrated in a graph by a rightward shift in the demand curve.

The following graph illustrates an increase in demand:



In the graph above, demand increases as D1 shifts to D2. Quantity supplied increases in the above case as the equilibrium point shifts along the supply curve from point A to point B.

The Difference Between Supply and Quantity Supplied

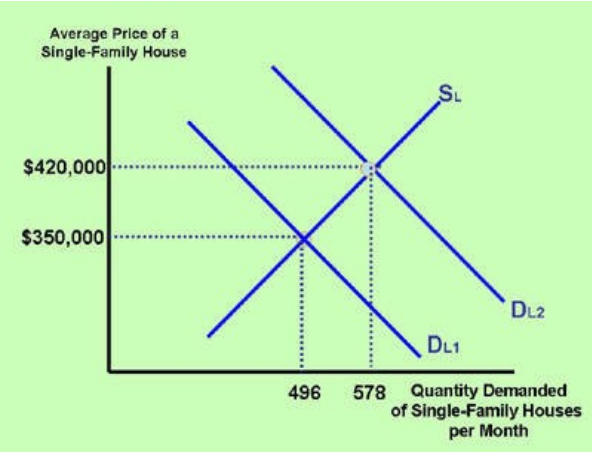
Supply and quantity supplied work the same way as demand and quantity demanded. When quantity supplied increases, it's because of the price of the product itself. So, for example, when the price increases, then the quantity supplied of the product goes up. This is a movement along the supply curve. Supply, on the other hand, increases or decreases because of a change in one of those four supply determinants described in a previous section. When supply changes, the entire supply curve shifts either to the right (increase) or to the left (decrease). The distinction between supply and quantity supply, again, is as a

result of the different reasons why the amount that firms supply changes. When quantity supplied changes, the reason is that the price of the product goes up. When supply changes, the reason is that one of the four supply determinants changes, for example, technology or prices of inputs and so forth.

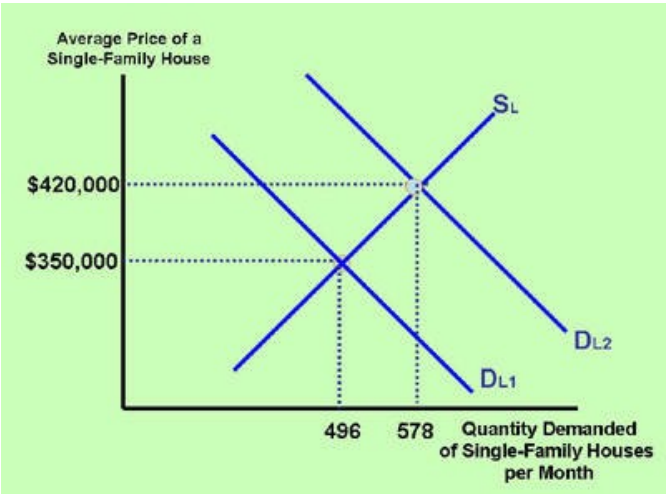
The distinction between supply and quantity supplied is similar to the difference between demand and quantity demanded.

Quantity Supplied

If the market price of a product increases, then the quantity supplied increases, and vice versa. For example, when housing prices increase (when the demand for houses has been strong), then more people will want to sell their house (quantity supplied increases). A quantity supplied change is illustrated in a graph by a movement along the supply curve.



Supply When one or more of the four supply determinants listed in Section 8 changes, then supply changes. For example, when technology advances, or the cost of production decreases, supply increases. An increase in supply is illustrated in a graph by a rightward shift in the supply curve. The following graph illustrates an increase in supply and an increase in quantity demanded.



The above diagram illustrates that supply increases as S1 shifts to S2, and quantity demanded increases as the equilibrium point shifts along the demand curve from point A to point B.

Price Changes in the Short Run and in the Long Run

Categories of Products

Prices of some categories of goods increase in the long run as demand rises, while others do not. Here we distinguish between products that are in limited supply, such as land, labour , raw materials, and sports and performance event tickets, and manufactured products, or ones that are in nearly unlimited supply in the long run. The latter category of products includes products such as grocery items, clothes, cars, and electronic products.

Products in Limited Supply

We have seen that as demand increases, the price of that product or service will increase. This is especially true for products that are of limited supply, for example, land, labour , collectible items, antiques, Superbowl tickets, and so forth. Usually when the demand for a product increases, the supply responds by increasing as well. However, for limited supply products, if the demand for those items increases, the supply cannot go up, and the price will rise will remain high as long as the demand remains high even in the long run.

In the long run, prices of products that are in limited supply fluctuate much more with changes in demand than products that are in abundant supply. Examples of limited supply goods and services include land, labour , natural resources such as oil, gas and minerals, tickets to major sporting events (the Superbowl), and products supplied by a monopoly.

If, for example, the demand for land in a certain area rises because of increased population and increased housing activity, the price of the land will increase. Because the supply of land is limited, the price of the land can remain high for a long period of time as long as the demand remains high.

Products supplied by a monopoly are limited because the firm may be the sole owner of a resource, or the firm may have a patent, a license, or other government approval to be the only supplier. The limited supply (if the demand is high) will cause the price of the product or service to be high.

Manufactured Products

Prices of manufactured products, such as DVD players, computers, cars, cell phones, and so forth, will also rise as demand rises. But assuming there is competition to make these products (which is realistic in most industries in industrialized countries), the high price will not be sustained in the long run. The higher price means higher profits for the company. High profits attract competing firms, and also gives existing firms more of an incentive to make

more of the products. So this will increase the supply in the market and bring the price back down in the long run. Exorbitantly high profits will really never be able to be sustained in competitive markets. Because it always brings in competition, additional firms, and the increase in supply will bring the price back down. So we can conclude that prices of manufactured goods are always near the cost of production plus a fair allowance of profits. No exorbitant profits exist.

Prices of products in abundant supply, or so-called manufactured products (except those produced by a monopoly), generally do not remain high in the long run. For example, let's take a look at the price of cheese. When the demand for cheese increases, the price increases in the short run. A higher price of cheese means that profits for the suppliers will be higher, assuming that the cost of production remains constant. If the profits to produce and sell cheese exceed the average level of profits in other industries, more entrepreneurs (more cheese suppliers) will enter the industry. This increases supply and brings the price back down in the long run. Thus, in the long run the price will settle at a level where profits are normal or average and not excessive.

Prices of manufactured products are set such that they merely cover the cost of production, plus a fair (not excessive) allowance for a profit.

The Free Market System and Externalities

The Free Market

The free market economy means that prices of goods and services, but also interest rates for currency exchange values and so forth, are determined by supply and demand. In a pure capitalist economy, no prices are controlled or determined by a government. In a mixed economy such as the one we have here in the United States, we have a combination of prices being determined by supply and demand and the government controlling prices. An economy in which all prices, wages, and interest rates are controlled by a government is called a command economy.

In a free market economy, prices of goods and services, wages, interest rates, and foreign exchange values are determined by supply and demand. There is no interference from a government in the form of price controls, labour laws, or other regulations affecting the market price of the product. A free market is economically efficient and generally leads to high standards of living. The following are specific advantages of a free market system.

Advantages of a Free Market System

In a free market economy, we say that goods and services are produced and priced according to the true needs of buyers. If people have a true need for a product, they will increase the demand for that product. Higher demand leads to

a higher price, a higher price leads to greater profits for the firms, and, therefore, the firms will supply more of the product. Through this mechanism, the needs and wants and desires of consumers are always satisfied. If a government sets a price, it's possible that we may be producing products that are not valued as much, or that are not priced properly. If prices are set by the government above the equilibrium, we would have a surplus, or if it's below the equilibrium, we would have a shortage. In the free market, in the long run, we would never have shortages and surpluses and we would have minimal waste of resources and products. Economists call this maximum economic efficiency.

1. Products are priced at their true worth.

The most important advantage of a free market system is that products are priced at their true "worth." The product's true worth is based on how much buyers and sellers value the product. This is reflected in the demand and supply of the product. Free market prices provide sellers with the greatest incentive to produce, and it ensures efficient production. Producers are always looking for the lowest cost and most efficient means to produce. It also provides consumers with the greatest purchasing value, as only those products are produced that consumers value. The demand for a resource (for example, labour) is based on how much businesses value the worker, which in turn is based on how much consumers value the product. The supply is based on the availability and cost of resources to make the product. The supply of labour is based on how much workers value the income from their work relative to the time sacrifice they are willing and able to make. If a certain occupation's income is high, consumers must be valuing the product highly, and subsequently, a worker has a greater incentive to enter the occupation. This responsiveness in the price system is what maximizes total economic value in society.

2. Greater incentives to work and a higher standard of living.

A free market with relatively low taxation encourages people to work hard and innovate. This profit incentive provides competition and entrepreneurship. Entrepreneurship leads to creation of jobs and production of products, which raise people's standards of living. Countries that have limited government interference in the free market have shown to be the most productive. The standard of living in politically and economically free, or mostly free, countries is the highest in the world, and poverty measured in absolute standard of living is the lowest.

3. Greater freedom.

A free market allows people the freedom to choose their occupation and the products they can afford to buy. Countries that encourage free markets and discourage economic and social discrimination allow for greater degrees of

income mobility. People have opportunities and the freedom to improve their economic positions through innovation and hard work. Even poor immigrants who come to the country with nothing but their own courage and determination often succeed and work their way up the economic ladder.

Disadvantages of a Free Market System

The role of the government is essential, even (or better yet, especially) in a purely capitalist economy. An economic system in which a government is non-existent brings about disadvantages, called externalities. Externalities can be positive or negative. An example of a negative externality is pollution. Let's say that a farmer produces wheat, but he uses a lot of fertilizer and pollutes nearby lakes and streams. If the farmer dumps these chemicals in these waters without any consequences, then there is no cost to the farmer. However, there is a cost to society, and especially the people living near these waters. Because the farmer bears no cost when it comes to dumping these chemicals, the price of the wheat does not reflect the cost of the pollution. To correct this, most economists agree that it is reasonable for a government to impose a fine, or fee, or some kind of financial cost to the farmer for polluting the environment. This way, the cost of the dumping of the chemicals is reflected in the price of the product. The government can then use the fine or fee money to help clean up the environment. An externality can also be positive. Health care is an example of a positive externality. When people are healthy, it helps not only the healthy person, but also society in general (especially if this person can avoid a contagious disease). Because of the benefits to society, most economists agree that a government should subsidize activities such as health care. Other examples of positive externalities include education and public transportation.

There are several disadvantages of a free market system, including the existence of

1. Income inequality.

In a free market system, a significant degree of income inequality is common. Workers who are more productive and innovative earn a higher income than workers who are less productive and innovative. Most people do not like too much income inequality. Governments correct income inequalities by imposing higher taxes on higher-income households, and by providing subsidies and government handouts to lower-income households. Despite government handouts, some products are priced beyond what lower income households can afford. If products are essential for survival (food, housing, medicine), and the government feels that some households cannot afford them, it may impose price ceilings. Price ceilings are prices below the equilibrium in the market.

2. Externalities.

Externalities are benefits or costs that are generated apart from the benefits or costs related to the trade itself. An externality can be positive or negative. An example of a negative externality is pollution caused by a factory. If a factory pollutes, the polluted area and its residents will suffer. This imposes a cost on the residents, even though the residents may not be direct parties to the trade of the product produced by the factory. Since this cost is not reflected in the price of the product, governments often impose pollution fees or taxes. These funds can then be used to clean up the polluted area or subsidize the expense associated with the pollution cost. Examples of positive externalities are health care services, education and training. When doctors, hospitals and community health organizations provide services (for example, inoculations) to keep people healthy, it also benefits people who are not using the health services. When fewer people get sick, especially contagiously, fewer other people get sick, too. In other words, even people not purchasing health services benefit from health services. Consequently, governments feel justified to collect taxes from everyone (since everyone benefits) and subsidize health services. Education and training similarly benefit society in general, as relatives, friends, and businesses benefit from the increased knowledge of the trained individual (assuming this person interacts with these members of society).

3. Public goods and the free rider problem.

The free rider problem is the phenomenon that public goods, such as public schools, roads, highways, parks, police, fire and military protection, are free. This means that there is no additional cost for an individual citizen when she or he uses one more unit of this good or service, other than the taxes we pay. But taxes are spread over a large number of people, so the marginal cost of using one more unit of a public good is very small. There is, therefore, a tendency for people to over-consume public goods, because the marginal benefit of an individual using the public good is greater than the marginal cost. For society as a whole, the marginal cost may well exceed the marginal benefit, however. Some economists, therefore, consider the idea that a government has to provide public goods a necessary evil. It would be better and more economically efficient if a private company provided the good. But it doesn't make sense for some goods (such as roads, highways, policy, fire and military protection) to be provided by private companies. Therefore, the government, albeit not as efficient as the private sector, must provide them.

Public goods are goods and services provided by the government without a direct charge to the user of the good. Examples of publics goods are public education, public transportation, public roads, bridges, highways, defense, a

legal system, and police and fire protection. In general, it is difficult or undesirable for these goods to be provided by private businesses. Defense, for example, has to be provided by a government because it is difficult to charge individuals for this service. Thus, the private sector may under-allocate resources relative to our needs in the case of public goods.

The problem with publicly provided goods is that some people contribute very little or nothing to the revenue (taxes) that the government collects. This means that they get to use the service for free, without any cost. This is called the free rider problem. Even for people who contribute taxes, their marginal cost of the service is less than their marginal benefit. Let's take a look at public transportation, for example. If public transportation were to charge each user the actual cost of the service, it may charge, for example, $3 per ride. People will use the service as long as the benefit of each ride exceeds the marginal cost of each ride ($3). However, if the government decides that the cost of public transportation will be borne by society and not by each individual user, the following will happen. Each ride still costs the government $3. If there are 200 riders, the total cost to the government is $600. Let's say that there are 6,000 taxpayers contributing to the funds to pay for public transportation. This means that each taxpayer contributes an average of $0.10 to pay for public transportation.

If we increase the number of riders from 200 to 201, the total cost to the government increases by $3. As the cost is borne by 6,000 taxpayers, the marginal cost for each tax-paying citizen is only $0.10. For most riders the marginal benefit of using public transportation is greater than $0.10, so the tendency is for users to over-consume this product, as long as the government continues to not charge for individual use of the public transportation. This free rider phenomenon is typical of all publicly provided goods, and is a disadvantage because it leads to overconsumption and ineffiency. For this reason, most economists support private production, as long as individuals can be charged for the service separately. Defense, police, and fire protection, by nature, must be publicly provided. Banking, insurance, and retirement plan services, for example, can be privately provided. Many of these services are, indeed, provided by the private sector. However, some are not. Some economists would like to see government unemployment insurance programs (Unemployment Compensation), government banking insurance programs (the Federal Insurance Deposit Corporation), and government retirement systems (Social Security) be replaced by private companies. Even the provision of roads and highways can, in the future, be provided by private companies, as new and less-expensive computer scanning equipment becomes available.

Free Market Interferences

When a government interferes with the workings of the free market, inefficiencies in the market occur in the form of shortages, surpluses, misallocations of resources, malinvestments, and business losses. From an economic point of view, this is harmful.

Price Ceilings

A price ceiling is a price below the free market price. Let's say a product's equilibrium price is $10 and the government requires manufacturers to sell the product for $8. Consumers prefer buying the product at this lower price. However, producers, faced with lower revenue, will have much less incentive to make the product. Some may produce the product with cheaper ingredients and at a lower quality to try to bring the cost down to less than $8. Other manufacturers will stop producing the product. A shortage of the product likely results.

Price Floors

A price floor is a price above the free market price. Sometimes governments require the price of a product to be higher than the market price. Government do this to help suppliers. If the market price is $10, and the government establishes it at $14, then producers have an incentive to produce more. They will experience higher profits per product. However, the higher price turns away consumers. Consequently, less of the product will be sold in the market, and surpluses result.

The government's purpose for interfering with market prices is to remedy social problems, such as poverty and homelessness. Economic evidence shows that this interference is usually accompanied by other, sometimes more severe, problems in the long run.

Rent Control

In the case of rent control in large cities, the government requires landlords to keep the rent of their apartments and houses below the free market level. The result is that it becomes unprofitable for many landlords to invest in property or build additional properties. The rent that the government allows is not worth the landlord's expenses and investments. Furthermore, it is more attractive for builders and landlords to invest in areas in which there is no rent control. Consequently, the supply of properties in the rent-controlled area decreases and shortages occur. The tenants who rent at the government-controlled price may feel fortunate at first. However, the property will suffer from poor maintenance because the landlords have no incentive to invest money in it and because there is a long waiting list of tenants. Rent control also prevents thousands of people

from acquiring anything at all because the artificially low rent discourages potential builders from building additional dwellings.

Correcting Income Inequalities

The government narrows income inequalities by imposing high taxes on the wealthy and providing government handouts to the poor. By doing this, the government runs the risk of taking away incentives for workers to be productive. If a productive worker and a non-productive worker receive the same rewards (after taxes and government handouts), why work hard?

Taxation

Given that some functions of government are essential to the effective operation of our economy, it is essential that government collects at least some taxes. It also seems fair that high-income earners contribute more to the government than low-income earners. However, a government is wise to ensure that more-productive workers are rewarded appropriately for their efforts. If a government redistributes incomes too much by levying high rates of taxation, people lose the incentive to innovate, produce, work hard, and create jobs. Too much redistribution of incomes leads to a decrease in a country's standard of living, as has been evident in the failing economies of past and current communist nations.

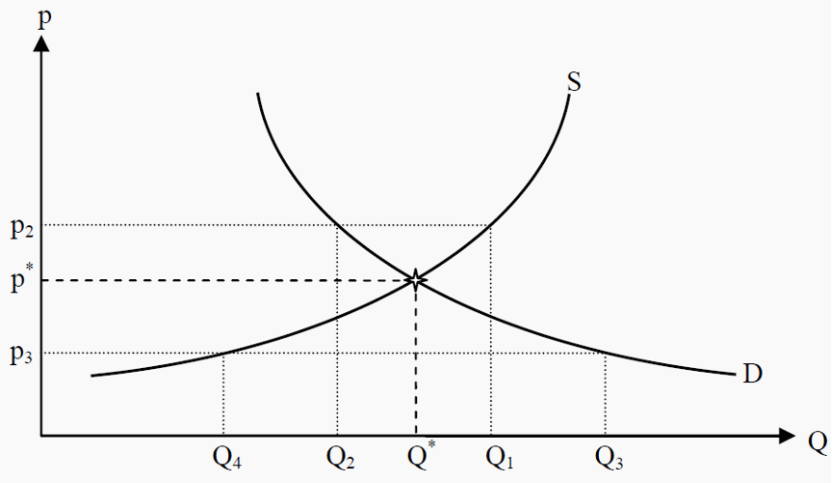
A market is in **equilibrium** when both of these conditions are fulfilled:

1. No agent wants to change her decision or strategy.
2. The decisions of all agents are compatible with each other, so that they can all be carried out simultaneously.

Equilibrium: A situation in which no agent wants to change her decision and all decisions are compatible.

If we join the supply and demand curves in one diagram, we get an equilibrium point where the two curves intersect. At this point, the price the consumers are willing to pay is the same as the price the producers demand. In Figure 2.3, the **equilibrium price** (market-clearing price) is p^* and the **equilibrium quantity** is Q^*.

Equilibrium price: The price that arises when there is an equilibrium in the market. **Equilibrium quantity**: The quantity that is bought and sold when there is an equilibrium in the market.



Equilibrium

The equilibrium point has two important properties in that it is most often (but not always) stable and self-correcting. That it is stable means that, if the market is in equilibrium there is no tendency to move away from it. That it is self-correcting means that, if the market is not in equilibrium then there is a tendency to move towards it.

To see more clearly what this means, suppose the price is higher than in equilibrium, e.g. that it is *p2*. At that price, producers are willing to supply the quantity *Q1* whereas the consumers are only willing to buy the quantity *Q2*. Therefore, there is an excess supply of the good. To get rid of the extra units the producers are prepared to lower the price. This will push the price downwards, closer to *p**. At *p**, there is no excess supply and the downward push on the price ends.

Then assume, instead, that the price is lower than *p**, e.g. that it is *p3*. At this price, the consumers demand the quantity *Q3* whereas the producers are only willing to supply the quantity *Q4*. Consequently, there will be a shortage of the good, and the consumers will be prepared to bid up the price to get more units. This will tend to push the price upwards, closer to *p** where, again, the push will end.

How to Find the Equilibrium Point Mathematically

Supply and demand can be written as mathematical functions, and in simple examples, they are often straight lines. They could, for instance, be:

$$\begin{cases} Qs=85+30p \\ QD=185-20p \end{cases}$$

Here, *QD* is the quantity demanded, *QS* is the quantity supplied, and *p* is the price.

We now want to find the price, *p**, that makes *QD* = *QS*. If the left-hand sides above are equal, the right-hand sides must also be so. Therefore, substitute *p** for *p* and set the right-hand sides equal to each other:

85+30p*=185-20p*

To get p^* alone on the left-hand side, we add 20 p^* on both sides and subtract 85 from both sides. Then we have that

50p*=100

Dividing by 50 on both sides yields the result that

P*=2

If we then want to know the equilibrium quantity, Q^*, we substitute the result we got for p^* into either the supply or the demand function above. (Note that they must yield the same quantity, since p^*, by definition, is the price that makes $QD = QS$.)

$$\begin{cases} Q^*s=85+30p^*=85+30*2=145 \\ Q^*= Q^*D=185-20p^*=185-20*2=145 \end{cases}$$

Consequently, we have the equilibrium price, $p^* = 2$, and the equilibrium quantity, $Q^* = 145$.

Price and Quantity Regulations

Many markets are, for a number of reasons, **regulated**. **Regulation**: Laws that influence prices and/or quantities in a market. The government could for instance decide about prices that the market is not allowed to go above or below, or about maximum quantities. Such regulations will benefit certain groups of people, but often have unintended negative side effects. These are often called **secondary effects**. **Secondary effect**: An unintended side effect of, for instance, a law.

Minimum Prices

Minimum prices (also called **price floors**) are often used for wages (the price of labour) and for certain types of goods such as agricultural goods. The minimum price is usually chosen above the equilibrium price, as in the opposite case it would not have any effect. (The market participants would then choose p^* instead.) Consumers and producers are consequently prevented from reaching the equilibrium price p^*.

Minimum price/price floor: The lowest price a regulation allows

Look at Figure The effect of the minimum price is that the consumers only demand the quantity *Q2* whereas the producers supply the quantity *Q1*. Therefore, we get an excess supply of the good.

Note that consumers and producers are allowed to buy and sell at any price above the minimum price. A price higher then *pmin* will however result in an even larger excess supply, so typically the minimum price is chosen.

The situation described is not an equilibrium. To see that, note that point 2 in the definition of an equilibrium (see Section 2.3) is not satisfied: Given the price *Pmin* producers want to sell the quantity *Q1*, but that is not possible since the consumers only want to buy the quantity *Q2*.

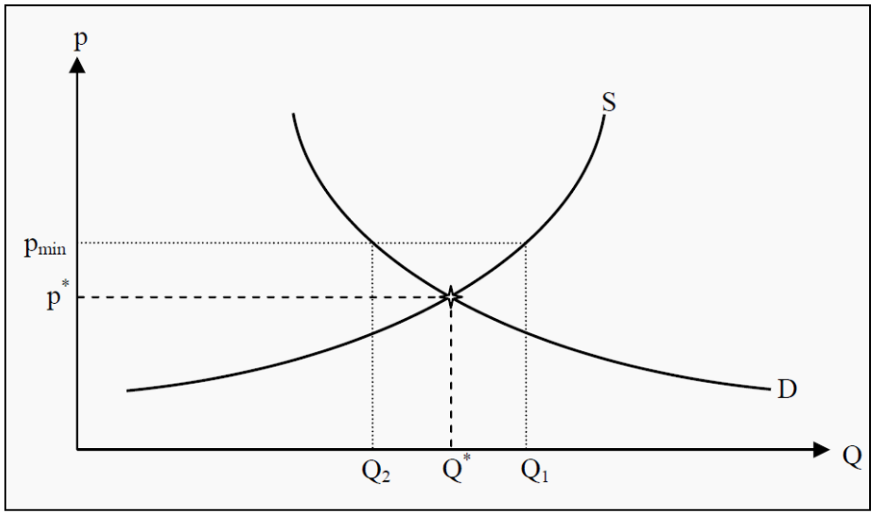
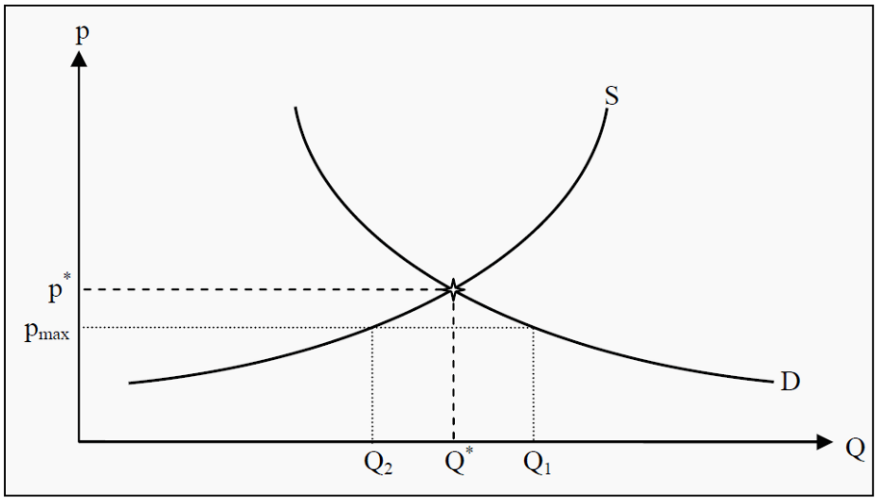


Figure The Effect of a Minimum Price

Maximum Prices

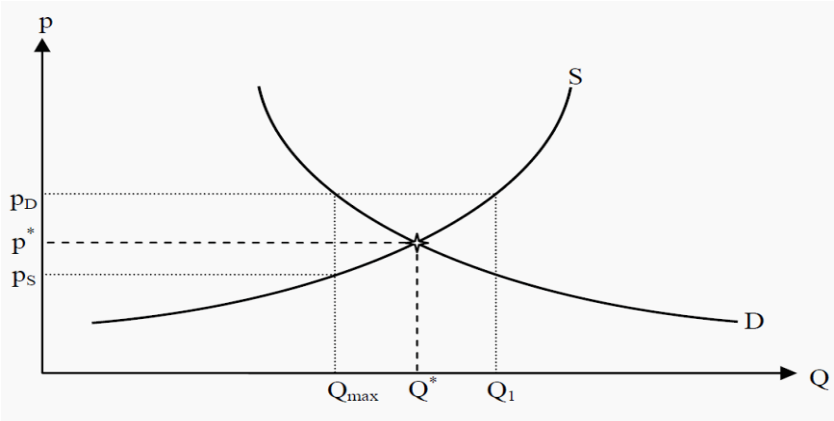
Maximum prices (also called **price ceilings**) are in several countries used for apartment rentals. **Maximum price/price ceiling**: The highest price a regulation allows. For a maximum price to have any effect, it has to be below the equilibrium price, and the effects are the opposite to those of a minimum price. In Figure 2.5, *pmax* is the maximum price. It causes the consumers to demand the quantity *Q1* whereas the producers only want to supply *Q2*, and, consequently, there is a shortage. A typical consequence of a maximum price is that the search time to find an appropriate good is increased since the supply is too small to meet the demand.



The Effect of a Maximum Price

Quantity Regulations

The effects of quantity regulations are similar to those of price regulations. Assume for instance that there is a restriction stating that one may only import the quantity *Qmax* of a certain good, say Asian textiles.



The Effect of a Quantity Regulation

Producers would have been willing to supply the quantity Q_{max} at a price of p_S, whereas the consumers would have been willing to buy that quantity at a price of *PD*. Since the quantity is not allowed to increase, there is excess demand at all prices other than p_D. When there is excess demand, consumers are likely to bid up the price, so the price that this market is likely to arrive at is p_D.

Note that at the price p_D, producers are willing to supply a much larger quantity, *Q1*, but that they are prevented from doing so by the regulation. The consumers have to pay a price that is larger than the equilibrium price (p_D instead of p*) and they get fewer units of the good, so they typically are made worse off by a quantity regulation.

5.Demand and supply elasticity

Plan

5.1. Definition of elasticity, types of elasticity, why we need to calculate it.
5.2. The price elasticity of demand, and other types of demand elasticises
5.2. The price elasticity of supply, and other types of supply elasticises

In previous unit we learned that if the price of a product increases, the amount demanded decreases. But how much does it decrease? The "how much" describes the concept of price elasticity of demand. If the price of a product increases and the amount demanded decreases by a lot, then the product is elastic. If it decreases by a little bit, or not at all, then the product is inelastic.

Different products have different elasticities, and different people have different elasticities. Businesses use the various elasticities of people and products to make better decisions about how to maximize their profits. For example, airlines often charge more to business travelers than to tourists, because business travelers have lower price elasticities of demand. Airlines attempt to distinguish between business travelers and tourists by placing restrictions (for example, Saturday stay required) on when and how long people can fly for certain fares. Governments can also use elasticity in determining the amount of tax on a product. There are high taxes on low-elasticity products such as gasoline and cigarettes, because raising taxes on gasoline or cigarettes is expected to not significantly affect the amount of these products demanded.

This unit will also discuss other types of elasticities, such as income elasticity of demand, cross price elasticity of demand, and price elasticity of supply

Demand Curves and Elasticity

Price Elasticity of Demand

In the last unit, we talked about the law of demand, which stated that as the price of a product increases, the amount purchased by consumers goes down, and vice versa. But we don't know how much the amount purchased goes up or down. This is what elasticity will tell us. High values for elasticity will tell us that buyers are very responsive to price increases or decreases. Low values for elasticity means that buyers are not very responsive to a price change - in other words, they will buy about the same, whether the price goes up or down.

Price elasticity of demand measures the responsiveness of buyers to a price change. If the price of gasoline increases by 10%, how will this affect the amount of gasoline purchased? Will the amount purchased decrease by more than 10%? Will the amount purchased decrease by less than 10%? Will the amount purchased decrease by exactly 10%? Or will the amount purchased not change at all? Once we know the price elasticity of demand, we can answer these questions, because price elasticity of demand measures the relationship between the percentage change in the amount purchased and the percentage change in the price.

To calculate price elasticity of demand, we need to have price and quantity demanded data. A demand schedule and its corresponding demand curve give us the data. How do we know the location and shape of a product's demand curve?

The Derivation of a Demand Curve

Economists who estimate the shape and the location of a product's demand curve, usually look at the following:

Historical data.

Price and quantity data show how consumers have responded to past changes in the price and quantity demanded of the product. Price and quantity demanded changes must be looked at in isolation of other variables. Prices may change, but so may other variables, such as buyers' incomes and prices of related products. It is, therefore, important to estimate price and quantity demanded changes assuming other variables remain constant (ceteris paribus).

Surveys.

You can simply ask consumers how they would respond to a future change in the price of the product. This may not always be accurate, because consumers don't always know in advance how they will respond to a price change. However, data from surveys allow economists to estimate the location and slope of a demand curve. When we know the location and the slope (the angle) of a product's demand curve, we can determine its price elasticity of demand.

The Formula for Price Elasticity of Demand

Price elasticity of demand is defined as the percentage change in the quantity demanded divided by the percentage change in the price. To compute a percentage change in economics, we take the change divided by the average of the two amounts. For example, if we change from 6 to 4, the percentage change is 2 (the difference) divided by 5 (the average). So price elasticity can be expressed as the difference in the quantities demanded divided by the average of the two quantities demanded, all this divided by the difference in the price, divided by the average of the two prices.

The law of demand states that as the price of a product decreases, quantity demanded increases, and vice versa. Elasticity measures how much less people buy of that product when the price rises, and vice versa.

We calculate price elasticity of demand by looking at the ratio of e = The percentage change in quantity demanded divided by the percentage change in the price of the product Or abbreviated:

$$e = \frac{\%\ \textbf{change in Q}}{\%\ \textbf{change in P}}$$

Where:

1. The % change in Q = the change in quantity demanded / the average of the two quantities demanded.

And:

2. The % change in P = the change in price / the average of the two prices.

Note that the above formula for calculating percentages is called the "arc" formula. There are other ways to calculate percentages, but the arc formula is the most accurate and most commonly used in economics.

Examples of how to Use the Formula for Price Elasticity of Demand

Let's look at several examples to see how to use the formula in the previous paragraph.

Example 1

Problem: Let's say that a department store sells pillows, and that in a typical week, buyers purchase 6 pillows when the price is $21. After the department store decreases its price to $19, it observes that buyers now purchase 10 pillows per week. Given these changes, what is the price elasticity of demand for the department store's pillows?

Solution: Remember that e = (the change in quantity demanded / the average of the two quantities demanded) / (the change in the price / the average of the two prices).

The change in the quantity demanded is 10 pillows minus 6 pillows, or 4. The average of these quantities is 8 (the sum of the two quantities (6 plus 10) divided by 2).

The change in the prices is $21 minus $19, or $2. The average of the two prices is $20 (the sum of the two prices ($19 + $21) divided by 2).

Therefore:

e = ((10 - 6) /8) / (($21 - $19) / $20) = (4 / 8) / ($2 / $20) = (.5) / (.1) = 5.

Therefore, the price elasticity of demand for the above product is 5.

The 5 means that the percentage change in the amount purchased is 5 times greater than the percentage change in the price. In other words, buyers are very sensitive to this price change. When the pillows decreased in price, buyers

responded strongly. The price decreased by only 10% (.1), but the amount purchased increased by 50% (.5).

Officially, the above number is -5 (negative 5), because the price decreased, while the quantity purchased increased. Because price elasticity of demand is always a negative number, economists leave out the negative sign, and express price elasticity of demand as its positive, or absolute, value.

Example 2

The numerator part of the formula states that we need to calculate the change in quantity demanded. The quantity demanded changes from 700 to 800, so the change is 100. We divide this by the average of the two quantities, which is 750. So the numerator part of the elasticity formula is 100 divided by 750. The denominator part is the percentage change in the price. So we have to take the change in the price = $1 (because the price changes from $2 to $3), divided by the average price = $2.50. So the denominator part is $1 divided by $2.50 = .133.

Problem: A grocery store observes that at $2/gallon, buyers purchase 800 gallons of milk per day. At $3/gallon, buyers purchase 700 gallon of milk per day. What is the price elasticity of demand for milk?

Solution:

1. The change in quantity demanded = 100
2. The average quantity demanded = 750
3. The change in price = $1
4. The average price = $2.50
5. So, e = (100 / 750) / ($1 / $2.50) = (.133) / (.4)= .3325

So the price elasticity of demand for milk given the above data is .3325. This means that if milk increases in price by 40% (.4), then the quantity demanded of milk decreases by 13.3% (.133). Relatively speaking, buyers are not very sensitive to a price change.

Example 3

Problem: A movie theatre observes that at $6 per movie ticket, 1,800 people attend the movie each week. At $4.80 per movie ticket, 2,600 people attend the movie each week. What is the price elasticity of demand for movie tickets?

Solution:

e = (800 / 2,200) / ($1.20 / $5.40)

= (.3636) / (.2222)

= 1.636

Example 4

Problem: Let's compute the price elasticity of demand for concert tickets. Suppose that for a concert, the price of a ticket is $15 and 25,000 people are in attendance. For another, nearly identical concert, the organizers charge $17 and 24,000 fans attend. What is the price elasticity of demand for concert tickets?

Solution: Using the formula for price elasticity of demand, we get

e = (1,000 / 24,500) / ($2 / $16) = (.0408) / (.125) = .3264

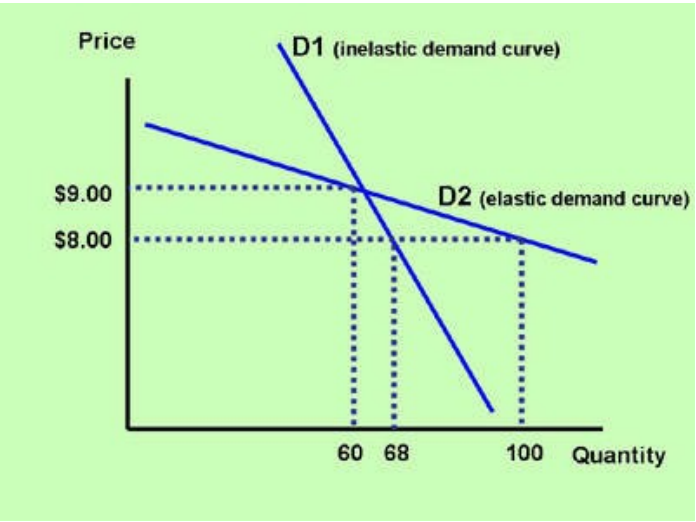
So the elasticity in this example is .33 (rounded), or 33%. This means that when concert tickets increase in price by 12.5% (.125), we can expect 4.08% (.0408) fewer people to attend. So when the price increases by 100%, then we can expect 33% fewer people to purchase tickets (assuming the price elasticity remains constant over that range).

Elasticity and the Slope of the Demand Curve

Demand Curves and Elasticity

A flat demand curve is usually associated with a product which is elastic. There is a relatively big change in the quantity demanded as a result of a relatively small change in the price. A steep demand curve is usually associated with a product, which is inelastic. There is a relatively small change in the quantity demanded as a result of a change in the price.

Elasticity affects the slope of a product's demand curve. A greater slope means a steeper demand curve and a less-elastic product. In the graph below, the steeper demand curve, D1, shows a change in quantity demanded of 8 products (from 60 to 68) when the price changes by one dollar (from $9 to $8). The flatter demand curve, D2, shows a change in quantity demanded of 40 products (from 60 to 100) when the price changes by $1 (from $9 to $8). Clearly, the flatter demand curve shows a much greater quantity demanded response to a price change. Therefore, it is more elastic.



Perfect Elasticity and Perfect Inelasticity

A perfectly elastic demand curve is a straight horizontal line. There is only demand at one price. There is no demand if the price increases or decreases. This represents an infinitely large change in quantity demanded as a result of a small price change. A perfectly inelastic demand curve is a straight vertical line. Buyers are willing to buy the same amount no matter what the price. Medicine, which someone needs to survive, is an example. The buyer is willing to buy the product, no matter what the price.

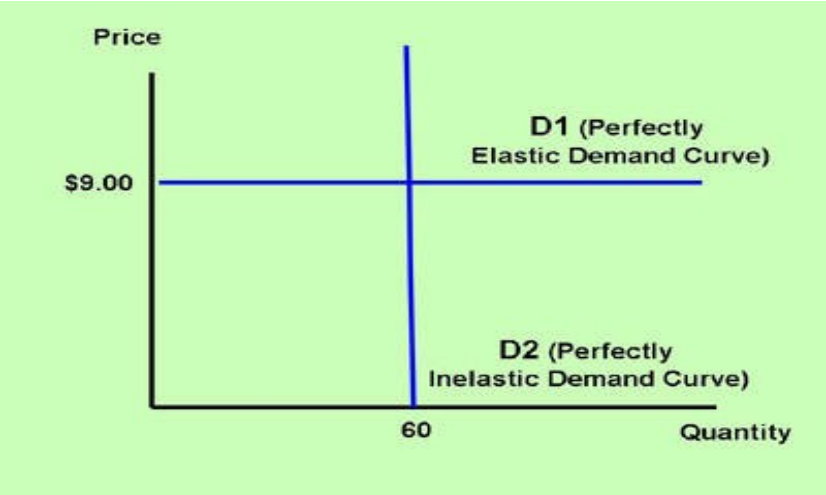
Perfect elasticity is when a product's price changes and the quantity demanded changes to zero. In the graph below, if the demand curve is D1 (perfect elasticity), buyers only buy the product at $9. They buy nothing at any other price.

Perfect inelasticity is when buyers purchase a certain quantity (60 in the graph below), regardless of the price. They buy 60 products at $1 or $2 or $100 or any other price.

Perfect elasticity and perfect inelasticity are two extremes. No product is perfectly elastic or perfectly inelastic. However, some products come close. A medicine that is the difference between life and death is close to perfectly inelastic. If their lives depend on it, buyers are willing to pay just about anything to get it.

No industry in today's world is truly perfectly competitive. But if we study the concept of perfect competition, we can visualize an industry which has thousands of firms. Consumers have the choice of going to company A, or B, or C, and so forth. In other words, there are quite a few substitutes available, and, therefore, the product is very elastic. In fact, we say in a perfectly competitive industry, the product is perfectly elastic. When graphing a demand curve, the more elastic a product is, the flatter the demand curve becomes. In fact, if it is perfectly elastic, the demand curve is horizontal.

A product that has many substitutes comes close to being perfectly elastic. A farmer, who sells grain competes with other farmers selling the same product. Grain from farmer A is nearly identical to grain from 100 or more other grain farmers. Therefore, if farmer A raises her/his price above the market price (for example, $9), then buyers will purchase zero products from farmer A (assuming the other farmers keep their price at $9). The farmer also cannot lower her/his price, because it would lower her/his profits to a level where (s) (s)he would go out of business. Thus, the farmer faces a horizontal demand curve and a market-controlled equilibrium price.



Determinants of Price Elasticity of Demand

Elasticity Determinants

Some products are very elastic - in other words, people are very responsive or sensitive to price changes. Other products or services are not very elastic. What does this depend on? We have three categories which are important in the determination of price elasticity. One is the availability of close substitutes. The more substitutes a product has, the greater is the price elasticity. For example, there is a lot of competition between Internet providers, such as Comcast, Verizon, etc. If, for example, Comcast increases its monthly fee for Internet provision, we would expect that quite a few buyers would now not be interested in the service, or perhaps even cancel their service. Because there is great responsiveness to the price increase for this product, we say that the product is elastic. Also, products which have a significant price tag, such as houses and cars, are generally more elastic. The reason is that if the price of one of these products goes up by, let's say, 5 or 10 percent, then this makes a big difference in the person's spending. People, therefore, are sensitive to the price increase and the product is elastic. On the other hand, a product such as salt is very cheap, and an increase in 5 or 10 percent is barely noticed by the consumer. Therefore, the elasticity is low, and we say that the product is inelastic. Another factor is the period of time under consideration. If, for example, the price of gasoline increases to let's say $5, then we would expect people to drastically cut back on the purchases of gasoline. But this probably wouldn't happen immediately. It takes time for people to make the adjustments to not drive as much. After a while, they may live closer to work, or may choose to live closer to school, start to carpool more, buy a car that is much more fuel efficient, and so forth. In the long run, after a year or so, consumers have much more of a chance to cut back on the consumption of gasoline. We say that gasoline is more elastic in the long run.

Some products are elastic (buyers are price sensitive), and some products are inelastic (buyers are not price sensitive). What makes people more sensitive to one product's price change compared to another product's price change? Some people will choose to not buy a car if its price increases by 10%, but are unaffected by an increase of 10% in the price of a bag of salt.

The three determinants of price elasticity of demand are1. The availability of close substitutes.

If a product has many close substitutes, for example, fast food, then people tend to react strongly to a price increase of one firm's fast food. Thus, the price elasticity of demand of this firm's product is high.

2. The importance of the product's cost in one's budget.

If a product, such as salt, is very inexpensive, consumers are relatively indifferent about a price increase. Therefore, salt has a low price elasticity of demand. Cars are expensive and a 10% increase in the price of a car may make the difference whether people will choose to buy the car or not. Therefore, cars have a higher price elasticity of demand.

3. The period of time under consideration.

Price elasticity of demand is greater if you study the effect of a price increase over a period of two years rather than one week. Over a longer period of time, people have more time to adjust to the price change. If the price of gasoline increases considerably, buyers may not decrease their consumption much after one week. However, after two years, they have the ability to move closer to work or school, arrange carpools, use public transportation, or buy a more fuel-efficient car.

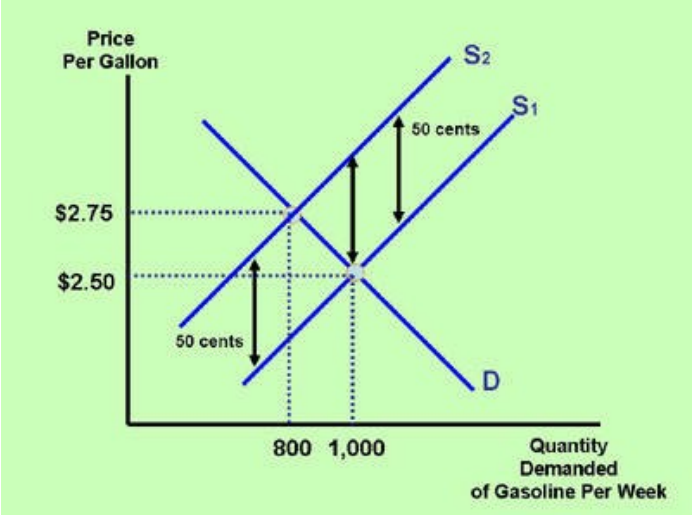
Elasticity and the Effect of a Tax Change on the Price of the Product

Let's say that the government increases the tax on a product by 50 cents. Does this mean that the price of the product will increase by 50 cents? The answer is no. How much will the price increase? This depends on the product's elasticity. In the first graph in this section, the product has an average, 45-degree, downward-sloping demand curve. The product is neither very elastic nor very inelastic. A tax increase of 50 cents means that the supply curve shifts to the left, because the firms' cost of supplying rises by 50 cents. The graph indicates that the market price of the product increases by 25 cents. This means that the burden of the tax is shared equally by the consumers and suppliers. In the graph at the bottom, the product is inelastic. The demand curve is steeper. In this case, the burden of the tax is mostly on the consumers, because the price of the product increases by 45 cents.

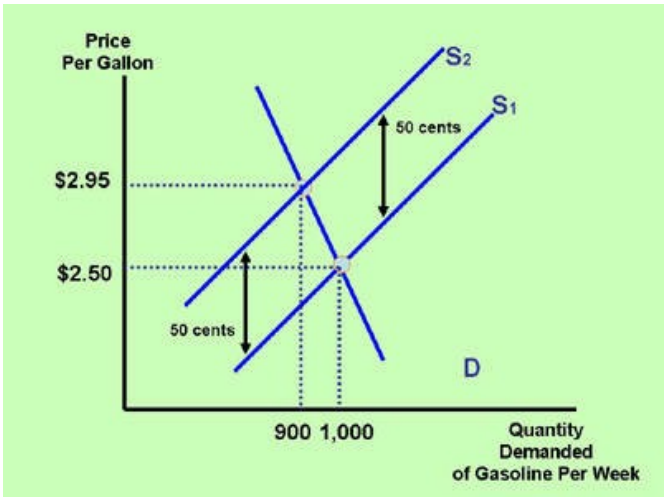
If a government increases the sales tax on a product by 50 cents, does that mean that the equilibrium price of the product will increase by 50 cents? The

answer is no. Typically, the equilibrium price will increase less than 50 cents. How much it will increase depends on the product's elasticity. Let's take a look at an example.

Let's assume that a state government increases the tax on gasoline by 50 cents. This means that the cost of supplying the gasoline increases by 50 cents. In the graph below, the supply curve shifts leftward. Note that the vertical difference between supply curve S1 and supply curve S2 is 50 cents (the increase in the cost of supplying the gasoline). The equilibrium price, however, did not increase by 50 cents, because the demand curve is sloped at an angle. The burden of any tax is typically shared between consumers and suppliers. In the graph below, the tax is shared equally as the price increases by 25 cents.



In the graph below, the demand curve is steeper than the demand curve in the graph above. This means that the product is less elastic. Consequently, most of the burden of the tax is born by the consumers. In general, for less-elastic products (steeper demand curves), the burden of the tax is mostly on the consumers. For more-elastic products (flatter demand curves), the burden of the tax is mostly on the suppliers.



Elasticity and Total Revenue

Definition of Elastic, Inelastic, and Unit Elastic Demand

A product is considered elastic when its elasticity is greater than 1. This is when the percentage change in the quantity demanded is greater than the percentage change in the price. In plain English, it means that buyers are relatively sensitive to a price change. In other words, when the price changes, buyers will change their quantity demanded of the product significantly. A product is considered inelastic when its elasticity is less than 1. This means that the percentage change in quantity demanded is less than the percentage change in the price. And a product is considered unit elastic when the elasticity is equal to 1. This means that the percentage change in quantity demanded is equal to the percentage change in the price.

By definition:

1. A product is elastic when its elasticity is greater than 1.

When a product is elastic and its price changes, the percentage change in quantity demanded is greater than the percentage change in the price. For example, if buyers purchase 20% fewer products as a result of a 10% price increase, then the product is elastic.

2. A product is inelastic when its elasticity is less than 1.

The numerator (percentage change in quantity demanded) of the elasticity formula is less than the denominator (percentage change in price). For example, if buyers purchase 6% fewer products as a result of a 15% price increase, then the product is inelastic.

3. A product is unit elastic when its elasticity is equal to 1.

If a product's price rises by 8% and its quantity demanded decreases by 8%, then the product is unit elastic.

Elasticity and Revenue

When a product is elastic, and its price rises, what happens to the firm's total revenue?

A firm's total revenue is equal to the number of products it sells times the price of the product. Thus:Total Revenue = Price times Quantity or

$TR = P \times Q$

For example, if a store sells 30 pairs of shoes at $10 each, then its revenue equals 30 times $10, or $300. If the store sells 20 pairs of shoes after the price increases to $25, then its total revenue equals 20 times $25, or $500. Thus, the store's total revenue increases.

In the above example, P (the price) increased, so, therefore, Q (the quantity demanded) decreased, and total revenue increased. Does a price increase always

lead to total revenue increase? The answer is "no". It depends on the product's elasticity. Let's look at the following example.

A supermarket sells 50 oranges at $1 each. Its revenue equals 50 times $1 or $50. If the store sells 20 oranges after the price increases to $2, then its revenue equals 20 times $2, or $40. Thus, the store's revenue decreases.

Elasticity affects a firm’s total revenue. Keep in mind that a firm’s total revenue is calculated by taking the price of the product times the amount of the product sold by the firm. So what happens if a firm sells a product that is elastic and the price increases? Anytime the price of a product increases, we know that consumers will purchase less of the product. So how will this affect total revenue? Well, we know that the price increase will be beneficial to total revenue. On the other hand, the quantity decrease will not help total revenue; it will make total revenue go down. So which effect is greater? Is the percentage change in the price greater, or is the percentage decrease in the quantity greater? Well, if the product is elastic, we know that the numerator of the elasticity value is greater than the denominator. The numerator is the percentage change in quantity and the denominator is the percentage change in the price. We know that if the product is elastic, elasticity is greater than 1; so by definition, the percentage change in the quantity is greater than the percentage change in the price. The quantity was going down, so this will have a negative effect on revenue and, therefore, revenue decreases. See if you can figure out what happens to total revenue in the other three examples.

If a product is elastic, the percentage change in the quantity demanded change is greater than the percentage change in the price. Therefore, for an elastic product, if the price increases, the percentage change in the quantity demanded decreases by a greater amount, and the firm's revenue will decrease, and vice versa.

If a product is inelastic, the percentage change in the quantity demanded change is smaller than the percentage change in the price. Therefore, for an inelastic product, if the price increases, the percentage change in the quantity demanded decreases by a smaller amount, and the firm's revenue will increase, and vice versa.

In summary:

When a product is elastic and its price falls, total revenue increases.

When a product is elastic and its price rises, total revenue decreases.

When a product is inelastic and its price rises, total revenue increases.

When a product is inelastic and its price falls, total revenue decreases.

When a product is unit elastic and its price changes, total revenue remains constant.

Income Elasticity of Demand, Cross Price Elasticity of Demand, and Price Elasticity of Supply

Income Elasticity of Demand

In addition to price elasticity of demand, we can also talk about income elasticity of demand. The concept is very similar, but instead of looking at price changes, we now look at income changes. So, for example, if my income doubles, how many more boxes of cereal or gallons of ice cream or apples will I buy in the grocery store? To calculate income elasticity of demand, you take the percentage change in the quantity demanded divided by the percentage change in incomes. The percentage in quantity demanded is expressed the same way as in one of the previous slides. The percentage change in incomes is simply the change in incomes divided by the average of the two incomes. Income elasticity of demand can either be positive or negative. For a normal good, we expect that if incomes go up, we buy more of that good. For an inferior good, when your income goes up, you can expect that you would buy less of it. An example of an inferior good may be a generic brand product. When your income goes up, you would probably buy fewer generic brand products, so that the income elasticity of demand for that product is negative.

Correspondingly, **income elasticity** (of demand) is the percentage change in demand if income changes one percent:

$$e_m = \frac{\Delta Q / Q}{\Delta m / m}$$

Here, e_m is income elasticity, and m and Δm are income and change in income, respectively. Similarly to price elasticity, goods are grouped depending on their income elasticity:

$e_m < 0$	Inferior goods
$0 < e_m$	Normal goods

$e_m < 0$	Inferior goods
$0 < e_m$	Normal goods

A **normal good** ($0 < em$) is a good one buys more of if income increases. **Normal good**: A good one buys more of if income increases. An **inferior** good ($em < 0$) is a good one buys less of when income increases. **Inferior**: A good one buys less of if income increases. These goods are typically of low quality, and one decreases one's consumption of them as one can afford better quality.

Normal goods are further divided into **necessary goods** and **luxury goods**. **Necessary good**: If income increases, one buys more of it, but not as many percentages more as the increase in income. If income increases with one percent, one buys less than one percent more of a necessary good, but more than one percent more of a luxury good. **Luxury good**: If income increases, one increases consumption by more percentages than the income.

Income elasticity of demand measures the percentage change in a buyer's purchase of a product as a result of a percentage change in her/his income. So income elasticity of demand is

e_i = the percentage change in demand / percentage change in income or

e_i = (change in demand / average demand) / (change in income / average income)

Example 1

If a person decides to buy 20% more bananas because of a 10% income increase, the person's income elasticity of demand for bananas is 20% / 10%, or 2.

Example 2

If a person decides to buy 50% fewer hamburgers because of a 20% income increase, the income elasticity of demand for hamburgers is (-50%) / (+20%), or -2.5. Note that when income elasticity is negative, the product is an "inferior" product. A person may decide to buy fewer hamburgers after an income increase, because the person can now afford to buy steak.

Unlike for price elasticity of demand, we cannot leave off the minus sign for income elasticity of demand, because income elasticity of demand can be either positive (for a normal good), or negative (for an inferior product).

Cross Price Elasticity of Demand

Cross-price elasticity is defined as the percentage change in demand on a good if the price of *another* good changes with one percent:

$$e_{12} = \frac{\Delta Q_1 / Q_1}{\Delta p_2 / p_2}$$

Cross-price elasticity: How sensitive demand is to price changes in another good.

Here, *e12* is the cross-price elasticity between good 1 and good 2; *Q1* and *ΔQ1* are quantity demanded and quantity change for good 1, whereas *p2* and

Δp2 are price and price change on good 2. Again, goods are grouped depending on their cross-price elasticity:

$e_{12} < 0$	Complementary goods
$e_{12} = 0$	Independent goods
$0 < e_{12}$	Substitute goods

Suppose the price of good 2 rises by one percent. If that leads to a decrease in the demand for good 1 (*e12* < 0) then good 1 and good 2 are probably goods that go together in some way: complements. If, instead, it leads to an increase in the demand for good 1 (0 < *e12*) then good 1 is probably something one can buy instead of good 2: a substitute.Cross price elasticity of demand indicates how much the demand for a product changes as a result of a price change in a related product. Coke and Pepsi are substitute products. Buyers buy one instead of the other. If the price of a substitute product increases, then the other product's demand increases. If Coke increases its price, then more people will demand Pepsi. In the case of substitute products, the cross price elasticity of demand is positive. Potato chips and dip are complementary products. Buyers usually buy one when they buy the other. If a complementary product's price increases, then the other product's demand decreases. In the case of complementary products, their cross price elasticity of demand is negative.

In the case of a product that has a substitute (like oranges and apples), the price change of one product affects the demand of the other. Cross price elasticity of demand measures this effect. The formula for the cross price elasticity of demand for product A relative to a price change in product B is

e_{cp} = the percentage change in the demand for product A / the percentage change in the price of substitute product B or

e = (change in the quantities of product A / the average of the quantities of product A) / (change in price of product B / average of product B prices)

Example 1

Problem: What is the cross price elasticity of demand for Pepsi if the demand for Pepsi decreases by 10% after the price of Coke decreases by 5%?

Solution: Coke and Pepsi are substitute products. If Pepsi's demand decreases by 10% because Coke's price decreases by 5%, and assuming no change in the price of Pepsi and no change in other variables in the economy (ceteris paribus), then the cross price elasticity of demand for Pepsi relative to a price change in Coke is ecp = (-10%) / (-5%) = +2.

Example 2

Cross price elasticity of demand can also be computed for complementary products. Complementary products are products that are consumed together. Computer software and personal computers are complementary products.

Problem: What will be the cross price elasticity of demand for computer software if the demand for computer software increases by 45% because of a decrease of 15% in the price of personal computers?

Solution: The cross price elasticity of demand for computer software relative to a price change in personal computers is $e_{cp} = (+45) / (-15) = -3$.

Note that for cross price elasticity of demand, if the number is negative, the two products are complements. If the number is positive, the two products are substitutes.

Price Elasticity of Supply

We know from the law of supply that as the price of a product increases, then suppliers will supply more of the product. Price elasticity of supply illustrates how much more they will supply. Price elasticity of supply is the percentage change in quantity supplied divided by the percentage change in the price. If price elasticity of supply is, for example, 3, then suppliers will supply 30 percent more of a product if the price increases by 10 percent.

Price elasticity of supply measures the percentage change in the quantity supplied by producers divided by the percentage change in the price of the product. We know from the law of supply that as the equilibrium price of the product increases, producers will supply more of the product. How much more will they supply as the price of a product increases by, for example, 10%?

Example 1

Problem: What is the price elasticity of supply if producers increase their quantity supplied by 30% as a result of a 10% price increase in the market price?

Solution: The price elasticity of supply is $e_s = (+30) / (+10) = 3$

Price elasticity of supply is always positive, because the law of supply states that (ceteris paribus) as the market price increases, the quantity supplied increases.

Note that in the above example, the price elasticity of supply is greater than 1. This means that it is elastic. An important determinant of price elasticity of supply is time. If a supplier is not able to increase its supply within a certain period of time because it doesn't have the resources to expand, or the resources are very inflexible (large pieces of machinery, fixed amount of land, etc.), then the price elasticity of supply is low. On the other hand, if a supplier's production process is very flexible, then its ability to expand its supply is greater. This increases the price elasticity of supply.

6.Theory of consumer's choice

Plan

6.1. Consumer's choice and the factors influencing it

6.2. The utility and the law of diminishing marginal utility

6.3. Indifference curves and their importance in consumer's choice

6.4. Budget line and consumer's equilibrium

Where does the demand curve come from? In order to explain why individuals choose different quantities at different prices, we will use a model with three components:

• Consumers have certain restrictions on how they can choose. Most importantly, they have a **budget**, but there can also be other restrictions. **Budget**: The amount of money, or wealth, a consumer has access to.

• Individual preferences (or tastes) determine how satisfied an individual will be with different combinations of goods and/or services. We measure the level of satisfaction in terms of **utility**. **Utility**: A measure of how satisfied a consumer is.

• Given preferences and restrictions, the individual **maximizes** her utility of consumption. We will now discuss these three components. **Maximize**: Choose in such a way that one gets as much as possible of something else.

Baskets of Goods and the Budget Line

As a consumer, one can choose between several different goods and services. A certain combination of goods and services is called a **basket of goods** (a **bundle of goods**, or a **market basket**). The consumer's problem can therefore be described as having to choose between different baskets, given the restrictions she faces, such that she maximizes her utility.

We begin by looking at a simple case where we have just two goods, good 1 and 2, with prices *p1* and *p2*. A basket that consists of the quantity *q1* of good 1 and *q2* of good 2 is written (*q1*,*q2*).

For example, (4,3) means that we have 4 units (or kilos, liters, etc) of good 1 and 3 units of good 2. The price of the basket (*q1*,*q*2) is then:

p1*q1=p2*q2

If we have a limited amount of money to buy these goods for, this will impose a restriction on how much we can buy of each good. Letting m denote the amount of money available, the price of the basket chosen must not exceed m. The different combinations of good 1 and 2 that cost exactly m can be written

p1*q1+p2*q2=m

Solving this expression for *q2*, we get the function of the **budget line**:

$$q_2 = \frac{m - p_1 * q_1}{p_2} = \frac{m}{p_2} - \frac{p_1}{p_2} * q_1$$

Budget line: A graphical description of the baskets a consumer can buy, given a certain budget.

This function is a straight line that intercepts the Y-axis at *m*/*p2* and has the slope *p1*/*p2* (see Figure).

All the points on the budget line cost exactly m. The points in the grey area below the budget line cost less than m whereas the points above cost more than *m*. The baskets that a consumer with wealth m can buy are, consequently, the ones on and below the budget line.

There is a simple strategy for finding the budget line: If we only buy good 2, the maximum quantity that we can buy is *m*/*p2*, whereas if we buy only good 1, the maximum quantity that we can buy is *m*/*p1*. Indicate the first point on the Y-axis and the second on the X-axis, and then draw a straight line between them. The line you have drawn is the budget line, and it will automatically have the slope *-p1*/*p2*.

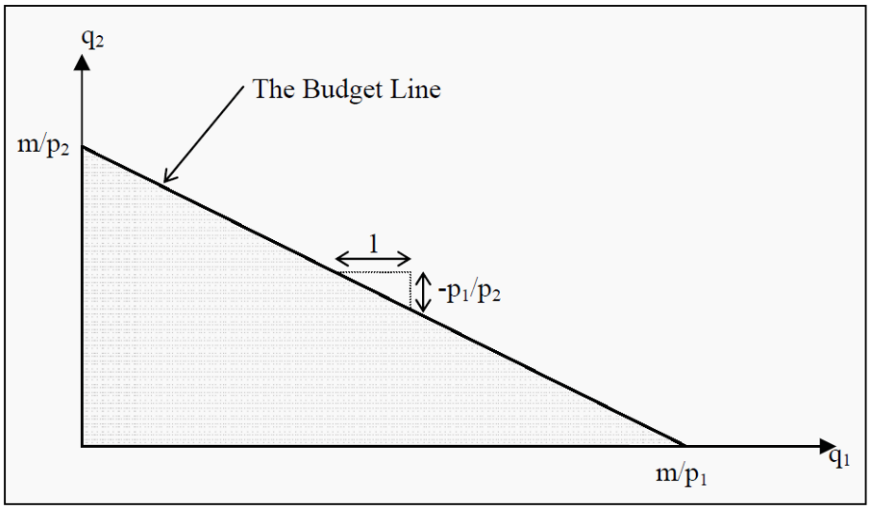


Figure: The Budget Line

The slope of the budget line is called the **marginal rate of transformation** (*MRT*). We consequently have that. **Marginal rate of transformation**: The slope of the budget line.

$$MRT = -\frac{p_1}{p_2}$$

Suppose, for instance, that the two goods are ice cream (price 10) and pizza (price 20). *MRT* will then be -10/20 = -0.5. We can interpret this such that you have to give up half a pizza if you want to have one more ice cream (or, vice versa, that you have to give up two ice creams, -20/10, to get one more pizza). To *transform* your basket into another basket with one more ice cream, you have to give up half a pizza. Note that this means that the price of ice cream measured in pizzas (instead of money) is half a pizza.

If income or prices change, the budget line will also change. Look at Figure and the budget line *B1*. If the price of good 1 rises from *p1* to *p'1*, we can only buy a maximum of *m*/*p'1* of that good, but we can still buy *m*/*p2* of good 2. Consequently, the budget line rotates about the intercept with the Y-axis to *B2*. If, instead, the price of good 2 rises from *p2* to *p'*2, then *B1* rotates about the intercept with the X-axis to *B3*.

When a price changes, *MRT* also changes since the slope of the budget line changes. If the price of ice cream rises from 10 to 20, *MRT* will be -20/20 = -1. Now, you have to give up a whole pizza to get one more ice cream. Note that this also means that the pizza has become cheaper, *relatively speaking*: You can now get one more pizza for just one ice cream, even though the price of pizza is unchanged.

Assume now that the prices are *p1* and *p2*, as they were originally, but that the income increases to *m'*. We can then buy a maximum of *m'*/*p2* of good 2 and a maximum of *m'*/*p1* of good 1. *B1* consequently shifts to *B4*. Note that the slope of *B4* is exactly the same as the slope of *B1*, since the prices are unchanged: You have more money, but you still have to give up half a pizza if you want to have one more ice cream.

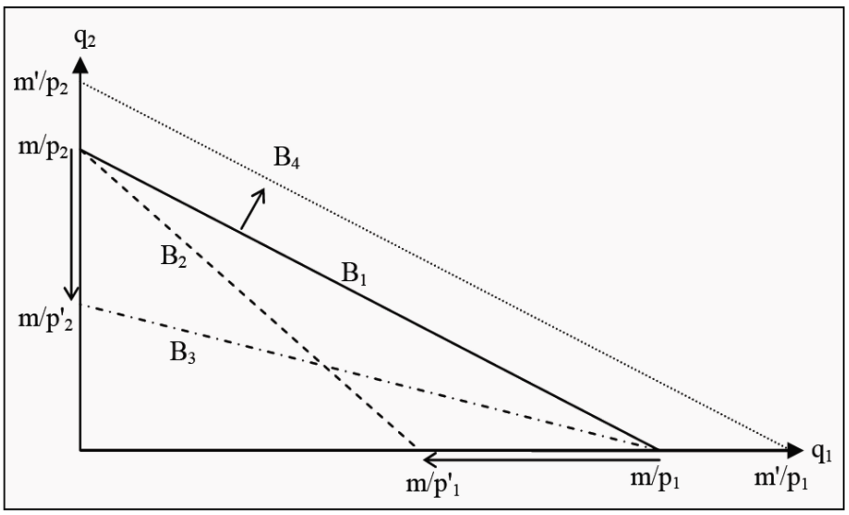


Figure 3.2: Changes in the Budget Line

If prices rise or if income falls, the area under the budget line becomes smaller. In the opposite cases, it becomes larger. The larger the area is, the more choices of consumption you have.

Preferences

The theory of preferences belongs to the most difficult parts of basic microeconomics, so take your time with this section. It is very important to both understand and be able to use preference-theory in the rest of the material.

You have probably heard the expression that "one should not compare apples and oranges," or something similar. The point here is precisely that one should do that, and even to compare anything with anything else. This is done through a **preference order**. We will assume that an individual always knows what she prefers: she prefers basket A to basket B, she prefers B to A, or she is **indifferent** between them. If all baskets are ordered accordingly, we have a preference order and such an order is valid for a certain individual.

Usually, the following four assumptions are made about preference orders:

• *Complete*. The individual can order all conceivable baskets of goods.

• *Transitive*. If the individual prefers A to B, and B to C, she also prefers A to C. In other words, there are no "circles" in preferences.

• *Non-satiation*. An individual always prefers more of a good to less. This assumption is a bit tricky. Suppose we think of pollution as a good. Is more pollution usually preferred to less pollution? No, obviously not. To get around this type of problem, we have to define the good in the opposite way: Instead of pollution, we define clean air to be the good. More clean air is better than less.

• *Convexity*. Suppose we have two baskets that an individual is indifferent between, A and B. She will then always prefer (or at least be indifferent between) baskets that lie between these two baskets. Say that she is indifferent between a basket consisting of (2 apples, 4 bananas) and (4 apples, 2 bananas). She will then, according to the assumption, prefer a basket of (3 apples, 3 bananas) to the other two (or, at least, be indifferent between all of them).

Are these assumptions true? Many people have debated the reasonableness of them. Are you, for instance, non-satiable? Which do you prefer: 2 liters of milk or 10,000 liters? Probably 2 liters. The rest will not fit into the refrigerator and will soon start to smell. It will also require a lot of work to get rid of them.

In many models, however, it is also assumed that there are no **transaction costs**. **Transaction costs**: Any cost, apart from the price of the good, that is associated with buying or selling it. This means that, there are no costs to trading, except for the price of the goods. Examples of transaction costs are the cost of a stamp if you mail in an order, the effort it takes to go to the market where you can buy things, or the cost to hire a lawyer to go through a contract

before you sign it. Models that include transaction costs become much more complicated, but, on the other hand, they also become more realistic. In the example, you would probably prefer 10,000 liters of milk if it would not cost you anything to sell them and immediately get rid of them. In a worst-case scenario, you would sell then at a price of 0, which should make you indifferent between 2 and 10,000 liters of milk.

Indifference Curves

If we only have two goods, we can illustrate different baskets that the individual if indifferent between with **indifference curves**. **Indifference curve**: A curve showing different combinations of two goods between which a consumer is indifferent. Similar to elevation contours on a map. All points on an indifference curve are baskets that the individual perceives are equally good. She is, in other words, indifferent between them. An example of a typical indifference curve is shown in Figure 3.3.

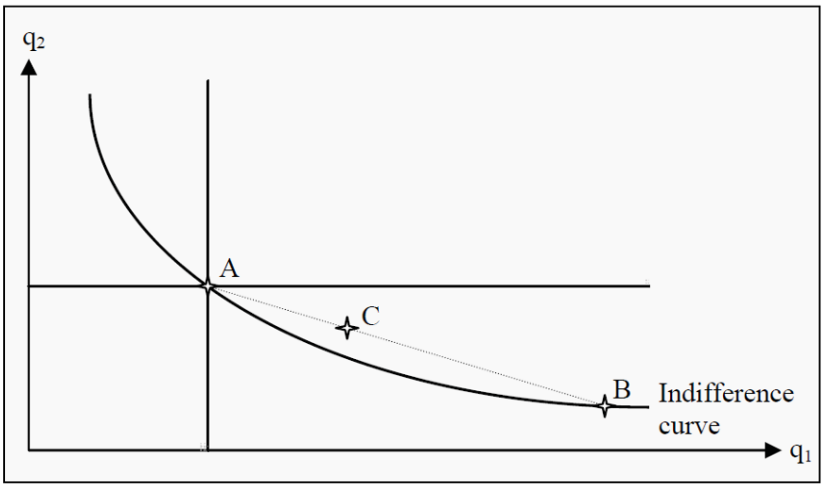


Figure 3.3: An Indifference Curve

After having made the four assumptions above, we can say a lot about what an indifference curve must look like. All points in the diagram (i.e. all possible combinations of good 1 and 2) correspond to a basket. Since the preferences are complete, there must be some preference curve that runs through any point in the diagram. Another way to say the same thing: Pick any point in the diagram; whichever point you picked, there is an indifference curve running through that point.

We now randomly select a point in the diagram, say point A. Since the individual is nonsatiable, all points where she gets more of either good 1, or good 2, or of both are better for her. This corresponds to the grey area northeast of point A. Similarly, all points where she gets less, the grey area southwest to A, must be worse for her. Consequently, she cannot be indifferent between

basket A and any point in the grey areas. Therefore, a preference curve that runs through A cannot also run through any point in the two grey areas. This means that an indifference curve will slope downwards.

The assumption of convexity implies that the slope will become smaller and smaller as we move to the right. Convexity means that, if we randomly choose any other point on the indifference curve that runs through A, say point B, and then choose a point in between them, say point C, then point C must be better than (or at least as good as) A and B. C must therefore lie on a higher indifference curve than the one that runs through A and B. If this is true for any choices of A, B, and C, then the curve must slope less and less the farther to the right we get.

An economic interpretation of this criterion is that, the less one has of a certain good, e.g. the lower *q1* is, the less inclined one is to give up one more unit of that good. If that is so, then one will demand more of the other good to compensate for the loss of that one unit. We, consequently, have to increase *q2* more and more, the lower *q1* is, to ensure that the individual has the same utility. And as we need larger and larger amounts of good 2 to keep the individual indifferent after having lost one more unit of good 1, the slope of the indifference curve will increase as we move to the left (i.e. as we reduce good 1), and vice versa when we move to the right.

Indifference Maps

Since the preferences are complete, some indifference curve must run through each point, i.e. each basket. If we randomly choose four baskets, A, B, C, and D, there will be some indifference curve that runs through each point (see Figure 3.4). If we move to the northeast in the diagram, the level of utility increases. Labeling the indifference curves *I1*, *I2*, *I3*, and *I4*, they must therefore represent higher and higher levels of utility. A collection of several indifference curves in one figure is called an **indifference map**. **Indifference map**: A collection of indifference curves in a diagram. It is common to compare indifference maps to elevation contours on a regular map: It is like walking up or down a hill when one moves from one indifference curve to another.

After we have drawn the indifference curves, we can also compare points that do not lie to the northeast or southwest of each other. In the figure, point B is not to the northeast of point A, but it does lie on an indifference curve that is "higher" than the one that runs through A.

Consequently, point B represents a basket that is better than the one represented by point A. We can also see this in the following way: Note that there are points on *I2* that lie to the northeast of point A (between the two dotted lines that originate at A). Those points must therefore be better than A.

Moreover, all points on *I2* are equally good for the individual (since she, by definition, is indifferent between all of them). Consequently, point B represents a level of utility that is exactly the same as the points on *I2* that are to the northeast of A. Therefore, B must be better than A is. Note that if we argue that way, we have used the assumption of transitivity.

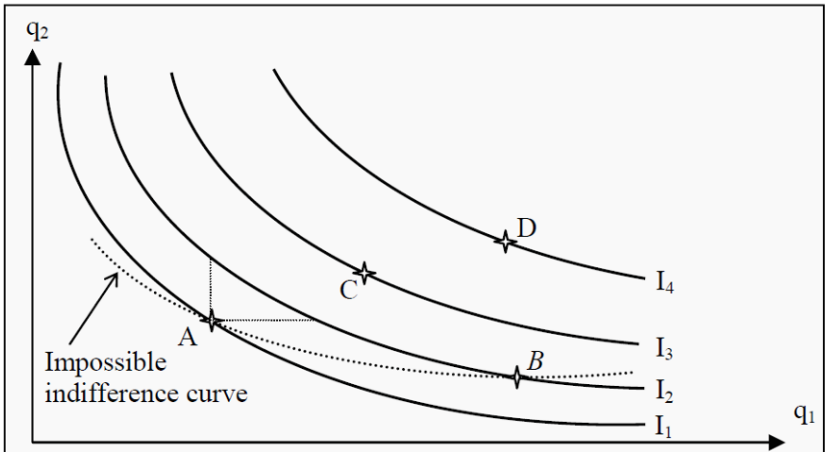


Figure 3.4: An Indifference Map

The indifference curves have the following four important properties:

• Baskets that are further away from the origin (the point (0,0) in the graph) are better than the ones closer to the origin.

• Every point has an indifference curve that runs through it, since the preferences are\ complete.

• Indifference curves cannot cross each other. This follows from the assumptions of transitivity and non-satiation.

• The indifference curves slope downwards. If they would slope upwards, we would violate the assumption of non-satiation.

The Marginal Rate of Substitution

Look at one of the indifference curves in Figure 3.4. The slope of the curves is of central importance. Think about what the slope means: If you choose some basket on one of the curves, how much would you be willing to give up of good 2 to get one more unit of good 1? If you would be willing to give up only a small quantity of good 2, the magnitude of the slope would be small, whereas if you were willing to give up a lot, it would be large.

Imagine that we have two individuals who each have 5 apples (good 1) and 5 bananas (good 2). To get one more apple, the first is willing to give up one banana, whereas the other is willing to give up two bananas. The first individual's indifference curve running through the point

(5,5) will then slope less than the second individual's indifference curve. These two individuals have different tastes regarding apples and bananas.

The numerical value of the slope of an indifference curve, the magnitude of the slope, is called the **marginal rate of substitution** (*MRS*), and it can *approximately* be calculated as

$$MRS = \frac{\Delta q_2}{\Delta q_1}$$

Here, *Δq1* and *Δq2* are the changes in quantity for good 1 and good 2, respectively. Individual 2 above was willing to give up 2 bananas to get one more apple. Then *Δq2* = -2, *Δq1* = 1, and *MRS* = -2/1 = -2. The fact that the indifference curves slope less and less to the right implies that MRS is decreasing. **Marginal rate of substitution**: How much an individual is willing to pay for an additional unit of a good in terms of another good (rather than money). It corresponds to the slope of an indifference curve.

Often, one does not keep the minus sign in *MRS*. It is then implicitly understood that one gets less (minus) of one good to get more (plus) of the other. Note that, if one leaves out the minus in *MRS*, one typically does so for *MRT* as well.

The expression for *MRS* above is only approximate. The smaller one chooses Dq1, the better the approximation will be. For it to become completely exact, Dq1 must be chosen infinitely small. This, in turn, makes it necessary to use derivatives. That, however, lies outside the scope of this book. Note that the word "**marginal**" means "infinitely small." You will hear that word many times in economics. **Marginal**: An infinitely small change. Usually, one speaks of a change of one unit.

Indifference Curves for Perfect Substitutes and Complementary Goods

An example of (almost) perfect substitutes we have already seen is green and blue pens. **Perfect substitutes** have the property that, instead of decreasing MRS, they have constant *MRS*. **Perfect substitutes**: Two goods that are possible to use interchangeably, so that a consumer is indifferent between them. This causes the indifference curves to be straight lines. This means that they have the same slope everywhere, i.e. they are straight lines sloping downwards to the right (see Figure 3.5). In the case of the pens we have that *MRS* = 1/1 = 1 (where we have dropped the minus sign), but *MRS* could be any number. The defining criterion for perfect substitutes is that *MRS* is constant.

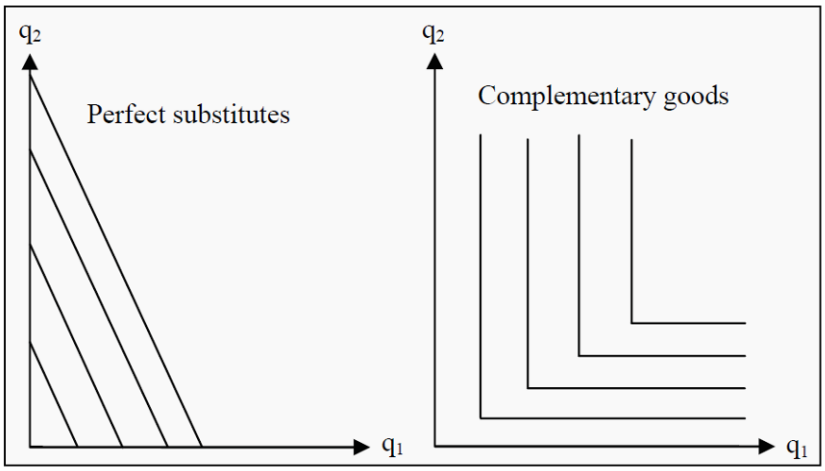


Figure 3.5: Perfect Substitutes and Complementary Goods

The example of **complementary goods** we saw before was right and left shoes. One has no use for one without the other. **Complementary goods**: Goods that go together, so that a consumer needs them both to have any use of them. This causes the indifference curves to be L shaped. This fact causes the indifference curves to become L-shaped (see Figure 3.5). Assume we have two left shoes and two right shoes. Even if we get many more right shoes, we will still have the same utility as before. The indifference curves are therefore vertical along *q2* and horizontal along *q1*, and the only way to reach a higher level of utility is to get more of *both* good 1 and good 2.

Utility Maximization: Optimal Consumer Choice

So far, we have described two of the three parts we need to explain how consumers choose goods. First, we described their limitations (scarceness; income; the budget line), and then we described their preferences (desires, taste). Now, we put these two parts together. Moreover, if we add the assumption that the consumer will maximize her utility, we will be able to predict which basket of goods she will choose: She will choose a point on an indifference curve that she can afford and that gives her maximum utility. This usually, but not always, singles out one point.

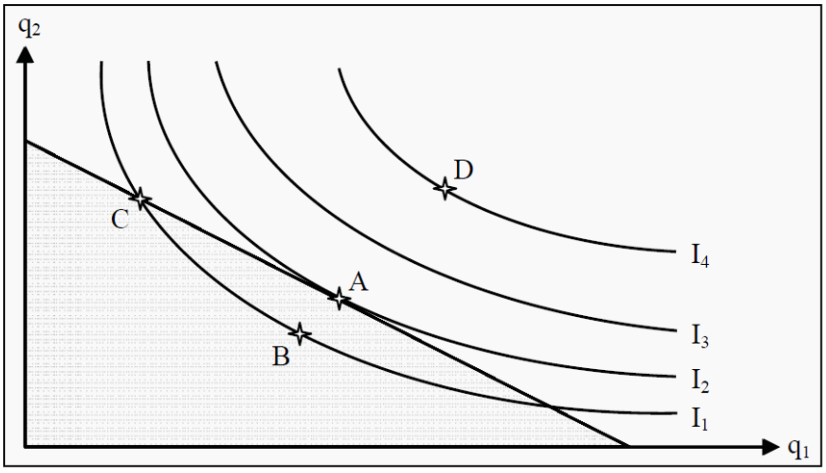


Figure 3.6: Utility Maximization

In Figure 3.6, we see the indifference curves from Figure 3.4 and the budget line from Figure 3.1 combined. Which of the points A – D is an optimal, utility maximizing, choice?

• Is, for instance, point B optimal? No, A is better than B since A is on a higher indifference curve. The consumer can also afford A, since A is on the budget line.

• Is C optimal? No, C is on the same indifference curve as B, and is therefore as good as B. However, A is better than B and, consequently, A must be better than C.

• Is D optimal? D is on a higher indifference curve than any of the other baskets, A – C. It therefore produces the highest level of utility. However, the consumer cannot afford D since it lies outside the budget line. Therefore, D is not an optimal choice.

• Is A optimal? Yes, A is the only basket that, given the consumers indifference curves and budget line, produces a maximum level of utility. All other points that lie on or below the budget line produce lower levels of utility. At point A, an indifference curve just touches the budget line (i.e. the budget line is a tangent to the indifference curve).

Point A has an interesting property. In that point, the budget line and the indifference curve have exactly the same slope. Remember that the slope of the budget line is (minus) the quotient between the prices $-p2/p1$, which we called the marginal rate of transformation (*MRT*), and that the slope of the indifference curves is the marginal rate of substitution (*MRS*). A criterion for being exactly at the point where we maximize utility is then that

$$MRT \left(= -\frac{p_1}{p_2} \right) = MRS$$

However, there are cases when the point of utility maximization does not fulfill this criterion. Look for instance at the indifference curves for perfect substitutes and complementary goods. If you fit a budget line into any of those graphs, you will find that the criterion *MRT* = *MRS* usually is not fulfilled. For perfect substitutes, the consumer will usually maximize her utility at either the X-axis or at the Y-axis, where she only consumes one of the goods (this is called a **corner solution**; the opposite is called an **interior solution**). If the budget line is parallel to an indifference curve, the consumer can choose any point on the line. She can afford them all, and she is indifferent between all of them.

Corner solution: The consumer chooses to consume only one of the goods, so that she ends up in a corner in the graph.

Interior solution: She chooses to consume at a point in the graph where there are no particular restrictions (as there are in a corner solution)

For complementary goods, she will maximize her utility at a point where an indifference curve has a corner. In such a point, the curve has no defined slope (since it has different slopes to the left and to the right) and, hence, *MRS* does not exist.

Use the following strategy to find the point of utility maximization:

• Draw the budget line.

• Find the indifference curve that just barely touches the budget line (i.e. an indifference curve that the budget line is a tangent to). In most cases, there is only one such indifference curve. All other indifference curves either crosses the budget line or does not touch it at all. Be careful, however, to check if there exists a corner solution.

• The point of utility maximization is the point of tangency (or the corner solution).

More than Two Goods

The method we have described uses only two goods. So, what do we do if we have more goods? One method we can use, if we want to use graphs in the same spirit as before, is to define a sort of composite good as "everything else," alternatively as "money" (since money represents possibilities to consume something else). Then we can draw a graph where good 1 is the good we want to analyze and good 2 is "everything else."

Another strategy that is used in more advanced textbooks is the so-called **utility function**. This mathematical function assigns a numerical value to the

utility level of a certain consumption choice. For two goods, the utility of consuming a certain combination of them could be:

$$U(q_1, q_2) = q_1 * q_2$$

The utility, *U*, of consuming, for instance, 2 units of good 1 and 3 units of good 2 will then be 2*3 = 6. The number 6 does not mean much more than that it is better than, for instance, 4 but worse than, for instance, 14. The analysis is then carried out such that one maximizes the value of *U*, given that the cost of buying must not exceed the budget. If you continue to study microeconomics, the analyses will become increasingly more concentrated on utility functions and less on graphical descriptions. In Chapter 6, we will briefly use a utility function in the analysis of attitudes towards risk.

Utility function: A mathematical function that gives a numerical value that corresponds to the level of utility a consumer attains.

Individual Demand

We will now show how to use the theory of preferences from last chapter, to derive an individual's demand curve. Remember that the consumer's budget line can change because of changes in prices or because of changes in income. Here, we will assume that the preferences themselves do not change. This makes us able to derive both the demand curve, and the so-called Engel curve, which shows how demand depends on income.

The Individual Demand Curve

It is possible to find the point of utility maximization if one knows a consumer's preferences, the prices of the goods, and her budget. Let us now do that, but vary the price of good 1 and see what effect that has on, *q1*, the quantity demanded.

Suppose we hold the price of good 2 (which you can think of as "all other goods") constant. Then the effect of varying the price of good 1 will be that the budget line rotates about the intercept on the Y-axis and intersects the X-axis at different points *m/p1i*, where *p1i* is the price one has chosen for good 1.

Look at the upper part of Figure 4.1. Suppose the price of good 1 is initially *p11*. Then the budget line is *BL1*. We find the indifference curve that just touches that budget line and label the point where it does so, point A. If we would raise the price of good 1 to *p*12, the possible choices become limited to *BL2* (that intersects the X-axis in *m*/*p12*) and then the consumer maximizes her utility in point B. If we continue to raise the price to *p13*, and repeat the maximization, we get point C. If we would repeat this procedure for all possible prices, we would get a curve that is called the **price-consumption curve**. It

shows how the optimal choice of quantity of good 1 varies with the price of that good, given that preferences, other prices and the income are held constant.

As you can see in the figure, the consumer will usually buy less of the good when the price increases. This is, however, not necessary. To see that, imagine that the indifference curve that runs through point B had been steeper. If it had been steep enough, it would touch *BL2* so far to the right that it would also be to the right of point A.

Now we want to find the demand curve for good 1. To that end, we indicate the prices we used for good 1 on the Y-axis in the lower graph of the figure, i.e. *p11*, *p12*, and *p13*. Then we check which are the corresponding quantities demanded in the upper graph, at points A, B, and C, and indicate them on the X-axis in the lower diagram. (Note that both diagrams have *q1* on the X-axis.) After that, we find the points where the quantities and the corresponding prices in the lower diagram intersect, the points labeled D, E, and F. Finally, we draw a line through those points and fill in for all those numerous points for which we have not done the analysis. This curve is the individual's demand curve for good 1.

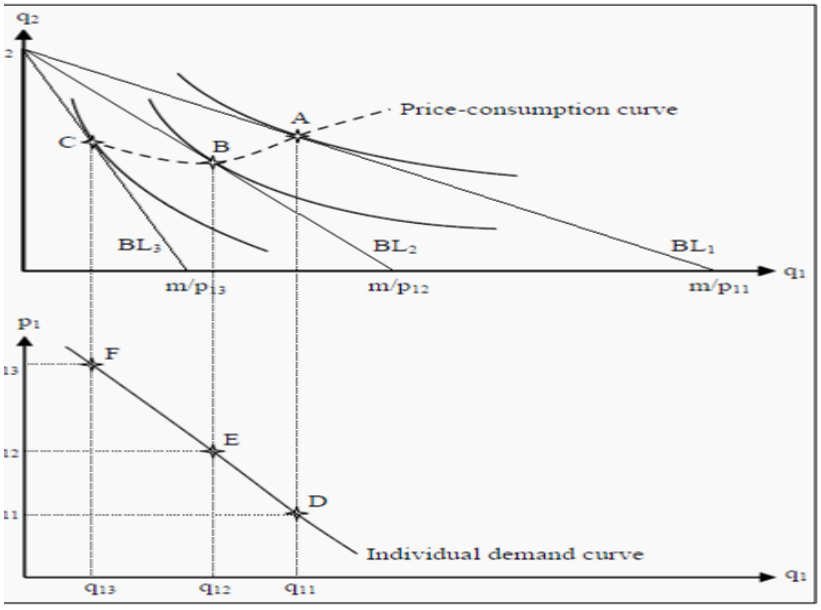


Figure 4.1: Derivation of an Individual Demand Curve The Engel Curve

The Engel Curve

In the previous section, we showed how it is possible to derive the relation between the price and the quantity demanded for a certain good. Now, we will instead show how to derive the relation between *income* and the quantity demanded. The resulting curve is called the **Engel curve**.

Engel curve: A curve that shows the relation between income and quantity demanded.

Compare to the demand curve.

Look at Figure 4.2. Just as in the previous case, we start with the individual's maximization problem where she must choose quantities of good 1 and good 2. (Again, think of good 2 as "all other goods.") However, instead of varying the price, we now vary the income m. This means that the budget line will shift outwards for higher incomes and inwards for lower incomes. We assume that preferences and prices are unchanged. For the increasingly higher incomes *m1*, *m2*, and *m3*, the budget lines become *BL1*, *BL2*, and *BL3*.

In the same way as before, we find the utility maximization points for each budget line: points A, B, and C. If we would do that for all possible incomes, we would get the so-called **income-consumption curve**. That curve shows the optimal consumption of good 1 and good 2 at different incomes, given preferences and prices.

Similarly to before, we indicate the quantities that correspond to points A, B, and C, i.e. *q11*, *q*12, and *q13* in the diagram below. Then we indicate the incomes m*1*, m*2*, and m*3* on the Y-axis, and the points where the incomes intersect the corresponding quantities: points D, E, and F. Thereafter, we draw a line through the points of intersection, as it would probably have looked if we had performed the same procedure for the points in between. The resulting curve is the so-called Engel curve, and it shows how the optimal consumption of good 1 varies with the income, given preferences and prices.

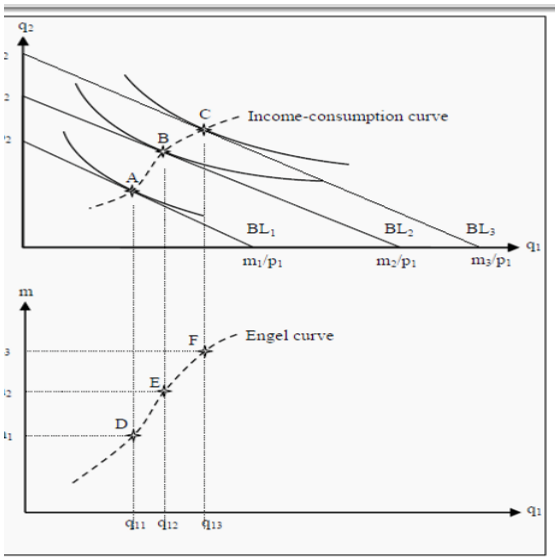


Figure 4.2: Derivation of the Engel curve

Market Demand

The market's demand consists of all individuals' demand. To find the market demand curve, we have to sum up the demand of all individuals for each price.

Suppose, for instance, that we have found demand curves for three different individuals, and that these three individuals together are the whole

market. In Figure 4.3, their demand curves (for simplicity, they are all straight lines) are labeled *D1*, *D2*, and *D3*.

If the price of the good is 4, all individuals demand a quantity of 0, but at a price of 3, the first individual demands 2 units. Since the others do demand is those 2 units. For prices between 3 and 4, the market's demand coincides with *D1*, i.e. the demand curve of the first individual. (A straight line from point (0,4) to point (2,3)).

When the price is 2, the first individual demands 4 units and the second demands 5 units. The market's total demand is then 9 units. For prices between 2 and 3, total demand is *D1* + *D2*. It will then be a straight line beginning in point (2,3) and ending in point (9,2).

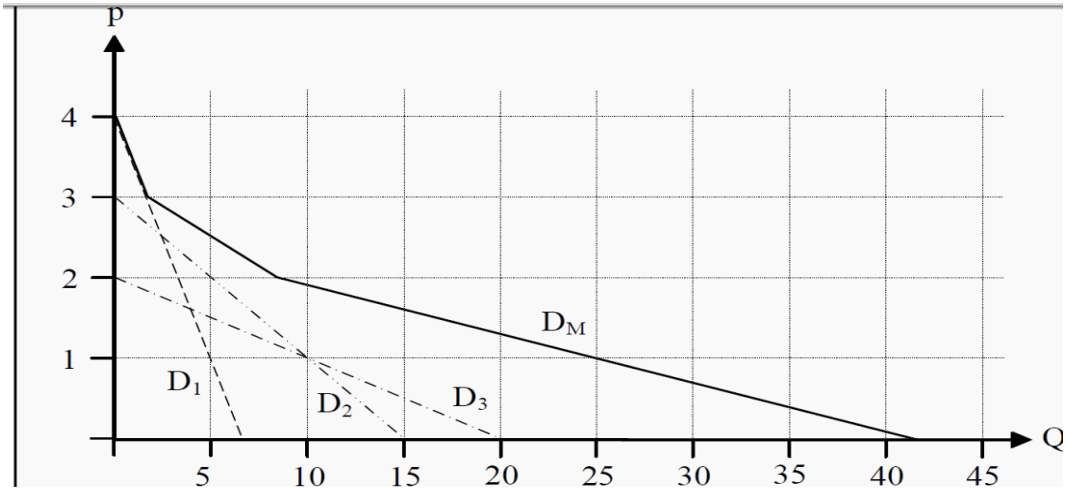


Figure 4.3: Market Demand

When the price is close to 0, all individuals demand it: The first demands 7 units, the second demands 15 and the third demands 20. Total demand is then 42 units. For prices between 0 and 2, total market demand is *D1* + *D2* + *D3*. It will then be a straight line starting in point (9,2) and ending in point (42,0). Note that we should not really allow a price of 0. Demand would then be infinite as more of the good is, by assumption, always better.

The **market demand curve**, *DM*, will consequently be the sum of the individual demand curves. If the individual demand curves are straight lines, the market demand curve will become a succession of straight lines, where a break signals that a new consumer starts demanding the good at that price.

7.Income and Substitution Effects

Plan

7.1. Substitution effect

7.2. Income effect

7.3. Changes in normal and Giffen goods

When we derived the individual demand curve, we saw how the quantity demanded changed when the price changed. We will now use consumer theory to perform a slightly more complicated analysis of a price change.

Suppose that we have a consumer, with a certain income, who has to choose between different quantities of good 1 and good 2 (which, again, can be thought of as "all other goods") in such a way that she maximize her utility. If the price of good 1 falls, we get two different effects:

• Since the price of good 1 falls, that good becomes cheaper relative the other good. This means that the marginal rate of transformation (*MRT*; the slope of the budget line) changes. Say that the prices of both goods initially are 1. The relative price is then 1/1 = 1. If the price of good 1 falls to 0.50, the relative price becomes 0.50/1 = 0.50. The consumer can now exchange one unit of good 2 for two units of good 1, and therefore good 1 becomes more attractive to her. As a result, she consumes more of the good. This effect is called the **substitution effect**. **Substitution effect**: The effect on demand that depends of the change in relative prices.

Substitution effect

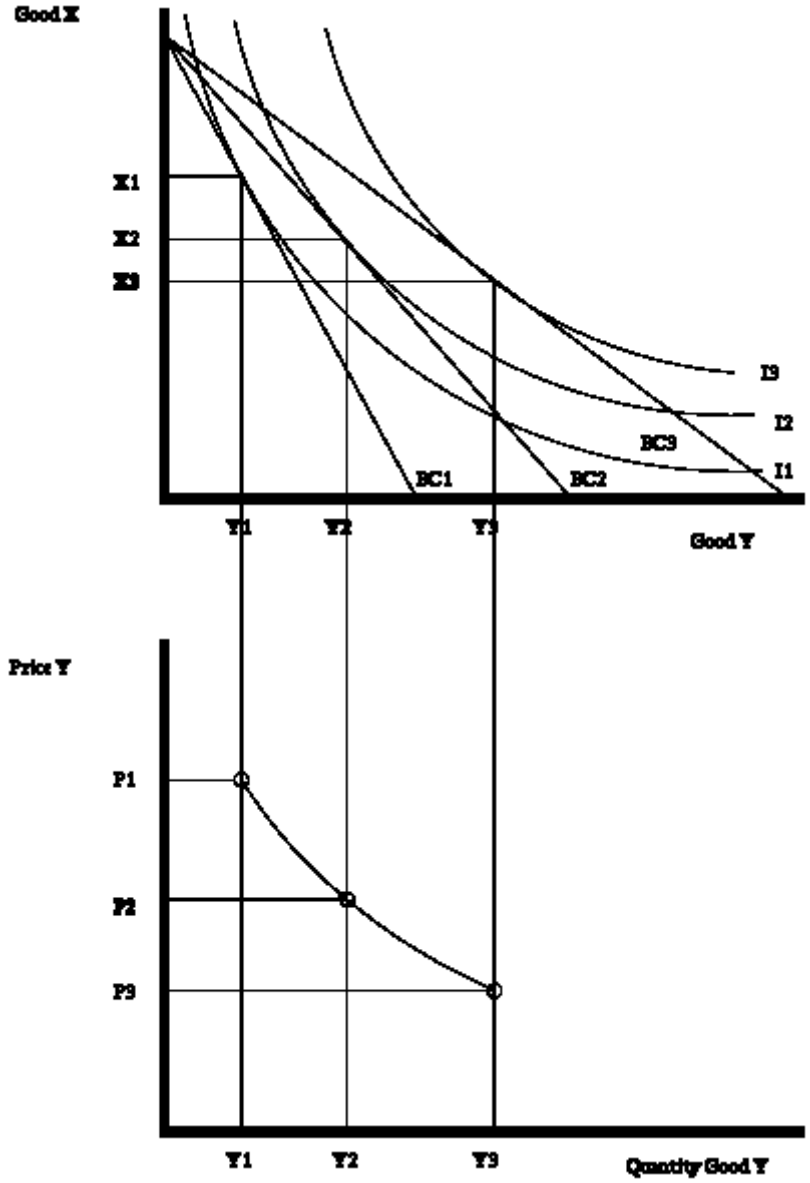
The substitution effect is the effect observed with changes in relative price of goods. This effect basically affects the movement along the curve.

These curves can be used to predict the effect of changes to the budget constraint. The graphic below shows the effect of a price increase for good Y. If the price of Y increases, the budget constraint will pivot from BC2 to BC1. Notice that because the price of X does not change, the consumer can still buy the same amount of X if he or she chooses to buy only good X. On the other hand, if the consumer chooses to buy only good Y, he or she will be able to buy less of good Y because its price has increased.

To maximize the utility with the reduced budget constraint, BC1, the consumer will re-allocate consumption to reach the highest available indifference curve which BC1 is tangent to. As shown on the diagram below, that curve is I1, and therefore the amount of good Y bought will shift from Y2 to Y1, and the amount of good X bought to shift from X2 to X1. The opposite

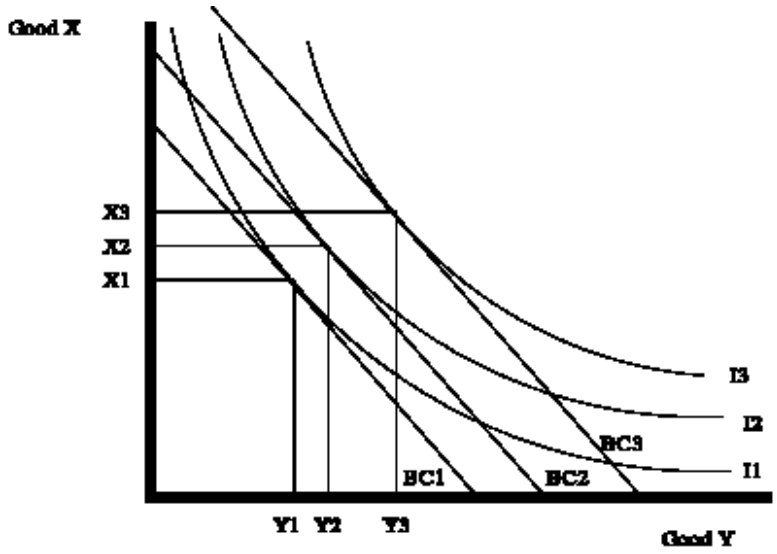
effect will occur if the price of Y decreases causing the shift from BC2 to BC3, and I2 to I3.

If these curves are plotted for many different prices of good Y, a demand curve for good Y can be constructed. The diagram below shows the demand curve for good Y as its price varies. Alternatively, if the price for good Y is fixed and the price for good X is varied, a demand curve for good X can be constructed.

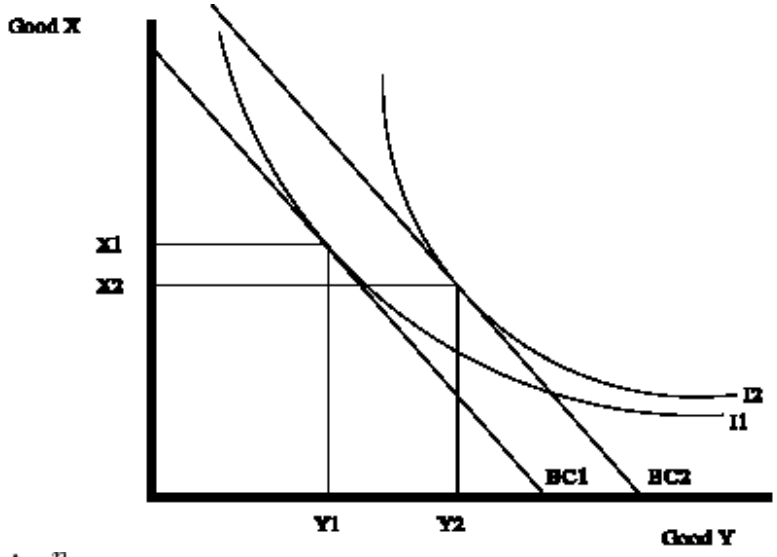


Income effect

Another important item that can change is the money income of the consumer. The income effect is the phenomenon observed through changes in purchasing power. It reveals the change in quantity demanded brought by a change in real income (utility). Graphically, as long as the prices remain constant, changing the income will create a parallel shift of the budget constraint. Increasing the income will shift the budget constraint right since more of both can be bought, and decreasing income will shift it left.



Depending on the indifference curves, as income increases, the amount purchased of a good can either increase, decrease or stay the same. In the diagram below, good Y is a normal good since the amount purchased increased as the budget constraint shifted from BC1 to the higher income BC2. Good X is an inferior good since the amount bought decreased as the income increases.



Δy_1^n is the change in the demand for good 1 when we change income from m' to m, holding the price of good 1 fixed at p_1':

$$\Delta y_1^n = y_1(p_1', m) - y_1(p_1', m').$$

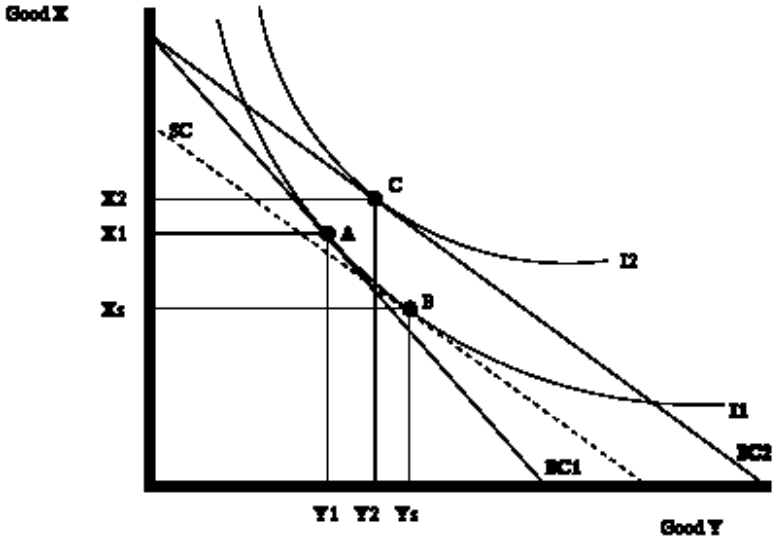
Price effect as sum of substitution and income effects

Every price change can be decomposed into an income effect and a substitution effect; the price effect is the sum of substitution and income effects.

The substitution effect is a price change that alters the slope of the budget constraint but leaves the consumer on the same indifference curve. In other words, it illustrates the consumer's new consumption basket after the price change while being compensated as to allow the consumer to be as happy as he or she was previously. By this effect, the consumer is posited to substitute

toward the good that becomes comparatively less expensive. In the illustration below this corresponds to an imaginary budget constraint denoted SC being tangent to the indifference curve I1.

If the good in question is a *normal good*, then the income effect from the rise in purchasing power from a price fall reinforces the substitution effect. If the good is an *inferior good*, then the income effect will offset in some degree the substitution effect. If the income effect for an inferior good is sufficiently strong, the consumer will buy less of the good when it becomes less expensive, a Giffen good (commonly believed to be a rarity).



In the figure, the substitution effect, Δy_1^s, is the change in the amount demanded for $y$when the price of good $y$falls from $p_1$to p_1'(increasing purchasing power for y) and, at the same time, the money income falls from $m$to $m'$to keep the consumer at the same level of utility on $I1$:

$$\Delta y_1^s = y_1(p_1', m') - y_1(p_1, m).$$

The substitution effect increases the amount demanded of good $y$from $y_1$to y_s. In the example, the income effect of the price fall in $y_1$partly offsets the substitution effect as the amount demanded of $y$goes from $y_s$to y_2. Thus, the price effect is the algebraic sum of the substitution effect and the income effect.

• The purchasing power of the consumer becomes larger because of the drop in the price. She can now buy as much as she did before the price changed, and still have money left. That extra money she can spend on both good 1 and on good 2. This is called the **income effect**. **Income effect**: The effect on demand that depends on the fact that one can afford more after a drop in the price, and vice versa.

In reality, we can only observe the total effect of the price change, i.e. how much more or less the consumer buys of the good. However, we will now see that it is possible to split up the total effect into the substitution- and income

effects. Depending on whether good 1 is a normal or an inferior good, we get two different cases.

Normal Good

Assume we have the same case as we did earlier: A consumer chooses between good 1 and good 2. Giver her income, m, the prices of the goods, *p11* and *p2*, and her preferences, she chooses that basket of goods that maximizes her utility. In Figure 5.1, this means that she initially chooses point A.

If the price of good 1 falls from *p11* to *p12*, the budget line rotates outwards from *BL1* to *BL2*. When the consumer chooses a new basket, she ends up in point B. Her consumption of good 1 has consequently increased from *q11* to *q12*, which is the total effect.

We now ask ourselves how much of the change in quantity from *q11* to *q12* that depends on the income effect (i.e. on the increase in purchasing power) and how much that depends on the substitution effect (i.e. on the change in the slope of the budget line). To answer this question, we first ask another question: If only the relative prices had changed, without the consumer getting any increase in utility, what effect had we then seen.

If the relative prices change, the slope of the budget line changes. All budget lines that have the same relative prices as *BL2* must also have the same slopes as that budget line. Furthermore, for the consumer to have the same utility as before, she must consume on the same indifference curve as she did before, i.e. on *I1*. We therefore construct an imaginary budget line, *BL**, that has the same slope as *BL2* and that, just as *BL1*, is a tangent to *I1*. (However, since it has a different slope than *BL1*, it must touch *I1* at different point than that budget line does.) If this had been the real situation, the consumer would have chosen point C. She had then increased her consumption of good 1 from *q11* to *q1**. At the same time, she would have decreased her consumption of good 2. This substitution from good 1 to good 2 depends on the change in the relative price, but it does not result in any change in the level of utility. This part is the substitution effect.

The remaining change, from *q1** to *q12*, is the part that depends on the increase in the consumer's purchasing power. As she moves to a higher indifference curve, from *I1* to *I2*, she increases her utility. This part is the income effect.

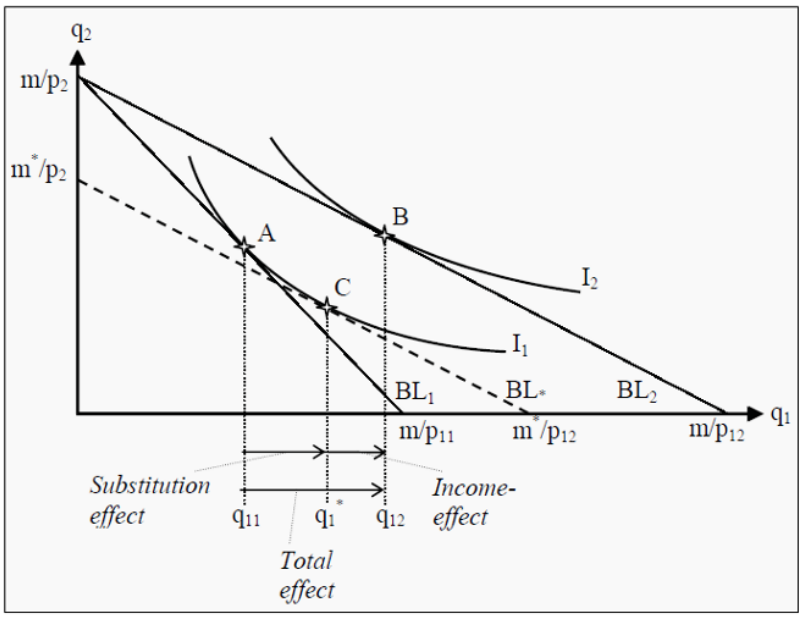


Figure 5.1: Income and Substitution Effects for a Normal Good

Inferior Good

The strategy to find the income- and substitution effects for an inferior good is exactly the same as for a normal good, but the result will look slightly different. As previously mentioned, an inferior good is a good one buys less of if one's income increases. The underlying reason for that is to be found in the preferences. As one becomes wealthier, one can afford to buy something of higher quality instead. This preference will have an effect on the shape of the indifference curves.

This time, when we split up the total effect into a substitution effect and an income effect, the income effect for the inferior good is negative. The substitution effect is always positive, which means that we get two cases depending on whether the negative income effect is smaller or larger in magnitude than the always-positive substitution effect. Goods that belong to the latter case are called **Giffen goods**, and these are a very rare kind of goods. Their distinguishing feature is that one buys more of them if the price rises. The demand curve almost always slopes downwards. Giffen goods are consequently an exception from that rule.

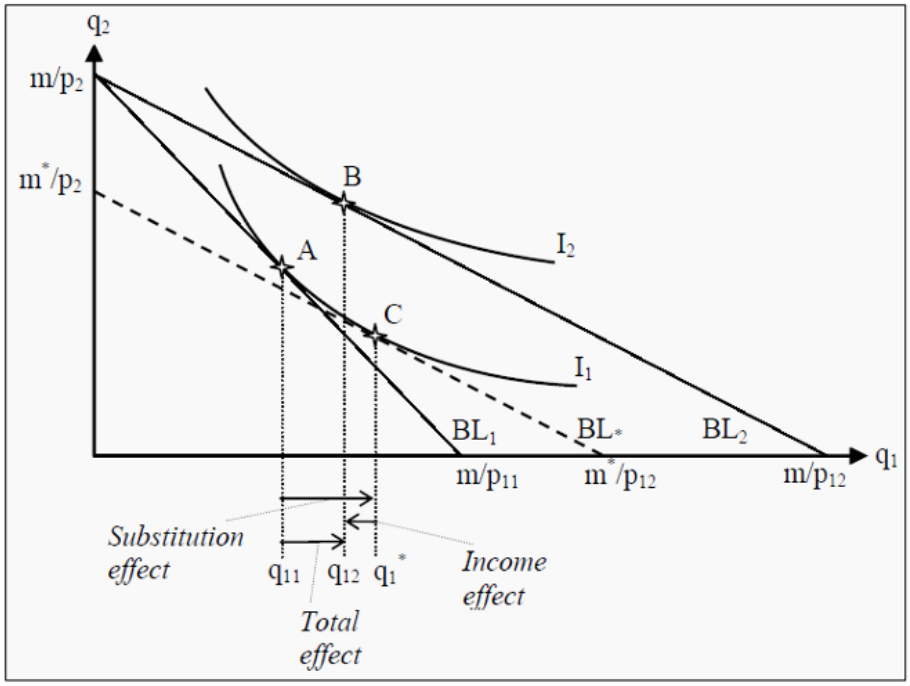


Figure 5.2: Income and Substitution Effects for an Inferior Good

In Figure 5.2, we have almost the same situation as in 5.1. The difference is that the consumer's indifference curve I*2* has been changed so that it touches the budget line *BL2* at a point between points A and C. This change makes the income effect negative and the total effect is smaller than before.

In Figure 5.3, the indifference curve *I2* has been changed again, so that it touches *BL2* at a point to the left of point A. The income effect now becomes very negative, so negative that it dominates over the substitution effect. The total effect thereby also becomes negative and we have a Giffen good.

Note, however, that the consumer does increase her utility. This can seem strange, as the total effect is that she consumes less of the good analyzed (and we have assumed that more is always better). The drop in the price of the Giffen good means that the consumer can afford to buy more of other goods. Furthermore, these other goods function as substitutes for the Giffen good. Hence, the increase in utility. The increase in consumption of good 2 can be read off as the distance between A and B on the Y-axis.

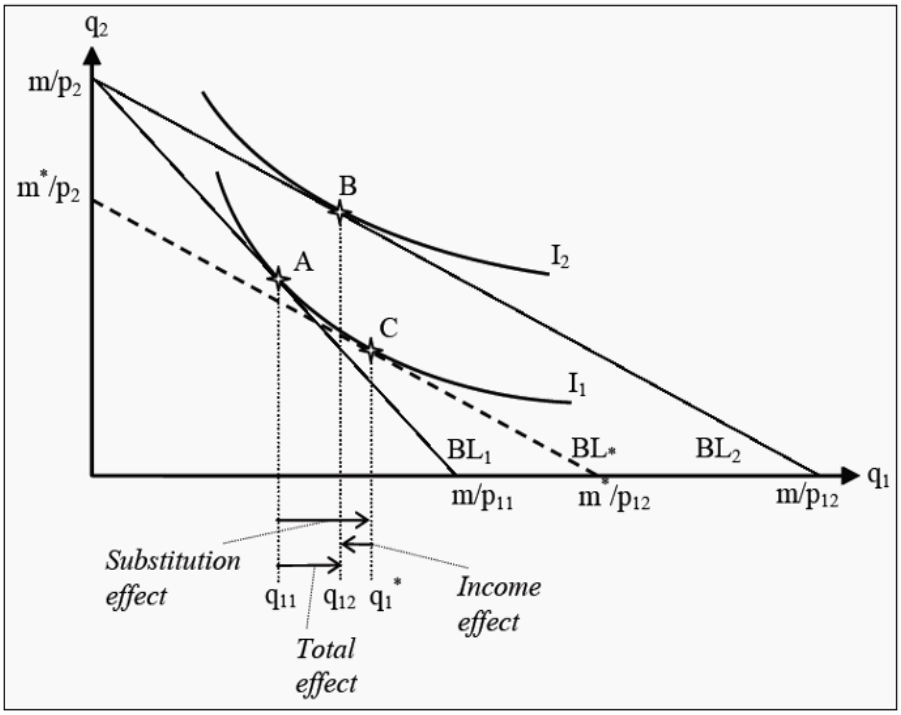


Figure 5.3: Income and Substitution Effects for a Giffen Good

Labour -leisure tradeoff

Someone can also use consumer theory to analyze a consumer's choice between leisure and labour . Leisure is considered one good (often put on the horizontal-axis) and consumption is considered the other good. Since a consumer has a finite and scarce amount of time, he must make a choice between leisure (which earns no income for consumption) and labour (which does earn income for consumption).

The previous model of consumer choice theory is applicable with only slight modifications. First, the total amount of time that an individual has to allocate is known as his time endowment, and is often denoted as *T*. The amount an individual allocates to labour (denoted *L*) and leisure (*l*) is constrained by *T* such that:

$$l + L = T$$

or

$$l + (T - l) = T$$

A person's consumption is the amount of labour they choose multiplied by the amount they are paid per hour of labour (their wage, often denoted w). Thus, the amount that a person consumes is:

$$C = w(T - l)$$

When a consumer chooses no leisure $(l = 0)$ then $T - l = T$ and $C = wT$.

From this labour -leisure tradeoff model, the substitution effect and income effect from various changes in price caused by welfare benefits, labour taxation, or tax credits can be analyzed.

8.Market and risk

Plan

8.1. Choice under Uncertainty
8.2. Risk Preferences
8.3. Risk averse

The situations we have discussed up to this point have all lacked any elements of uncertainty. Individuals and firms have made their choices knowing what the outcomes would be. That is, of course, very unrealistic. Most of the time, we cannot be certain about which consequences our actions will have, even though we can perhaps know which consequences they will *probably* have.

A few examples of important decisions under uncertainty are:

• Buying a house or an apartment. You know what you pay for it, but what will it be worth when you sell it? What happens if the house burns down?

• Investments in an education. It is often easy to get statistics on today's salaries but in the future, they might change substantially.

• A firm invests in a new factory. Will the goods produced in the factory still be in demand in the future? Think, for instance, about the computer market where development is very rapid.

It is common in economics to view uncertainty as a sort of lottery. In a lottery, one often knows which outcomes are possible: There might, for instance be a list showing how much you can win. It is also possible to calculate the probabilities for the different outcomes. In the situations covered here, we will also assume that this is the case.

Expected Value

In statistics, "expected value" is a technical term. Suppose we toss a coin. If "heads" comes up, we win 5; if "tails" comes up we lose 5. The expected value of that lottery is then

$$\begin{aligned} EV &= \Pr(\text{"heads"}) * \text{value}(\text{"heads"}) + \Pr(\text{"tails"}) * \text{value}(\text{"tails} \\ &= 50\% * 5 + 50\% * (-5) \\ &= 0 \end{aligned}$$

Here, Pr(.) is the probability that the event within the parentheses will occur. If there are more than two possible outcomes, the expected value is the probability of each outcome multiplied with the value of that outcome, and then summed together. Note that the expected value need not to be something you

would expect to occur. In the lottery above, we do not expect the outcome to be 0. We expect it to be either +5 or -5

The expected value can be seen as a sort of average over the outcomes, where an outcome with high probability has a higher weight than one with lower probability. A lottery with an expected value of zero is called a **fair lottery**. Note that most real-world lotteries are not fair. **Fair lottery**: A lottery with an expected value of zero.

Expected Utility

Consider a case where an agent has to choose between several alternatives, all of which will lead to an uncertain outcome. A naive method could then be to analyze them as if they were lotteries, and then choose the one with the highest expected value. There are several reasons why such a method would not be a good one.

To begin, we need to define a utility function (compare to Section 3.8) over wealth. Usually, more wealth is better for an individual but as she becomes wealthier additional wealth matters less and less. The utility an individual has of wealth is often written as

$U=U(W)$

U stands for utility and *W* for wealth. The expression can then be read as "the utility level is a function of wealth." What form the utility function takes varies between individuals, but a function that is often used for illustrations is

$U=\sqrt{W}$

In Figure 6.1, we have drawn this function (sqrt = "the square root"). Note that the slope of the function becomes less and less steep. That means that the individual, as we just noted, receives less utility of extra wealth as she becomes wealthier. Note that how much extra utility the individual gets from a small increase in wealth corresponds to the slope of the utility function. The slope is called the **marginal utility**, *MU*. **Marginal utility**: The additional amount of utility an agent receives from an additional amount of wealth.

We differentiate between three different kinds of utility functions

• *Diminishing marginal utility*. The slope decreases with increased wealth, such as the utility function in Figure 6.1.

• *Constant marginal utility*. The utility function is straight line, i.e. the slope is constant.

• *Increasing marginal utility*. The slope increases with increased wealth.

If we use the utility function together with expected value, we can calculate the *expected utility*. Suppose our wealth is 5. If we participate in the lottery above, we will either win 5 or lose 5, both with a 50% probability. The result

will then be that we have either 0 or 10. The utility we would have of these outcomes, and the expected utility is then

$$U(0)=\sqrt{0}=0$$
$$U(10)=\sqrt{10}\approx 3{,}2$$
$$E(U)=50\%*(0)+50\%*(3{,}2)=1{,}6$$

E(U) stands for expected utility. Earlier, we calculated the expected value of the lottery to 0. Our expected wealth, as opposed to expected utility, is then 5 + 0 = 5 (the sum of what we have plus the expected value of the lottery). Note now that, the utility we have from a certain wealth of 5 is

$$U(5)=\sqrt{5}=2,$$

The utility from getting the expected value with certainty (the utility of 5) is usually higher than the expected utility of participating in a fair lottery (the utility of either 0 or 10, both with a 50% probability). We will study this more closely in the next section.

Risk Preferences

Study Figure 6.1 again. We have a wealth of 5 plus an uncertain outcome of a lottery. Together, these give us an end wealth of either 0 or 10. We have indicated these values on the X-axis. The corresponding utilities we have indicated with points a and b. The expected utility of the wealth plus the lottery will be a point somewhere along a straight line from a to b, depending on the probability of each outcome. In the present case, the probability for each outcome is

50% and then the expected utility will be a point exactly half-way in between a and b, i.e. in point c where the utility is 1.6. (With other probabilities, we would have ended up in another point on the same straight line.) We have now illustrated the expected utility of an uncertain outcome of either 0 or 10.

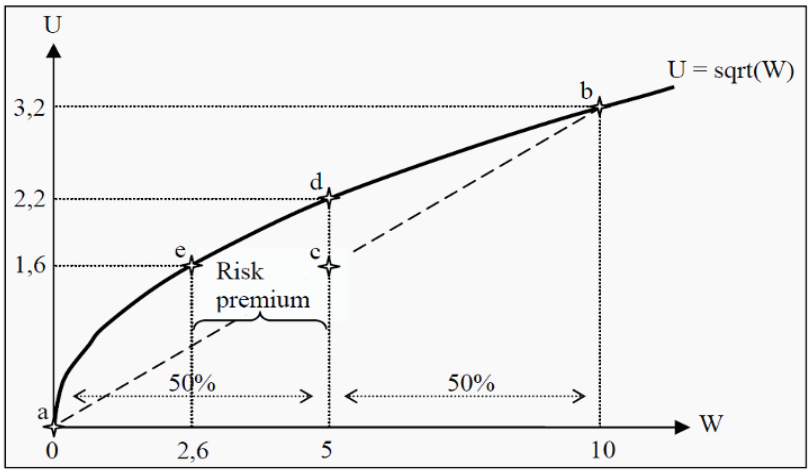


Figure 6.1: Utility Function

What if we chose not participate in the lottery at all? In that case, we would keep a certain wealth of 5. The expected utility is unchanged: The expected value of a certain 5 is 5, and the expected value of a certain 5 plus the lottery is also 5. However, the utility of a certain wealth of 5 is 2.2, corresponding to point d in the figure. The outcome that, participating in the lottery gives less utility than not participating, depends on the fact that the utility function slopes less and less steep as wealth increases, i.e. that we have diminishing marginal utility. A person with such a utility function will always prefer not to participate in a fair lottery, and she is said to be risk averse

Depending on which type of marginal utility an individual has (compare to above), we can classify her attitude towards risk:

• **Risk averse** (diminishing marginal utility). **Risk averse**: An agent who dislikes risk. Prefers not to participate in a fair lottery. Most people, if not all, are risk averse. Note, however, that this theory (at least in the basic version presented here) is unable to explain why many people in real life participate in lotteries.

• Risk neutral (constant marginal utility). Is indifferent.

• Risk loving (increasing marginal utility). Prefers to participate in the lottery. A very unusual property!

Certainty Equivalence and the Risk Premium

Look at Figure 6.1 again. We have already seen that an ordinary person (i.e. a risk averse person) prefers not to participate in the lottery. One may then ask which level of certain wealth she would value as much as participating in the lottery.

As we saw before, her utility of participating is 1.6 (point c). The question is then which wealth would give her that same utility. Follow the line from 1.6 to the utility function and you will end up at point e, corresponding to a certain wealth of 2.6. This individual is, consequently, indifferent between participating in the lottery and having a certain wealth of 2.6. The value 2.6 is then said to be **certainty equivalent** to participating in this lottery. **Certainty equivalent**: The amount of wealth an agent has the same utility of as another uncertain amount of wealth.

Since she now has a wealth of 5, she is, in other words, prepared to pay 5 - 2.6 = 2.4 to avoid the lottery. Alternatively, if her wealth had been 2.6, how much would we have had to pay her in order to make her willing to participate in the lottery? The answer is the same: 2.4. This amount is called the **risk premium**. **Risk premium**: How much an agent is maximally willing to pay not to participate in a lottery (uncertain outcome).

Risk Reduction

Since most people are risk averse, they want to reduce risk. That is often achieved by pooling the risk and sharing it. This is, for instance, the idea behind insurance, where the risks are shared between many people

Asymmetric Information

We have already mentioned that information is important in economics and, most often, we have assumed that the agents have perfect information. That is hardly a reasonable assumption. For instance, usually a seller knows more about a product than the buyer does, and a worker knows her skills better than the employer does. We will now look at some implications of the problem of **asymmetric information**. **Asymmetric information**: A situation in which different agents have different amounts of information about a good. There are two important subcategories:

• **Adverse selection**. **Adverse selection**: Depending on asymmetric information, different agent act in different ways before agreeing on a contract. Depending on the fact that one side in a contractual agreement, the buyers or the sellers, have information that the other part does not have, only some buyers or sellers will want to enter into the contract. Only the ones that will profit the most from the contract will do so. Moreover, those are, typically, the ones the other part wants to avoid.

• **Moral hazard**. **Moral hazard**: Depending on asymmetric information, agents change their behaviour after having agreed on a contract. Sometimes, one's counterpart cannot check whether one fulfills one's obligations after having agreed on a contract. One may them be tempted to exploit the other's lack of knowledge.

Note the difference between the two types: Adverse selection is about what happens *before* the agreement has been made. Moral hazard is about what happens *after* it has been made.

Adverse selection

We will give two classical examples of adverse selection: the market for insurance and the market for used cars. Note, however, that the concept is possible to apply on many types of goods and services.

Insurance

The price of insurance largely depends on the probability that the insurance firm will have to pay, for instance, on the probability that your bike is stolen. If there is a high probability, the price of insurance will also be high.

Different people differ in how well they keep after their belongings, and the risk that a careless person will get her bike stolen is much higher than that a carful person will get hers stolen. However, the insurance firm cannot see a

difference between careless and careful people, and therefore charges them the same price corresponding to an average of the risks.

This, however, makes the insurance a good deal for the careless people, but it might make it too expensive for the careful people. They will probably not lose their bikes anyway. Then only the careless people remain; the ones that constitute a high risk for the insurer. When the insurer realizes that all people buying insurance are high-risk people, they will have to increase the price even more. The high-risk people will then have pushed the low-risk people out of the market, even though the latter might be fully willing to pay for insurance.

Used Cars

Suppose there are 100 used cars in a market, and that they are of two different levels of quality: Half of them are of high quality (H-cars) and half are of low quality (L-cars). The sellers want at least 50,000 for an L-car and at least 100,000 for an H-car, whereas the buyers are prepared to pay at most 60,000 for an L-car and 110,000 for an H-car. There are consequently possibilities for trades that are beneficial for both sides. If there had been two submarkets, one for L-cars and one for H-cars, people could have negotiated prices between 50,000 and 60,000 for L-cars and between 100,000 and 110,000 for H-cars.

However, if they are sold in the same market, the buyers cannot tell them apart. Neither can she ask the sellers, as all sellers would say that their car is an H-car. If the chance that she will get an L- or an H-car is 50% each, the buyer could think of this as a lottery. Suppose, for simplicity, that the buyer is risk neutral (so that she does not demand a risk premium for taking a risk). She would then be willing to pay the expected value of the car, i.e.

50%(60.000)+50%*(110.000)=85.000*

She will then maximally offer 85,000. However, at that price no seller is prepared to sell an H-car. Their lowest price for an H-car is 100,000. Consequently, they withdraw the H-cars from the market and only sell L-cars.

Then, however, the probability of getting an L-car is no longer 50%, but instead 100%. Since the buyer realizes this, she is prepared to pay a maximum of 60,000 for a used car, and the L-cars have pushed the H-cars out of the market.

This outcome is not efficient, since there are cars that the buyers have a higher valuation for than the sellers do, but that are not traded.

Signaling and How to Reduce Problems with Adverse Selection

There are several ways to reduce problems with adverse selection:

• *Legislation*. For instance, one could demand that sellers have to reveal the ingredients= of (food) products. Thereby, buyers gain more information and we get less asymmetric information.

• *Demand more information*. Insurers often demand, for instance, a medical examination before selling insurance.

• A firm could acquire a *reputation for quality*. The cost of selling an L-car as if it was an H-car, i.e. lying about the product, would then be too high, since that would damage the reputation. Therefore, the customers know that all the seller's cars are H-cars.

• One could also offer a warranty for the cars. Since the probability that an L-car will break down is much higher than that an H-car will do that, a seller of L-cars cannot offer the guarantee. Thereby the sellers sort themselves into two groups, and for L-cars and one for H-cars.

The last two examples are variants of **signaling**. **Signaling**: A behaviour (sign) that makes it possible to distinguish an agent as being different from others.

The idea with signaling is that the agents themselves signal to which group they belong. It is, of course, not enough that they *say* that they belong to a certain group. It must be a signal that the low-quality group cannot afford, so that truth telling is optimal.

Moral hazard

Moral hazard has to do with asymmetric information after an agreement has been made, for instance after a contract has been signed. We can continue the insurance example from above in the following way: Say that the careful person has managed to convince the insurance firm that she is, indeed, carful. Therefore, she constitutes a low-risk person, and she only has to pay a small premium to get the insurance.

Say that she bought insurance for her bike, and that this guarantees her a new bike if the one she has is stolen. Before she bought insurance, she would have lost the full value of the bike if it had been stolen; now she will only lose the time it takes to get a new one. Consequently, there is much less reason for her to go through the trouble of taking good care of her bike.

Therefore, the risk that the bike is stolen increases and she might now constitute a risk for the insurer that is as big as the careless people are.

Because she has insurance, her risk behaviour has changed to the insurer's disadvantage. She only had to pay a low price since she is careful, but after she got insurance, she is no longer careful and should have had to pay a high price. Since the insurer cannot check if her risk-behaviour has changed, she can take advantage of the firm and offload a larger share of the risk on them than she has paid for.

How to Reduce Problems with Moral Hazard

The classical way to reduce problems with moral hazard in the insurance sector is to demand that the customer keeps a part of the risk. Usually, an insurer demands that the customer pays a certain amount herself, the so-called deductable. Thereby, the risk that she becomes overly careless is reduced.

9. The firm and its organizational and economic bases.

Plan

9.1. The economic nature of the organization

9.2. Types of the firms

The Firm and Its Economic Problem

Million of firms in the world differ in size and in the scope of what they do, but they all perform the same basic economic functions. Each firm is an institution that hires factors of production and organizes those factors to produce and sell goods and services. Our goal is to predict firms' behaviour. To do so, we need to know a firm's goal and the constraints it faces. We start with the goal.

The Firm's Goal

When economists ask entrepreneurs what they are trying to achieve, they get many different answers. Some talk about making a high-quality product, others about business growth, others about market share, and others about the job satisfaction of their workforce, and an increasing number today talk about social and environmental responsibility. All of these goals are pursued by firms, but they are not the fundamental goal: They are the means to that goal. A firm's goal is to maximize profit. A firm that does not seek to maximize profit is either eliminated or taken over by a firm that does seek that goal. What is the profit that a firm seeks to maximize? To answer this question, we'll look at Campus Sweaters, Inc., a small producer of knitted sweaters owned and operated by Cindy.

Accounting Profit

In 2016, Campus Sweaters received $400,000 for the sweaters it sold and paid out $80,000 for wool, $20,000 for utilities, $120,000 for wages, $5,000 for the lease of a computer, and $5,000 in interest on a bank loan. These expenses total $230,000, so the firm had a cash surplus of $170,000. To measure the profit of Campus Sweaters, Cindy's accountant subtracted $20,000 for the depreciation of buildings and knitting machines from the $170,000 cash surplus. Depreciation is the fall in the value of a firm's capital. To calculate depreciation, accountants use Internal Revenue Service rules based on standards established by the Financial Accounting Standards Board. Using these rules, Cindy's accountant calculated that Campus Sweaters made a profit of $150,000 in 2016.

Economic Accounting

Accountants measure a firm's profit to ensure that the firm pays the correct amount of income tax and to show its investors how their funds are being used. Economists measure a firm's profit to enable them to predict the firm's decisions, and the goal of these decisions is to maximize economic profit. Economic profit is equal to total revenue minus total cost, with total cost measured as the opportunity cost of production.

A Firm's Opportunity Cost of Production

The opportunity cost of any action is the highest valued alternative forgone. The opportunity cost of production is the value of the best alternative use of the resources that a firm uses in production. A firm's opportunity cost of production is the value of real alternatives forgone. We express opportunity cost in money units so that we can compare and add up the value of the alternatives forgone. A firm's opportunity cost of production is the sum of the cost of using resources

- Bought in the market
- Owned by the firm
- Supplied by the firm's owner

Resources Bought in the Market

A firm incurs an opportunity cost when it buys resources in the market. The amount spent on these resources is an opportunity cost of production because the firm could have bought different resources to produce some other good or service. For Campus Sweaters, the resources bought in the market are wool, utilities, labour , a leased computer, and a bank loan. The $230,000 spent on these items in 2016 could have been spent on something else, so it is an opportunity cost of producing sweaters.

Resources Owned by the Firm

A firm incurs an opportunity cost when it uses its own capital. The cost of using capital owned by the firm is an opportunity cost of production because the firm could sell the capital that it owns and rent capital from another firm. When a firm uses its own capital, it implicitly rents it from itself. In this case, the firm's opportunity cost of using the capital it owns is called the implicit rental rate of capital. The implicit rental rate of capital has two components: economic depreciation and forgone interest. **Economic Depreciation**

Accountants measure depreciation, the fall in the value of a firm's capital, using formulas that are unrelated to the change in the market value of capital. Economic depreciation is the fall in the market value of a firm's capital over a given period. It equals the market price of the capital at the beginning of the period minus the market price of the capital at the end of the period. Suppose that Campus Sweaters could have sold its buildings and knitting machines on January 1, 2010, for $400,000 and that it can sell the same capital on December

31, 2016, for $375,000. The firm's economic depreciation during 2016 is $25,000 ($400,000 – $375,000). This forgone $25,000 is an opportunity cost of production. Forgone Interest The funds used to buy capital could have been used for some other purpose, and in their next best use, they would have earned interest. This forgone interest is an opportunity cost of production. Suppose that Campus Sweaters used $300,000 of its own funds to buy capital. If the firm invested its $300,000 in bonds instead of a knitting factory (and rented the capital it needs to produce sweaters), it would have earned $15,000 a year in interest. This forgone interest is an opportunity cost of production.

Resources Supplied by the Firm's Owner A firm's owner might supply both entrepreneurship and labour .

Entrepreneurship

The factor of production that organizes a firm and makes its decisions might be supplied by the firm's owner or by a hired entrepreneur. The return to entrepreneurship is profit, and the profit that an entrepreneur earns on average is called normal profit. Normal profit is the cost of entrepreneurship and is an opportunity cost of production. If Cindy supplies entrepreneurial services herself, and if the normal profit she can earn on these services is $45,000 a year, this amount is an opportunity cost of production at Campus Sweaters.

Owner's Labour Services

In addition to supplying entrepreneurship, the owner of a firm might supply labour but not take a wage. The opportunity cost of the owner's labour is the wage income forgone by not taking the best alternative job. If Cindy supplies labour to Campus Sweaters, and if the wage she can earn on this labour at another firm is $55,000 a year, this amount of wages forgone is an opportunity cost of production at Campus Sweaters.

Economic Accounting: The table below summarizes the economic accounting. Campus Sweaters' total revenue is $400,000; its opportunity cost of production is $370,000; and its economic profit is $30,000.

Cindy's personal income is the $30,000 of economic profit plus the $100,000 that she earns by supplying resources to Campus Sweaters.

Decisions

To achieve the objective of maximum economic profit, a firm must make five decisions:

1. What to produce and in what quantities
2. How to produce
3. How to organize and compensate its managers and workers
4. How to market and price its products
5. What to produce itself and buy from others

In all these decisions, a firm's actions are limited by the constraints that it faces. Your next task is to learn about these constraints.

TABLE Economic Accounting

Item		Amount
Total Revenue		**$400,000**
Cost of Resources Bought in Market		
Wool	$80,000	
Utilities	20,000	
Wages	120,000	
Computer lease	5,000	
Bank interest	5,000	$230,000
Cost of Resources Owned by Firm		
Economic depreciation	$25,000	
Forgone interest	15,000	$40,000
Cost of Resources Supplied by Owner		
Cindy's normal profit	$45,000	
Cindy's forgone wages	55,000	$100,000
Opportunity Cost of Production		**$370,000**
Economic Profit		**$30,000**

Information and Organization

Each firm organizes the production of goods and services by combining and coordinating the productive resources it hires. But there is variety across firms in how they organize production. Firms use a mixture of two systems:

- Command systems
- Incentive systems

Command Systems A command system is a method of organizing production that uses a managerial hierarchy. Commands pass downward through the hierarchy, and information passes upward. Managers spend most of their time collecting and processing information about the performance of the people under their control and making decisions about what commands to issue and how best to get those commands implemented. The military uses the purest form of command system. A commander-in-chief (in Uzbekistan, the President) makes the big decisions about strategic goals. Beneath this highest level, generals organize their military resources. Beneath the generals, successively lower ranks organize smaller and smaller units but pay attention to ever-increasing degrees of detail. At the bottom of the managerial hierarchy are the

people who operate weapons systems. Command systems in firms are not as rigid as those in the military, but they share some similar features. A chief executive officer (CEO) sits at the top of a firm's command system. Senior executives who report to and receive commands from the CEO specialize in managing production, marketing, finance, personnel, and perhaps other aspects of the firm's operations. Beneath these senior managers might be several tiers of middle management ranks that stretch downward to the managers who supervise the day-to-day operations of the business. Beneath these managers are the people who operate the firm's machines and who make and sell the firm's goods and services.

Small firms have one or two layers of managers, while large firms have several layers. As production processes have become ever more complex, management ranks have swollen. Today, more people have management jobs than ever before, even though the information revolution of the 1990s slowed the growth of management. In some industries, the information revolution reduced the number of layers of managers and brought a shakeout of middle managers.

Managers make enormous efforts to be well informed. They try hard to make good decisions and issue commands that end up using resources efficiently. But managers always have incomplete information about what is happening in the divisions of the firm for which they are responsible. For this reason, firms use incentive systems as well as command systems to organize production.

Incentive Systems An incentive system is a method of organizing production that uses a market-like mechanism inside the firm. Instead of issuing commands, senior managers create compensation schemes to induce workers to perform in ways that maximize the firm's profit. Selling organizations use incentive systems most extensively. Sales representatives who spend most of their working time alone and unsupervised are induced to work hard by being paid a small salary and a large performance-related bonus. But incentive systems operate at all levels in a firm. The compensation plan of a CEO includes a share in the firm's profit, and factory floor workers sometimes receive compensation based on the quantity they produce.

Mixing the Systems Firms use a mixture of commands and incentives, and they choose the mixture that maximizes profit. Firms use commands when it is easy to monitor performance or when a small deviation from an ideal performance is very costly. They use incentives when it is either not possible to monitor performance or too costly to be worth doing. For example, PepsiCo can easily monitor the performance of workers on a production line. If one person

works too slowly, the entire line slows, so a production line is organized with a command system.

In contrast, it is costly to monitor a CEO. For example, what does Steve Jobs, the CEO of Apple Inc., contribute to Apple's success? This question can't be answered with certainty, yet Apple's stockholders have to put someone in charge of the business and provide that person with an incentive to maximize stockholders' returns. The performance of Apple illustrates a general problem, known as the principal–agent problem.

The Principal–Agent Problem The principal–agent problem is the problem of devising compensation rules that induce an agent to act in the best interest of a principal. For example, the stockholders of Texaco are principals, and the firm's managers are agents. The stockholders (the principals) must induce the managers (agents) to act in the stockholders' best interest. Similarly, Steve Jobs (a principal) must induce the designers who are working on the next generation iPhone (agents) to work efficiently.

Agents, whether they are managers or workers, pursue their own goals and often impose costs on a principal. For example, the goal of stockholders of Citicorp (principals) is to maximize the firm's profit—its true profit, not some fictitious paper profit. But the firm's profit depends on the actions of its managers (agents), and they have their own goals. Perhaps a bank manager takes a customer to a ball game on the pretense that she is building customer loyalty, when in fact she is simply enjoying on-the-job leisure. This same manager is also a principal, and her tellers are agents. The manager wants the tellers to work hard and attract new customers so that she can meet her operating targets. But the workers enjoy conversations with each other and take on-the-job leisure.

Nonetheless, the firm constantly strives to find ways of improving performance and increasing profits.

Coping with the Principal–Agent Problem Issuing commands does not address the principal–agent problem. In most firms, the shareholders can't monitor the managers and often the managers can't monitor the workers. Each principal must create incentives that induce each agent to work in the interests of the principal. Three ways of attempting to cope with the principal–agent problem are

- Ownership
- Incentive pay
- Long-term contracts

Ownership By assigning ownership (or part-ownership) of a business to managers or workers, it is sometimes possible to induce a job performance that increases a firm's profits. Part-ownership is quite common for senior managers

but less common for workers. When United Airlines was running into problems a few years ago, it made most of its employee's owners of the company.

Incentive Pay Incentive pay—pay related to performance—is very common. Incentives are based on a variety of performance criteria such as profits, production, or sales targets. Promoting an employee for good performance is another example of the use of incentive pay.

Long-Term Contracts Long-term contracts tie the long-term fortunes of managers and workers (agents) to the success of the principal(s)—the owner(s) of the firm. For example, a multiyear employment contract for a CEO encourages that person to take a long-term view and devise strategies that achieve maximum profit over a sustained period.

These three ways of coping with the principal–agent problem give rise to different types of business organization. Each type of business organization is a different response to the principal–agent problem. Each type uses a different combination of ownership, incentives, and long-term contracts. Let's look at the main types of business organization.

Types of Business Organization The three main types of business organization are

- Proprietorship
- Partnership
- Corporation

Proprietorship A proprietorship is a firm with a single owner—a proprietor—who has unlimited liability. Unlimited liability is the legal responsibility for all the debts of a firm up to an amount equal to the entire wealth of the owner. If a proprietorship cannot pay its debts, those to whom the firm owes money can claim the personal property of the owner. Businesses of some farmers, computer programmers, and artists are examples of proprietorships. The proprietor makes management decisions, receives the firm's profits, and is responsible for its losses. Profits from a proprietorship are taxed at the same rate as other sources of the proprietor's personal income.

Partnership A partnership is a firm with two or more owners who have unlimited liability. Partners must agree on an appropriate management structure and on how to divide the firm's profits among themselves. The profits of a partnership are taxed as the personal income of the owners, but each partner is legally liable for all the debts of the partnership (limited only by the wealth of that individual partner). Liability for the full debts of the partnership is called joint unlimited liability. Most law firms are partnerships.

Corporation A corporation is a firm owned by one or more limited liability stockholders. Limited liability means that the owners have legal liability

only for the value of their initial investment. This limitation of liability means that if the corporation becomes bankrupt, its owners are not required to use their personal wealth to pay the corporation's debts.

Corporations' profits are taxed independently of stockholders' incomes. Stockholders pay a capital gains tax on the profit they earn when they sell a stock for a higher price than they paid for it. Corporate stocks generate capital gains when a corporation retains some of its profit and reinvests it in profitable activities. So retained earnings are taxed twice because the capital gains they generate are taxed. Dividend payments are also taxed but at a lower rate than other sources of income.

Pros and Cons of Different Types of Firms The different types of business organization arise from firms trying to cope with the principal–agent problem. Each type has advantages in particular situations and because of its special advantages, each type continues to exist. Each type of business organization also has disadvantages. The table below summarizes these and other pros and cons of the different types of firms.

TABLE The Pros and Cons of Different Types of Firms

Type of Firm	Pros	Cons
Proprietorship	■ Easy to set up ■ Simple decision making ■ Profits taxed only once as owner's income	■ Bad decisions not checked; no need for consensus ■ Owner's entire wealth at risk ■ Firm dies with owner ■ Cost of capital and labor is high relative to that of a corporation
Partnership	■ Easy to set up ■ Diversified decision making ■ Can survive withdrawal of partner ■ Profits taxed only once as owners' incomes	■ Achieving consensus may be slow and expensive ■ Owners' entire wealth at risk ■ Withdrawal of partner may create capital shortage ■ Cost of capital and labor is high relative to that of a corporation
Corporation	■ Owners have limited liability ■ Large-scale, low-cost capital available ■ Professional management not restricted by ability of owners ■ Perpetual life ■ Long-term labor contracts cut labor costs	■ Complex management structure can make decisions slow and expensive ■ Retained profits taxed twice: as company profit and as stockholders' capital gains

10.The theory of Production

Plan

10.1. Factors of production.
10.2. Production function.
10.3. Isoquants and isocosts.

A producer uses raw materials, capital, and labour to produce goods and services. Here, we will present a simple model for how they decide how much to produce and which technology to use for the production.

A large part of producer theory is very similar to consumer theory. Basic assumptions for consumer theory are that consumers have a goal to maximize their utility, but that they have restrictions due to limited income and prices. Producers also have a goal. They wish to maximize their profit. They also have restrictions. These are, for instance, the costs of labour and capital; but they also have restrictions regarding the technology of production.

An aspect that will also prove important for a firm is the amount of competition they face: Do they have one, a couple, or many competitors? Alternatively, do they not face any competition at all? We will study different market forms in later chapters.

• The producers have certain restrictions. Primarily because different combinations of **inputs** (labour and capital) have different associated costs.

• The firm operates in a market that, in turn, has certain structures that the firm cannot influence.

• Technology: Different combinations of input produce different quantities of goods.

• We will distinguish between production in the short run and in the long run. In the short run, the quantity of available capital is fixed; in the long run, both labour and capital are variable.

• Given production and restrictions, the producer maximizes her profit.

• Another important question is how large a firm should be. The important concept here is returns to scale. How firm size affects how efficiently it can transform input to output.

The Profit Function

We will use a very simple model of a firm. It produces a single good, and the most important input factors are labour and capital (for instance machines).

The producer has a certain cost, *C*, and a certain **revenue**, *R*. Her profit, p, can then be written as the difference between revenue and cost:

π=R-C

The revenue, in turn, depends on the price of the good and how large quantity she sells,

R=p*q

The costs are, of course, also dependent on how large quantity she produces, but usually in a more complicated way. The profit can therefore be written as

π =p*q-c(q)

where *C(q)* means that the cost, *C*, is a function of the quantity, *q*.

We will analyze each of the three variables, *p*, *q*, and *C*, in the profit function. The price is often set by the market. *C* depends both on the costs of the input factors and the quantity produced. The firm therefore chooses the quantity that maximizes profit. In this chapter, we will analyze production. In Chapter 8, we will look at the costs of production, and in later chapters, we will study different market forms.

The Production Function

The quantity the producer will produce of the single good, depends on the number of working hours, *L* (for Labour), and the amount of capital, *K*, that she uses. *q* is consequently a function of *L* and *K*:

Q=*f* (L,K)

The letter *f* in the expression means that we have a *function* of *L* and *K*. That could mean 'L + K', 'L*K' or 'L2 + 9*ln(K)' to just mention a few arbitrary examples. Which function that is appropriate depends on the technology, which good one produces, etc.

Note that we, of course, assume that the production of *q* units is done in the most efficient way possible. If it, for instance, is possible to produce 10 units of the good using a certain combination of *L* and *K*, it is also possible to produce only 9 units with the same combination. However, that production cannot be efficient, since one is wasting resources that could be used for the production of one more unit.

Average and Marginal Product

Before we begin the analysis, we need to define a few concepts that will be important later on. The **average product** is how much of the good that on average is produced by a certain input, *L* or *K*. We therefore have that the average products, *AP*, for labour and capital, respectively, are

$$\begin{cases} AP_L = \dfrac{q}{L} \\ AP_K = \dfrac{q}{K} \end{cases}$$

Average product: The quantity of goods that, on average, is produced per hour worked or per unit of capital.

The **marginal product**, *MP*, is how much extra quantity that can be produced if one increases the amount of either labour or capital with one unit, keeping the other one constant:

$$\begin{cases} MP_L = \dfrac{\Delta q}{\Delta L} \\ MP_K = \dfrac{\Delta q}{\Delta K} \end{cases}$$

The expression for *MP* is, just as in the case of *MRS*, only approximate. It will also become more and more exact the smaller one chooses ΔK or ΔL.

The Law of Diminishing Marginal Returns

Beside the conclusion that "supply = demand", the law of diminishing marginal returns (or the law of diminishing marginal product) is probably the most frequently cited concept from microeconomics. Suppose we keep everything constant, except for one single input factor, for instance *L*. If we increase the number of hours worked, we will probably produce more. The law of diminishing marginal returns states that the increase will eventually become smaller and smaller when the number of hours worked is large enough.

To use an example: Suppose you start a firm that produces photocopies. You buy a powerful copying machine and you are the only worker. Say that you work one hour per day. You probably will not be able to make many copies during that time. The machine needs fifteen minutes to warm up, you need to prepare things, etc. If you increase the number of hours worked by one hour, you will probably make more copies during the second hour than during the first. Consequently, the marginal product is higher during the second hour than during the first, and over that interval, we therefore have increasing marginal product.

However, if you continue to increase the number of hours, you will eventually not produce many more copies per additional hour. You will become too tired to work. The same thing will happen if you hire other people to work for you: eventually, additional hours or additional workers produce very little additional output. If you, for instance, hire several people, the space will become crowded and the workers will become less efficient.

This “law” is based on experience and speculation, but is not considered particularly controversial. We will use it when we construct the product curve.

Production in the Short Run

It is common to distinguish between the **short run** and the **long run** regarding production. The short run is defined as the time during which (at least) one of the input factors is fixed, usually capital. If the firm, for instance, buys a factory, it may not be able to increase or decrease its size as fast as they would wish. During the time that the firm is stuck with the factory as it is, it amounts to a fixed cost. In the long run, all costs are variable.

We will assume that in the short run, labour is variable but capital is fixed. To make it clear that the quantity of capital is fixed in the short run, one often adds a line above the K in the production function: $q = f(L, \bar{K})$.

The relationship between total production and the number of hours worked can be drawn in a graph. Often, one combines that graph with another graph that shows the marginal product and the average product of labour . We will now show how to construct such a graph.

The Product Curve in the Short Run

If we keep the amount of capital constant, the quantity produced is a just function of the number of hours worked, L. In Figure 7.1, we see a typical product curve with associated average and marginal product curves.

The product curve has a few typical features: In the beginning, when the number of hours worked is low, production increases slowly, and later it becomes steeper and steeper. Eventually it reaches a maximum and thereafter it decreases.

After we have drawn the product curve, we want to construct the curves for the average and marginal product of labour . (The corresponding values for capital are not as interesting, since capital is a fixed cost in the short run.) To do that, we first observe that there is a simple method to find the value of the average product.

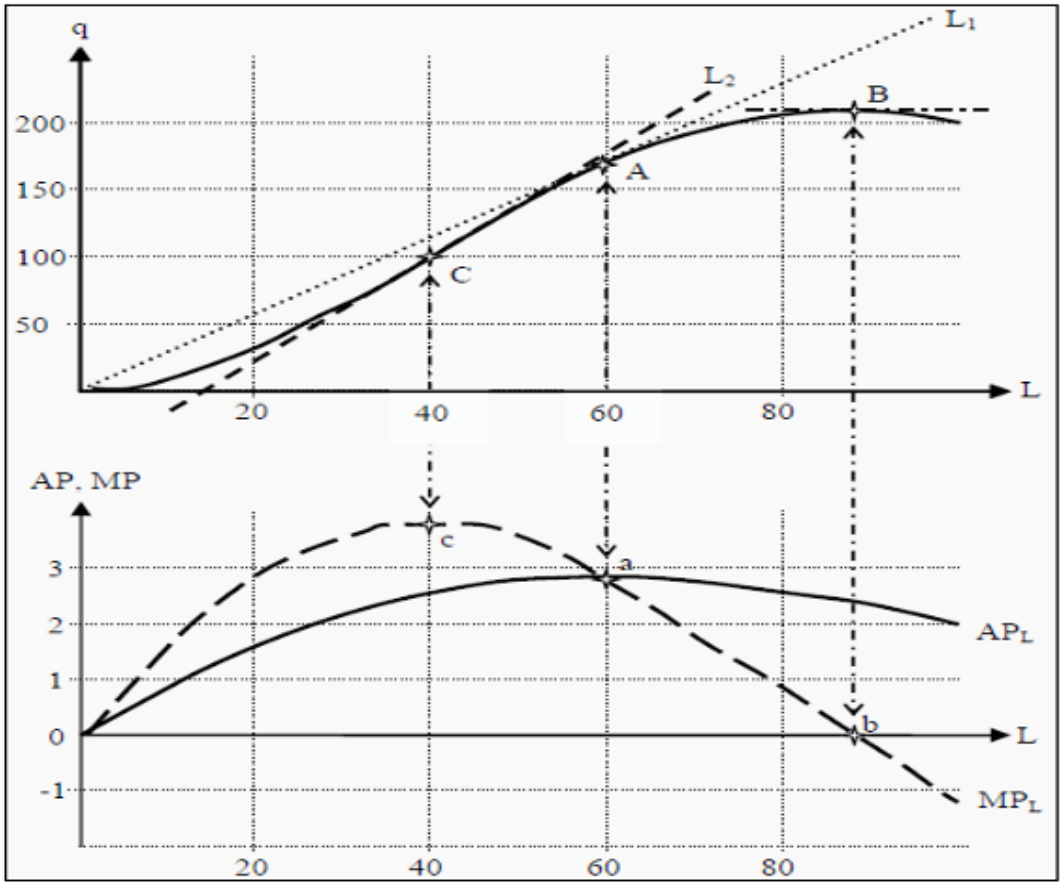


Figure 7.1: The Production Function with Average and Marginal Product

When you have drawn the product curve in the upper part of the graph, you draw a similar diagram below it with the same scale on the X-axis. Now, take a ruler and position it in the upper graph, with one point at the origin (0,0) and another at some point on the product curve, for instance as the line *L1* indicated in the graph. The slope of the ruler will now be equivalent to the average product, *APL*, at that point where the ruler touches the product curve. (That is, *APL* at point A is equivalent to the slope of line *L1*.)

The maximum value of *APL* we get at point A, when L is 60. Indicate a point in the lower graph at $L = 60$, point a. To find the correct value on the Y-axis for point a, we calculate the slope of *L1* in the upper part of the diagram: Point A is at $L = 60$ and $q = 170$, so the slope is 170/60 = 2.83. Point a should then be at (60, 2.83) in the lower diagram. At point a, *APL* reaches its highest value and must consequently slope downwards both to the left and to the right. Draw such a curve and label it "*APL*."

To construct *MPL*, let instead the ruler glide along the product curve in the upper graph so that it indicates the slope of the curve at different points. That way we can see that at point B, when production is at its maximum, the slope must be zero. Consequently, $MPL = 0$ in that point and we indicate the corresponding value for *MPL* in the lower graph, point b.

Then, let the ruler glide along the product curve and note when the slope is as high as possible. In Figure 7.1, that is at point C (when the ruler looks like *L2*). In that point, *MPL* reaches its highest value. Indicate it in the lower graph. It is easy from the upper graph to see that, in this case, the slope of *L2* is higher than the slope of *L1*. Consequently, *MPL* (at point C) must be higher than *APL* (at point A) and point c in the lower graph must be higher than point a.

After that, draw the graph for *MPL*: It must slope downwards both to the left and to the right of *c*. It must also pass through a (where *MPL = APL*) and then through point b. Now, the graph is finished. Note that we have obeyed the law of diminishing marginal returns: To the right in the graph, *MPL* becomes smaller and smaller (and eventually it becomes negative).

Note also that, the two graphs for *MPL* and *APL* in the lower graph are closely related to each other. *MPL* must intersect *APL* in the latter's maximum point. That fact has a purely mathematical reason: To the left of point a, *MPL* > *APL*. That means that when we add one more unit of *L* in that region, we produce exactly *MPL* more units of the good. Since that is more than the average so far, the average must increase. This is true as long as *MPL* > *APL*. To the right of point a, we have that *MPL* < *APL*. That means that if we add one more unit of *L*, we produce *MPL* more units of the good, which here is less than the average so far. Consequently, the average must decrease and *APL* must slope downwards.

Production in the Long Run

In the long run, both labour and capital are variable inputs. That means that the quantity produced is a function of both *L* and *K*, where either of them can be changed, i.e. $q = f(L,K)$ (and not $f(L, K)$.).

It is usually the case that, the same quantity can be produced with different combination of labour and capital. Workers can, at least to some extent, be substituted for machines, and vice versa. This idea can be illustrated in a graph that is very similar to the indifference curves in consumer theory (see Section 3.3). An **isoquant** ("iso" = similar/same; "quant" = quantity) is a curve that shows different combinations of *L* and *K* that produce the same quantity of the single good (still assuming that the production is efficient). They are usually drawn in a way that is similar to indifference curves. Since we have diminishing marginal returns, they must slope less and less steep to the right. In Figure 7.2, you can see an example.

Start by looking at point A. With that combination of labour and capital (*L1*,*K1*), a maximum of $q = 10$ units of the good can be produced. The same quantity could also have been produced with the combination (*L2,K2*), point B. If one wants to increase the production to 23 units, one can choose, for instance,

point C, where both the amount of capital and of labour has been increased. Consequently, one can move from A to C only in the long run.

In the short run, *K* is fixed. If one wants to increase production, one therefore has to choose the same *K*. If one wants to produce 23 units in the short run (assuming we start at point A), one has to choose the combination *(L4,K1)*, point D, and if one wants to produce 41 units, one has to choose the combination *(L5,K1)*, point E.

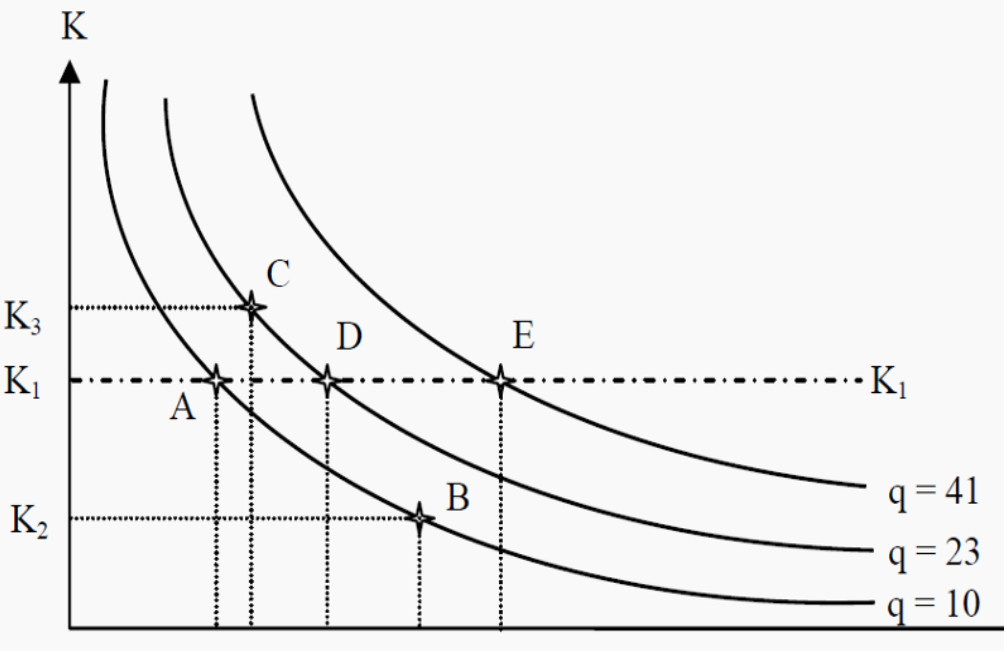


Figure 7.2: An Isoquant Map

Note that:

• Isoquants further away from the origin correspond to larger quantities.

• The isoquants cannot cross each other.

• The isoquants slope downwards.

• The extreme cases of isoquants are, just as for indifference curves, straight lines and L-shapes.

The Marginal Rate of Technical Substitution

From the isoquants in the previous section, one can derive the **marginal rate of technical substitution**, *MRTS*. The *MRTS* corresponds to the marginal rate of substitution, *MRS*, from consumer theory. **Marginal rate of technical substitution**: The amount of capital one has to add to producti if one reduces labour with one unit but still wishes to produce the same quantity. Corresponds to the slope of the isoquant curve.

MRTS can *approximately* be calculated as

$$MRTS = \frac{\Delta K}{\Delta L}$$

Since the curves slope downwards, if ΔK is positive then ΔL must be negative, and vice versa. That means that *MRTS* is a negative number. By convention, however, the minus sign is often omitted.

The Marginal Rate of Technical Substitution and the Marginal Products

There is an important relation between *MRTS* and the marginal products of labour and capital. As we have seen, $MPL = \Delta q/\Delta L$, which means that if we increase the amount of hours worked with ΔL, production will increase with $\Delta q = MPL * \Delta L$. Similarly, for capital we have that $MPK = \Delta q/\Delta K$, so if we use one unit less of capital, production decreases with $\Delta q = MPK * \Delta K$. For instance, if the marginal product of labour , *MPL*, is 3 and we add 1 more hour of labour , we will produce 3*1 = 3 units more of the good.

Let us combine these two observations in the following way: Suppose that you are on an isoquant, for instance in point B in Figure 7.2. If you increase labour with ΔL, production will increase with $\Delta q = MPL * \Delta L$. However, suppose that you at the same time decrease your use of capital *exactly so much* that you still produce the same quantity as you did in point B. Then the total change in *q* must be zero. We can express this as

$$\begin{cases} MP_L * \Delta L = \Delta q \\ MP_K * \Delta K = -\Delta q \end{cases}$$
$$MP_L * \Delta L + MP_K * \Delta K = 0$$

If we rearrange the last expression, we can get an alternative expression for *MRTS* (see the previous section):

$$-\frac{MP_L}{MP_K} = \frac{\Delta K}{\Delta L} = MRTS$$

The marginal rate of technical substitution, *MRTS*, which, by definition, equals (minus) the change in capital divided by the change in labour , also equals one marginal product divided by the other. Note that on the left-hand side, we have the marginal product of labour in the numerator but in the middle, we have ΔL in the denominator.

Returns to Scale

Suppose that, using labour *L* and capital *K*, we produce the quantity *q* of a good. If we would double both *L* and *K*, we would probably increase the quantity produced as well, but by how much? If q is also doubled, we have constant **returns to scale** (we can think of this as that the *scale* is the same for *(L,K)* and *q*). **Returns to scale**: By how much does the quantity change if one changes the inputs? If instead *q* increases by less than two times, we have

decreasing returns to scale, and if it increases by more we have increasing returns to scale.

More generally, we increase L and K by a factor t, and then check if q increases by more, less, or by the same factor. We can express this as

f(t*L,t*K) < t*f(L,K)	Decreasing returns to scale
f(t*L,t*K) = t*f(L,K)	Constant returns to scale
f(t*L,t*K) > t*f(L,K)	Increasing returns to scale

Look again at the expressions above: *f(L,K)* is the quantity produced from the start. We introduced this same expression in Section 7.2. *f(t*L,t*K)* is the quantity produced if you increase both K and L by the factor t. Then you ask if you get more, less, or the same as t times the production you had from the beginning, i.e. *t*f(L,K)*.

There can be different reasons why we get different returns to scale. For instance:

• *Constant returns to scale*. Suppose we have a factory that produces a certain quantity of a good. Then we build another factory that has the same size and that uses the same number of workers, so that we now have two factories. It seems reasonable to assume that the second factory produces the same quantity as the first one does. This means that, as we double the inputs we also double the output.

• *Decreasing returns to scale*. Suppose it becomes more and more difficult to coordinate the production as the size increases, so that we get higher and higher costs for administration. Then the costs will increase proportionally more than the production, and the production will grow by less than the inputs.

• *Increasing returns to scale*. Oftentimes, large firms are more efficient than small firms are. This is called *large-scale advantages*.

11. Production Costs

Plan

11.1. Types of production costs.
11.2. Production Cost in the Long Run
11.3. The Relation between Long-Run and Short-Run Average Costs

So far, we have only studied how different combinations of inputs produce different quantities of a good. Now, we will instead look at the cost of production. As before, we distinguish between the short and the long run.

When we study costs, it is important that we use the *opportunity cost* as measure, i.e. the cost of using our resources equals how much they had been worth if we had instead used them for the best alternative.

One reason for studying the cost side is that we want to find the cheapest way of producing a good. However, there is also another reason. The relationship between output and cost play an important role for which type of market that will arise: how many firms will there be, and how high the price will be relative to the cost of production. That question we will return to in later chapters.

Production Costs in the Short Run

In the short run, not all input factors are variable. We therefore distinguish between fixed cost, *FC*, and variable cost, *VC*. Total cost, *TC*, is the sum of the two:

TC=VC+FC

We also need to define a few other central concepts. Regarding average cost, we will have use for the averages of all three of the above. If we divide each of them with *q*, we get average total cost, *ATC*, average variable cost, *AVC*, and average fixed cost, *AFC*:

$$\begin{cases} ATC = \dfrac{TC}{q} \\ AVC = \dfrac{VC}{q} \\ AFC = \dfrac{FC}{q} \end{cases}$$

Note that the following must hold:

ATC=AVC+AFC

The marginal cost, *MC*, in turn, measures the cost of producing one more unit of the good:

$$MC = \frac{\Delta TC}{\Delta q} = \left[\frac{\Delta(VC + FC)}{\Delta q} = \right] \frac{\Delta VC}{\Delta q}$$

Note that we can use either the change in total cost or the change in variable cost. Both must give the same answer, since the fixed cost does not change ($\Delta FC = 0$). As before, the expression for marginal change is only an approximation.

Now, we will construct a graph to illustrate these different measures of costs (see Figure 8.1). The fixed cost, *FC*, is constant, independent of how many units we produce, so the curve illustrating *FC* must be a horizontal line. Total cost, *TC*, must always increase with production; else, the production is not efficient. Furthermore, since if we produce nothing *TC* must equal *FC*, the curve for *TC* must start in the same point as *FC* on the Y-axis. Since $TC = VC + FC$, the curve for variable cost, *VC*, must have the same shape as *TC*. Obviously, *VC* of producing nothing is zero, so the curve for *VC* must start at the origin.

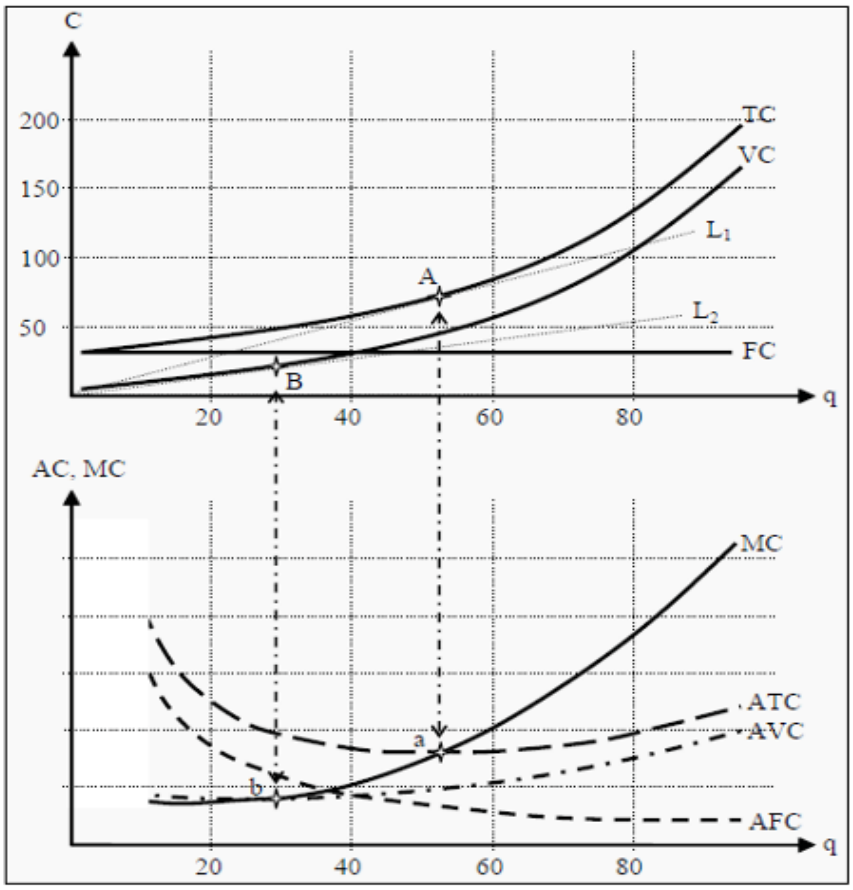


Figure 8.1: The Cost Function with Average and Marginal Costs

Using the curves we have drawn in the upper part of the figure, we will now construct the ones in the lower part, i.e. *ATC*, *AVC*, *AFC*, and *MC*. First, we

use the same technique as we did in Section 7.3.1. Lay a ruler in the upper part of the figure such that it has one point at the origin and another point on the *TC* curve. Find the point on *TC* where the ruler has the smallest slope. In the figure, this corresponds to line *L1* and point A. You have now found the smallest possible average cost, *ATC*. Proceed in the same way to find the point on *VC* where the ruler has the smallest slope: the line *L2* and point B. That point corresponds to the lowest possible average variable cost, *AVC*.

Draw the two curves for *ATC* and *AVC* in the lower part of the figure. Of course, *ATC* must lie above *AVC*. *ATC* should have its lowest point at a, and *AVC* at b. If you wish to find the numerical value for, for instance, point a, then read off the location of point A in the upper part of the figure: (53,75). Then calculate 75/53 = 1.4. Point a should then be at (53,1.4).

You can now also draw *MC* in the lower part of the figure. It must run through both point a and point b (for the same reasons as in Section 7.3.1) and it should correspond to the slope of *TC* (or *VC*, since it has exactly the same slope) in the upper part of the figure. Note that, since the slope of *TC* becomes higher and higher, *MC* should increase as we move to the right. Lastly, *AFC* must become smaller and smaller the more products we produce, since *FC* is a constant and we divide with an increasingly higher quantity, *q*.

Production Cost in the Long Run

In the long run, both labour and capital are variable. That allows us to, in a way similar to the budget line in consumer theory, construct the so-called **isocost lines** ("iso" = similar/same). If the price of one hour of work is *w* (for wage) and the price of one unit of capital is *r* (for rental rate), an isocost line is defined as all combinations of *L* and *K* that cost the same:

Isocost line: All combinations of inputs that cost the same

w*L+r*K=C

Solving this expression for *K*, we get

$$K = \frac{C}{r} - \frac{w}{r} * L.$$

For the time being, we assume that the prices of labour and capital are given. If we insert a few different values for *C*, we can draw a few isocost lines, for instance the lines *C1*, *C2*, and *C3* in Figure 8.2. Similar to the budget line, the slope of the isocost line depends on the value of *w/r*, and the easiest way to draw the budget line is to find the points on the X- and Y-axes where one buys only labour or capital. One can, for instance, calculate *C1*/*r*, indicate that value on the Y-axis, and *C1*/*w*, and indicate that value on the X-axis. Then draw a

straight line between the two points to get all combinations of L and K that cost $C1$.

Now, you can probably see where we are heading. In Figure 8.2 we have also drawn an isoquant (see Section 7.4), and in point A, the isoquant just barely touches one of the isocost lines, $C2$. If we are prepared to pay the cost $C2$, then $q = 23$ is the maximum quantity we can possibly produce. We do that by choosing the quantities L^* and K^* of labour and capital, respectively.

Note that we can also reason the other way around. If we want to produce 23 units, then the lowest cost we can possibly do that at is $C2$. The optimal choices of inputs are then L^* and K^*. For a production of exactly 23 units of the good, all other combinations of L and K are either inefficient or do not produce enough of the good.

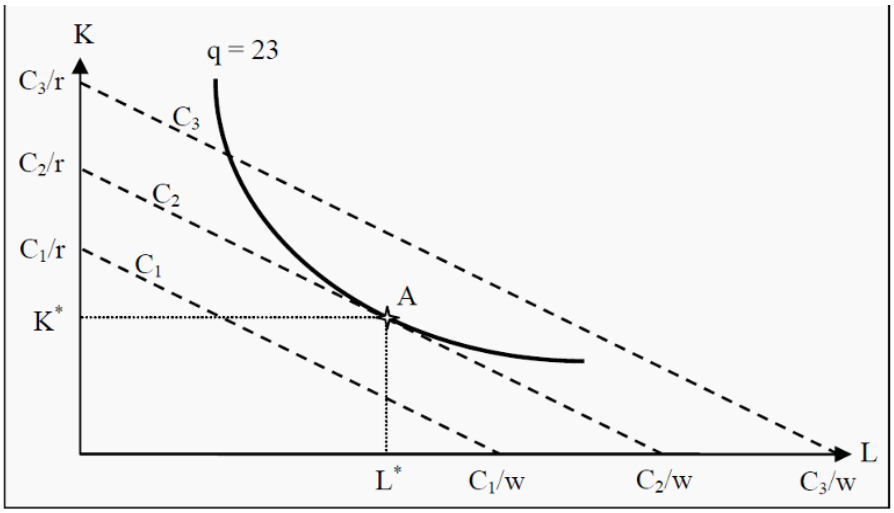


Figure 8.2: Isocost Lines

Just as we did in consumer theory, we can give a mathematical formulation of the result. At the point of tangency, the isoquant and the isocost line must have the same slope. The slope of the isocost line is $-w/r$ and the slope of the isoquant is the marginal rate of technical substitution, MRTS. At the point of tangency, we must then have that

$$-\frac{w}{r} = MRTS \left[= -\frac{MP_L}{MP_K} = \frac{\Delta K}{\Delta L} \right]$$

Note that, if one uses the convention to omit the minus sign in front of $MRTS$, one must also do so in front of w/r. As a reminder, we have also included how we found $MRTS$ earlier.

It is important to understand how to interpret this criterion. If we rearrange the expression, we can get

$$\frac{MP_K}{r} = \frac{MP_L}{w}$$

Remember that *MPK* is the number of additional units we produce if we add one more unit of capital, while holding everything else constant. *MPL* is the same for one more unit of labour. *MPK*/*r* is then the number of additional units we get per dollar (or other currency), if we use one more unit of capital. *MPL*/*w* is the number of additional units we get per dollar if we use one more unit of labour (work one more hour). At the optimal point, these two must be equal, and the producer is then indifferent between using labour and using capital.

If we repeat the procedure for finding the optimal point for many different isocost lines and isoquants, we will trace out a curve that shows all efficient combinations of labour and capital. This is the so-called **expansion path**. **Expansion path**: How much one can produce at different costs. From that curve, it is possible to derive the long-run cost of production. (Compare to the income-consumption curve and the Engel curve)

Look at Figure 8.3. In the upper part of the figure, we have drawn three isocost lines, *C1*, *C2*, and *C3*, and then found the points on each of them where an isoquant just about touches them. The three points are A, B, and C where the produced quantities are 100, 300, and 500 units of the good. If we had done this for all possible costs, we would have gotten the long-run expansion path. We see that, for a cost of *C1* we can produce a maximum of 100 units, for *C2* a maximum of 300 units, and for *C3* a maximum of 500 units. In the lower part of the figure, we have indicated those combinations at points D, E, and F, and then drawn a line through them. That line is the long-run cost of production. Note that the line must start at the origin, since the long-run cost of producing nothing is zero.

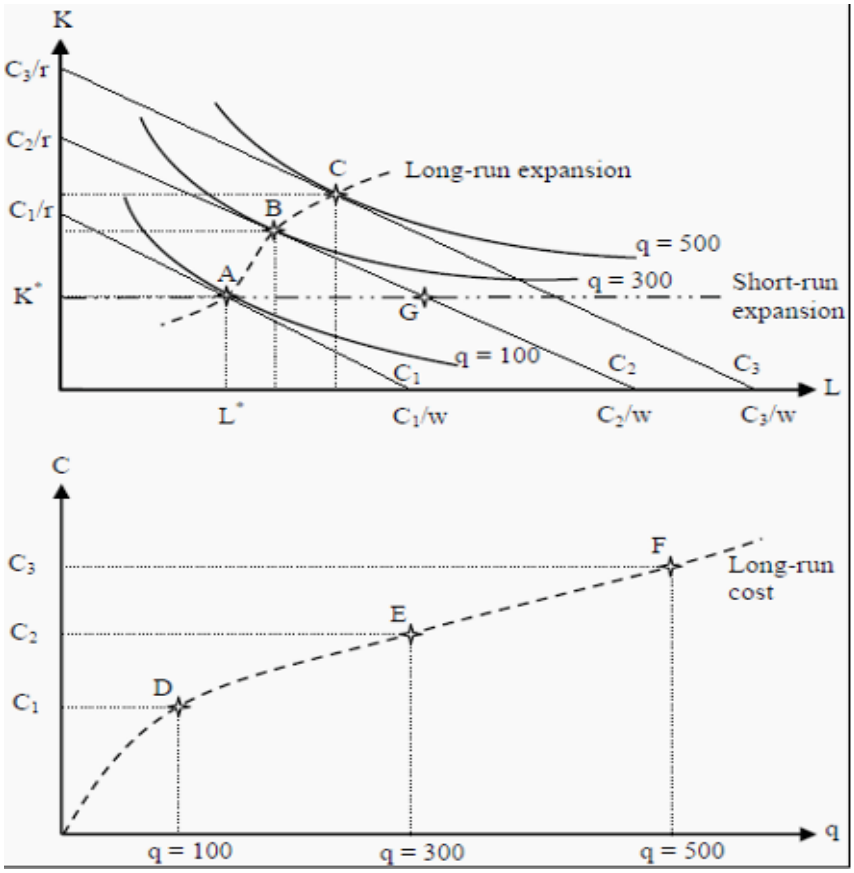


Figure 8.3: Derivation of the Long-Run Cost Curve and the Expansion Path

In Figure 8.3, we have also drawn the short run expansion path. In the short run, the quantity of capital is fixed, K^*. In the diagram, that amount of capital is optimal for a production of 100 units. That can be seen from the fact that the isocost line *C1* touches the isoquant $q = 100$ in point A where the amount of capital is K^*. If we want to produce more than 100 units in the short run, we must do that using only additional labour , i.e. the expansion must follow the short-run expansion path. At point G, the cost of production is as high as at point B, but the number of produced units must be smaller since the isoquant $q = 300$ is further from the origin than point G. When one chooses the long-run amount of capital to use, one does so under the assumption that the production in the short run will be optimal at precisely that amount. In the diagram, one has chosen K^* because one believed that, in the short run one will produce 100 units. For other quantities, K^* is not an efficient choice.

The Relation between Long-Run and Short-Run Average Costs

As we saw above, the short-run cost of production must always be higher than the long-run cost, except for at one certain point where they are the same. In Figure 8.3 the short-run cost and the long-run cost of producing 100 units is the same, given that one has chosen an amount of capital equal to K^*. For every

other choice of capital, it is more expensive to produce 100 units in the short run than in the long run.

If this is true about the cost, it must also be true about the average cost, i.e. the long-run average cost must always be smaller than the short-run average cost, except for at one point where they are the same. If we draw a few different curves for short-run average costs, where each curve is valid for different long-run investments in capital, we get a picture as the one in Figure 8.4.

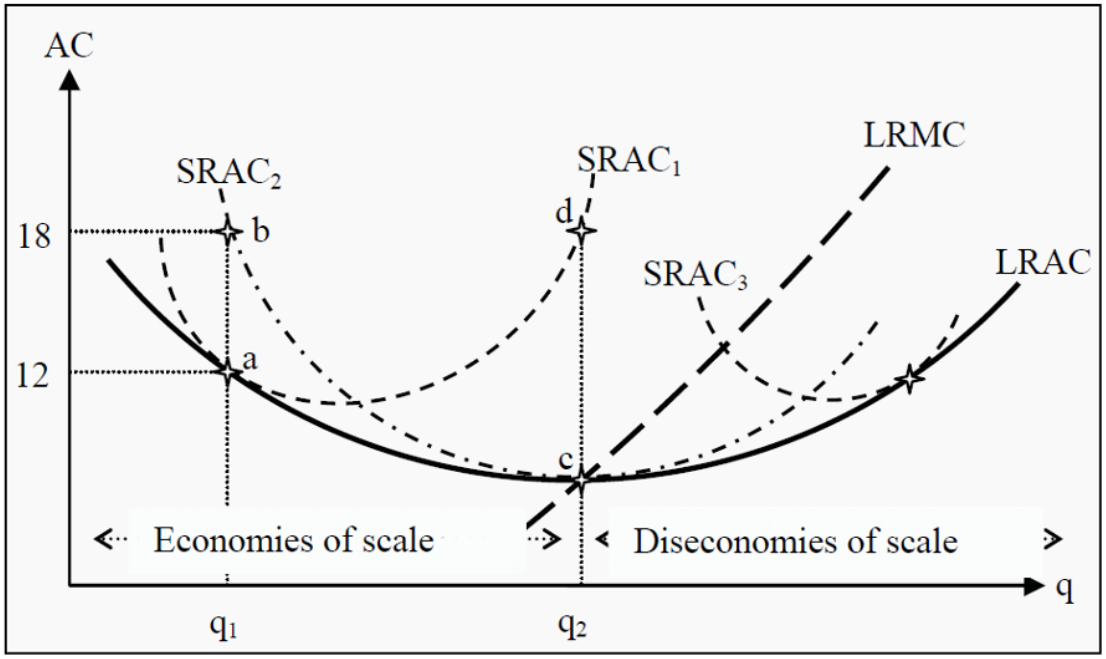


Figure 8.4: Long-Run and Short-Run Average Costs

We have three different short-run average cost curves, *SRAC1*, *SRAC2*, and *SRAC3* (Short Run Average Cost) and one long-run average cost curve, *LRAC* (Long Run Average Cost). Each *SRAC* curve has one point where it is optimal in the long run as well. For example, *SRAC1* is optimal at point a, where it touches *LRAC* and the average cost is 12. If one had instead chosen a different amount of capital, for instance, such that one would have been constrained to *SRAC2*, one would have ended up at point b if one wanted to produce the quantity q1. Average cost would then have been 18. *SRAC2* is instead long-run optimal if one wants to produce *q2*.

If one takes all such points where the short-run average cost is optimal, i.e. for all possible *SRAC* curves, not just the ones drawn here, one will get the curve for the long-run average cost, *LRAC*. Just as the short-run marginal cost curves must intersect the *SRAC* curves at their lowest points, the long-run marginal cost curve, *LRMC*, must intersect *LRAC* at its lowest point.

The *LRAC* curve in Figure 8.4 has another interesting property. To the left of the quantity *q2*, *LRAC* slopes downwards (towards *q2*), but to the right it

slopes upwards. That means that the lowest cost per unit of the good is achieved at the quantity q2 and at point c in the diagram. To the left of *q2*, we have **economies of scale** and to the right we have **diseconomies of scale**. **Economies of scale**: The more one produces, the lower is the cost per unit. Diseconomies of scale: The more one produces, the higher is the cost per unit. Note that this can be very important if there is competition in the market. If the firm is at a point to the left of *q2*, it can lower its cost per unit by increasing the scale of production. In the next step, it can undercut the price of its competitors.

12. Profit maximizing firm in short run in a competitive market

Plan

12.1. Perfect Competition
12.2. Profit maximizing firm in short run
12.3. Short-Run Equilibrium

So far, we have discussed how the consumers make their decisions, and what the producers' production possibilities and cost of production look like. The consumers often take prices as given and choose quantities based on the prices. The question is how prices arise. One factor is, of course, the cost of production. The price cannot be below the cost, at least not in the long run. The price is, however, very dependent on the structure of the market. Among the most important questions one can ask about the market structure are:

• The degree of **concentration** of buyers and sellers. Do we have many, a few, or one?

• The degree of **product differentiation**. Are the products identical to each other, or how different are they from each other?

• Are there any **barriers to entry** in the market?

The answers to these questions largely determine which kind of market we get, and this, in turn, largely determines the price. In this chapter, we will look at one type of market, a perfectly competitive market. In later chapters, we will look at other market forms.

Conditions for Perfect Competition

For a market to be perfectly competitive, it has to fulfill the following conditions:

• All agents are **price takers**. No single buyer or seller can affect the price of the good. Everyone takes the price as given, and, depending on the price, decides about quantity. This condition will be true if there are many small buyers and sellers.

• **Homogenous products**. Each seller's products are identical to every other seller's products. Furthermore, there are no extra costs, such as transportation costs, for some sellers. The buyers are therefore neutral between different sellers.

• All factors of production are completely variable. There are no barriers to entry for new firms or barriers to leave for existing firms.

• All buyers and sellers have complete information about existing alternatives in the market.

• There are no agreements to collude in the market. For instance, the sellers cannot form a **cartel**. **Cartel** is several producers who cooperate on prices or quantities.

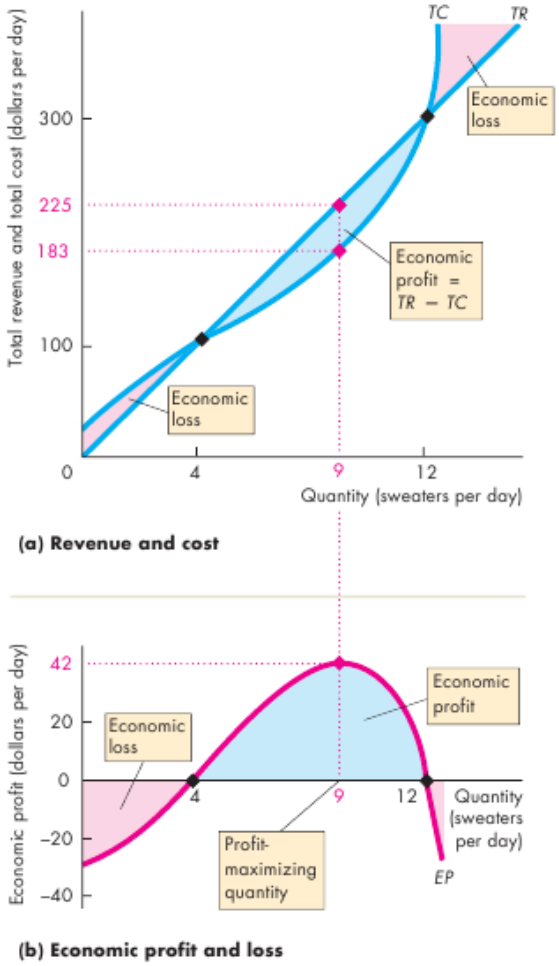
These conditions are hard to satisfy and few, if any, real markets do that. Even so, the model is very informative and delivers several interesting results. Furthermore, many economists are highly in favour of competition and some of the most important reasons for that will be revealed as we use this model.

The Firm's Output Decision A firm's cost curves (total cost, average cost, and marginal cost) describe the relationship between its output and costs. And a firm's revenue curves (total revenue and marginal revenue) describe the relationship between its output and revenue. From the firm's cost curves and revenue curves, we can find the output that maximizes the firm's economic profit. Figure below shows how to do this for Campus Sweaters. The table lists the firm's total revenue and total cost at different outputs, and part (a) of the figure shows the firm's total revenue curve, TR, and total cost curve, TC. These curves are graphs of numbers in the first three columns of the table.

Economic profit equals total revenue minus total cost. The fourth column of the table in Fig. shows the economic profit made by Campus Sweaters, and part (b) of the figure graphs these numbers as its economic profit curve, EP.

Campus Sweaters maximizes its economic profit by producing 9 sweaters a day: Total revenue is $225, total cost is $183, and economic profit is $42. No other output rate achieves a larger profit. At outputs of less than 4 sweaters and more than 12 sweaters a day, the Campus Sweaters would incur an economic loss. At either 4 or 12 sweaters a day, the Campus Sweaters would make zero economic profit, called a break-even point.

FIGURE Total Revenue, Total Cost, and Economic Profit



Quantity (*Q*) (sweaters per day)	Total revenue (*TR*) (dollars)	Total cost (*TC*) (dollars)	Economic profit (*TR* − *TC*) (dollars)
0	0	22	−22
1	25	45	−20
2	50	66	−16
3	75	85	−10
4	100	100	0
5	125	114	11
6	150	126	24
7	175	141	34
8	200	160	40
9	**225**	**183**	**42**
10	250	210	40
11	275	245	30
12	300	300	0
13	325	360	−35

The table lists Campus Sweaters' total revenue, total cost, and economic profit. Part (a) graphs the total revenue and total cost curves and part (b) graphs economic profit.

Campus Sweaters makes maximum economic profit, $42 a day ($225 – $183), when it produces 9 sweaters a day. At outputs of 4 sweaters and 12 sweaters a day, Campus Sweaters makes zero economic profit—these are break-even points. At outputs less than 4 sweaters and greater than 12 sweaters a day, Campus Sweaters incurs an economic loss.

Marginal Analysis and the Supply Decision

Another way to find the profit-maximizing output is to use marginal analysis, which compares marginal revenue, MR, with marginal cost, MC. As output increases, the firm's marginal revenue is constant but its marginal cost eventually increases. If marginal revenue exceeds marginal cost (MR > MC), then the revenue from selling one more unit exceeds the cost of producing it and an increase in output increases economic profit. If marginal revenue is less than marginal cost (MR < MC), then the revenue from selling one more unit is less than the cost of producing that unit and a decrease in output increases economic profit. If marginal revenue equals marginal cost (MR = MC), then the revenue from selling one more unit equals the cost incurred to produce that unit. Economic profit is maximized and either an increase or a decrease in output decreases economic profit.

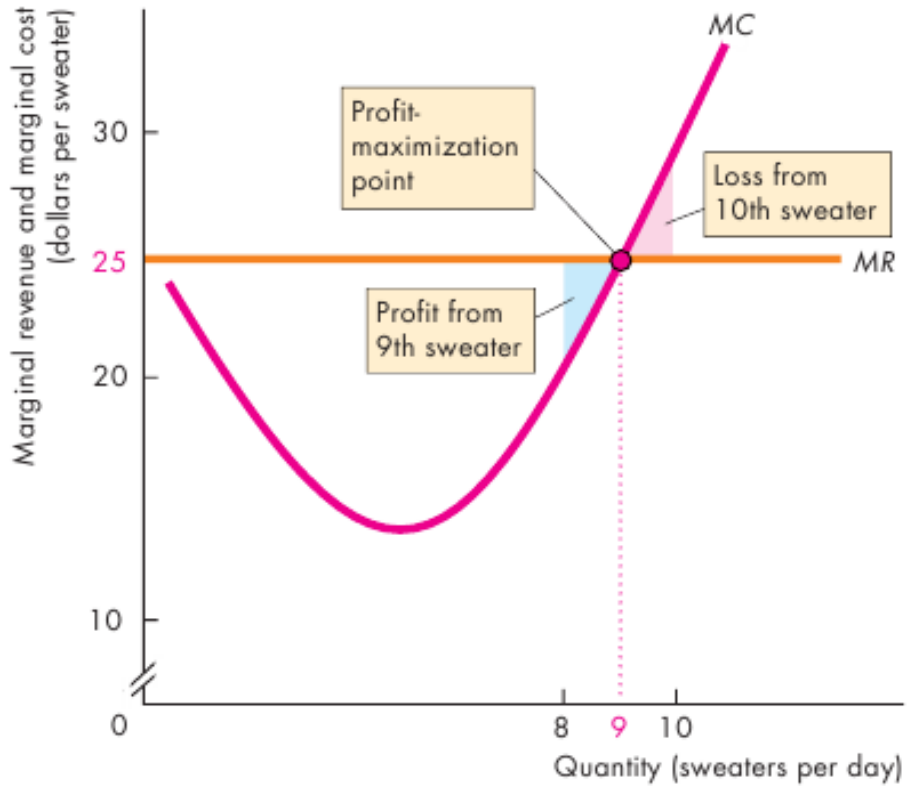
Figure below illustrates these propositions. If Campus Sweaters increases its output from 8 sweaters to 9 sweaters a day, marginal revenue ($25) exceeds marginal cost ($23), so by producing the 9th sweater economic profit increases

by $2 from $40 to $42 a day. The blue area in the figure shows the increase in economic profit when the firm increases production from 8 to 9 sweaters per day.

If Campus Sweaters increases its output from 9 sweaters to 10 sweaters a day, marginal revenue ($25) is less than marginal cost ($27), so by producing the 10th sweater, economic profit decreases. The last column of the table shows that economic profit decreases from $42 to $40 a day. The red area in the figure shows the economic loss that arises from increasing production from 9 to 10 sweaters a day. Campus Sweaters maximizes economic profit by producing 9 sweaters a day, the quantity at which marginal revenue equals marginal cost. A firm's profit-maximizing output is its quantity supplied at the market price. The quantity supplied at a price of $25 a sweater is 9 sweaters a day. If the price were higher than $25 a sweater, the firm would increase production. If the price were lower than $25 a sweater, the firm would decrease production. These profit-maximizing responses to different market prices are the foundation of the law of supply:

Other things remaining the same, the higher the market price of a good, the greater is the quantity supplied of that good.

FIGURE Profit-Maximizing Output



Quantity (*Q*) (sweaters per day)	Total revenue (*TR*) (dollars)	Marginal revenue (*MR*) (dollars per additional sweater)	Total cost (*TC*) (dollars)	Marginal cost (*MC*) (dollars per additional sweater)	Economic profit (*TR* – *TC*) (dollars)
7	175	25	141	19	34
8	200	25	160	23	40
9	**225**	25	**183**	27	**42**
10	250	25	210	35	40
11	275		245		30

The firm maximizes profit by producing the output at which marginal revenue equals marginal cost and marginal cost is increasing. The table and figure show that marginal cost equals marginal revenue and economic profit is maximized when Campus Sweaters produces 9 sweaters a day. The table shows that if Campus Sweaters increases output from 8 to 9 sweaters, marginal cost is $23, which is less than the marginal revenue of $25. If output increases from 9 to 10 sweaters, marginal cost is $27, which exceeds the marginal revenue of $25. If marginal revenue exceeds marginal cost, an increase in output increases economic profit. If marginal revenue is less than marginal cost, an increase in output decreases economic profit. If marginal revenue equals marginal cost, economic profit is maximized. **Profit Maximizing Production in the Short Run**

The goal of an individual firm is to maximize its profit, i.e. the difference between revenues and costs. In the short run, it does that under the restriction that it cannot change the amount of capital.

We will now study the short-run production in a diagram. In the upper part of the diagram in Figure 9.1, we have drawn the **total cost**, *TC*, **total revenue**, *TR*, and the **profit**, p = *TR* - *TC*. Since the firm cannot influence the price in a perfectly competitive market, *TR* will simply be a straight line with a slope equal to *p* (the price). This is since each additional unit of the good it sells will yield an income of *p*. The shape of *TC* is often more complicated (see Section 8.1)

Total cost: The total cost of producing a certain quantity of a good.

Total revenue: The total income from selling a certain quantity of a good.

Profit: The difference between revenue and cost.

The goal is to maximize the profit, which in the graph occurs at a quantity of q = 78 units, where the profit is 41. (This is the point where p reaches its maximum.) As profit is the difference between revenues and costs, the difference between *TR* and *TC* is at a maximum here: 172 - 131 = 41.

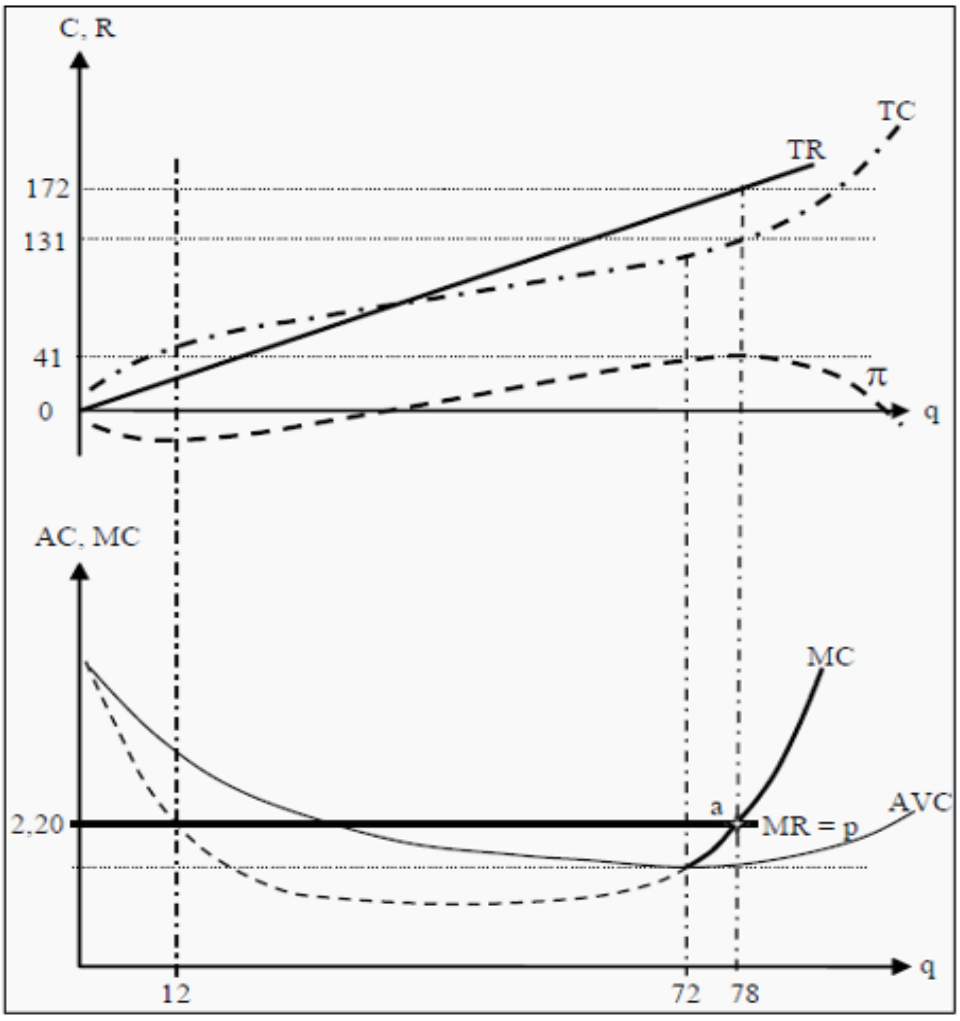


Figure 9.1: Profit Maximization under Perfect Competition

In the lower part of the diagram, we have drawn the **marginal revenue**, *MR*, the price, *p*, the **marginal cost**, *MC*, and the average variable cost, *AVC*. **Marginal revenue**: The additional income a firm receives if it sells one more unit. **Marginal cost**: The additional cost a firm incurs if it produces one more unit. *MR* corresponds to the slope of *TR*, which we argued must be equal to *p*. In other words, if we sell one more unit of the good, we receive an additional income equal to the price, *p*. Therefore, *MR* is equal to *p*.

In point a, the *MC* curve intersects the *MR* curve. This is a condition for profit maximization. To see why, think about what would happen if we sold one unit more or one unit less than 78. If we had produced and sold one unit more, we would have incurred a cost of *MC*, but we had only received an income of

MR. And *MR* < *MC*, so we had reduced profit. Conversely, if we had produced one unit less, we would have saved the production cost of that unit, *MC*, but we would also have lost the revenue from selling it. Moreover, to the left of 78, *MR* > *MC*, so we had reduced profit that way as well. Therefore, 78 is indeed the best choice we can make. The condition for profit maximization is:

MR(q*)=MC(q*)

The firm, consequently, chooses the quantity, q^*, that makes *MR* = *MC*. Note that, at the quantity 78 in the figure, *TR* and *TC* have the same slope. That is the same thing as *MR* = *MC*.

Strategy to Find the Optimal Short-Run Quantity

We can summarize the strategy for finding the point where the firm maximizes its short-run profit in a few steps:

• Find the point where *MC* = *MR* and where the *MC* curve is increasing.

• Is that point above (or equal to) *AVC*, i.e. is $p = MR \geq AVC$? In that case, choose to produce the corresponding quantity.

• In the opposite case, i.e. if $p = MR < AVC$, choose to produce nothing at all; $q = 0$. The condition $p = MR < AVC$ is called the **shut down condition**. **Shut down condition**: The condition under which it is better to produce nothing rather than produce something: MR < AVC.

Note that (as in the first bullet point) the *MC* curve must be increasing. In Figure 9.1, we can see that the *MC* curve also intersects the *MR* curve at the quantity $q = 12$, but there the *MC* curve is decreasing. That point instead maximizes the loss!

Also, note for bullet points 2 and 3, the reasoning behind the condition $MR \geq AVC$: Since we are looking at the short run, the fixed cost, *FC*, cannot be changed. The firm can always choose to produce nothing. If it does so, it receives no revenues and incurs no variable costs, but it will still incur the total fixed cost, *FC*. Total profit will then be a loss of $-FC$. This means that the firm will choose to produce as long as it can at least recover some of that loss. Moreover, the firm will do so as long as the price, and therefore *MR*, is larger than or as large as *AVC*.

In the short run, the firm can consequently accept to produce at a (small) loss, since the loss will be smaller than if one chooses to shut down production completely. If instead $MR < AVC$, the revenues from additional units sold cannot even cover the average variable cost of producing them. Then it is better to shut down.

The Firm's Short-Run Supply Curve

What happens if the market price changes? Then *MR* changes, and the point of intersection between *MR* and *MC* also changes. The firm will then

choose to produce the quantity that corresponds to the new point of intersection, so the quantity supplied follows the *MC* curve as the price changes.

However, this is only true as long as the price is higher than *AVC*. To see why, look at the shut down condition above again. Suppose the market price falls to the point where the MC curve intersects the *AVC* curve, i.e. at the quantity q =72 in the figure. At that point, MR = p = MC = AVC and the profit becomes q*(p - AVC) - FC = 72*0 - FC = - FC. Note that p – AVC is what the firm gets paid in excess of average variable cost for each unit it sells; q*(p - AVC) is then what it gets paid in excess of average variable cost for all units it sells; finally, subtracting FC yields what it gets paid in excess of all costs (= profit). The loss is consequently as large as if we choose to produce nothing at all. If the price falls even more, the losses increase and it is better to produce nothing. The conclusion of this is that, the firm's short-run supply curve is the part of the *MC* curve that lies above *AVC*, i.e. the part that is drawn with a full line in the lower part of Figure 9.1.

The Market's Short-Run Supply Curve

The market is the sum of all individual firms. We get the market's supply curve by summing all individual firms' supply curves horizontally.

Short-Run Equilibrium

In Figure 9.2, we have summarized the equilibrium in the market and the equilibrium for an individual representative firm. To the right in the figure, we have the individual firm's *MC-, ATC-,* and *AVC* curves. The short-run supply curve of the firm is the part of the *MC* curve that is above *AVC*. For prices below *pmin*, there is consequently no supply at all. If we sum all firms' supply curves, we get the market's supply curve, S, to the left in the figure. *(Σ(MC)* means "the sum of all *MC* curves.")

In the market, supply meets demand, *D*, and an equilibrium price, p^*, and an equilibrium quantity, Q^*, arise. p^* is the price that the individual firm receives for each unit of the good it sells. Since there are a large number of firms, no individual firm can charge a higher price than p^*. If some firm did, the consumers would choose one of its competitors instead. The *MR* curve of an individual firm is consequently horizontal and equal to the price, p^*. The firm chooses to produce the quantity q^*, as this quantity makes *MC* = *MR* and, consequently, maximizes profit.

In the short run, a firm in a perfectly competitive market can make a profit. In Figure 9.2, the profit corresponds to the grey rectangle on the right-hand side. To see that this is the profit, note that in a perfectly competitive market *AR* (Average Revenue) is as large as *MR* is, since the firm is paid the same amount

for each unit sold. Furthermore, $q^*AR = TR$ and $q^*ATC = TC$. Profit is then p = $TR - TC$. To summarize, we have that

π=TR-TC=q*AR-q*ATC=q*(MR-ATC)

The right-hand side of this expression corresponds to the grey rectangle in Figure 9.2. With the example we used before, we get that π=78*(2.20-131/78) =41.

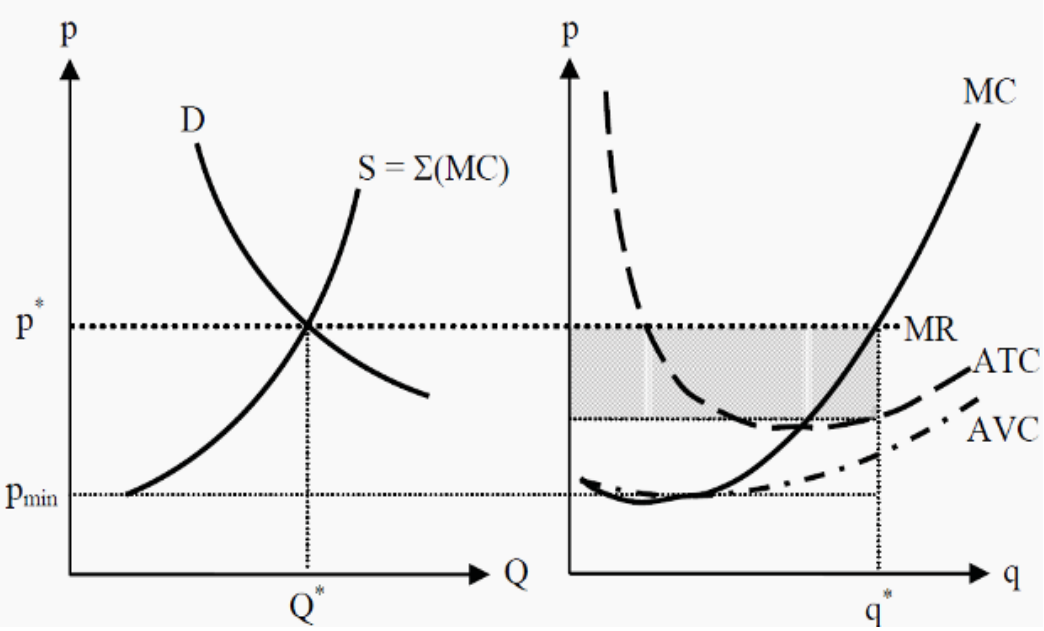


Figure 9.2: Short-Run Equilibrium for the Market and an Individual Firm

Market demand and short-run market supply determine the market price and market output. Figure (a) shows a short-run equilibrium. The short-run supply curve, S, is the same as SM in Fig. 12.6. If the market demand curve is D1, the market price is $20 a sweater. Each firm takes this price as given and produces its profit-maximizing output, which is 8 sweaters a day. Because the market has 1,000 identical firms, the market output is 8,000 sweaters a day.

A Change in Demand Changes in demand brings changes to short-run market equilibrium. Figure 12.7 shows these changes. If demand increases and the demand curve shifts rightward to D2, the market price rises to $25 a sweater. At this price, each firm maximizes profit by increasing its output to 9 sweaters a day. The market output increases to 9,000 sweaters a day. If demand decreases and the demand curve shifts leftward to D3, the market price falls to $17. At this price, each firm maximizes profit by decreasing its output. If each firm produces 7 sweaters a day, the market output decreases to 7,000 sweaters a day. If the demand curve shifts farther leftward than D3, the market price remains at $17 a sweater because the market supply curve is horizontal at that price. Some firms

continue to produce 7 sweaters a day, and others temporarily shut down. Firms are indifferent between these two activities, and whichever they choose, they incur an economic loss equal to total fixed cost. The number of firms continuing to produce is just enough to satisfy the market demand at a price of $17 a sweater.

Profits and Losses in the Short Run

In short-run equilibrium, although the firm produces the profit-maximizing output, it does not necessarily end up making an economic profit. It might do so, but it might alternatively break even or incur an economic loss. Economic profit (or loss) per sweater is price, P, minus average total cost, ATC. So economic profit (or loss) is (P – ATC) x Q. If price equals average total cost, a firm breaks even—the entrepreneur makes normal profit. If price exceeds average total cost, a firm makes an economic profit. If price is less than average total cost, a firm incurs an economic loss. Figure 12.8 shows these three possible short-run profit outcomes for Campus Sweaters. These outcomes correspond to the three different levels of market demand that we've just examined.

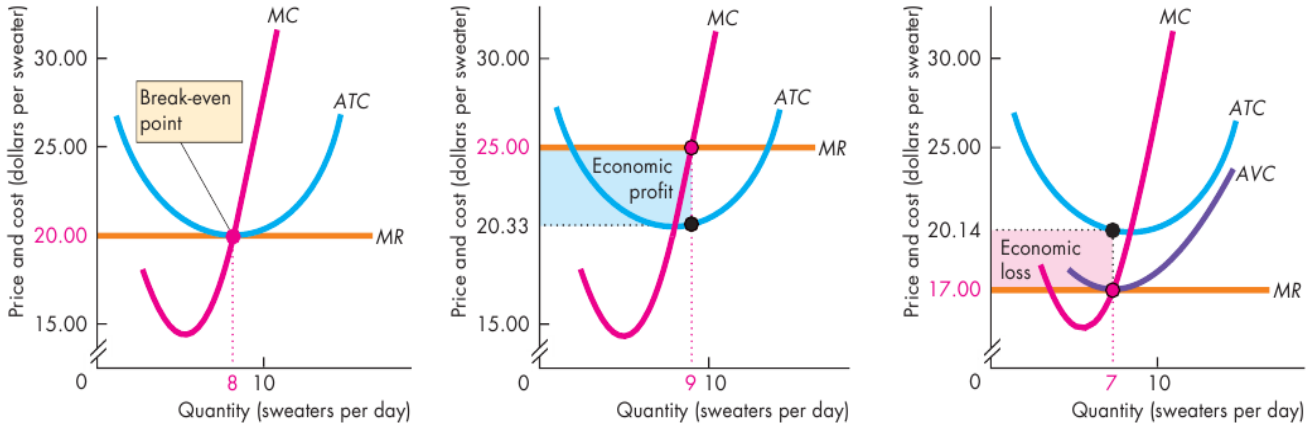
FIGURE Short-Run Equilibrium

Three Possible Short-Run Outcomes

Figure 12.8(a) corresponds to the situation in Fig. 12.7(a) where the market demand is D1. The equilibrium price of a sweater is $20 and the firm produces 8 sweaters a day. Average total cost is $20 a sweater. Price equals average total cost (ATC), so the firm breaks even (makes zero economic profit). Figure 12.8(b) corresponds to the situation in Fig. 12.7(b) where the market demand is D2. The equilibrium price of a sweater is $25 and the firm produces 9 sweaters a

day. Here, price exceeds average total cost, so the firm makes an economic profit. Its economic profit is $42 a day, which equals $4.67 per sweater ($25.00 – $20.33) multiplied by 9, the profit-maximizing number of sweaters produced. The blue rectangle shows this economic profit. The height of that rectangle is profit per sweater, $4.67, and the length is the quantity of sweaters produced, 9 a day. So the area of the rectangle is economic profit of $42 a day. Figure 12.8(c) corresponds to the situation in Fig. 12.7(b) where the market demand is D3. The equilibrium price of a sweater is $17. Here, the price is less than average total cost, so the firm incurs an economic loss. Price and marginal revenue are $17 a sweater, and the profit-maximizing (in this case, loss-minimizing) output is 7 sweaters a day. Total revenue is $119 a day (7 x $17). Average total cost is $20.14 a sweater, so the economic loss is $3.14 per sweater ($20.14 – $17.00). This loss per sweater multiplied by the number of sweaters is $22. The red rectangle shows this economic loss. The height of that rectangle is economic loss per sweater, $3.14, and the length is the quantity of sweaters produced, 7 a day. So the area of the rectangle is the firm's economic loss of $22 a day. If the price dips below $17 a sweater, the firm temporarily shuts down and incurs an economic loss equal to total fixed cost.

FIGURE 12.8 Three Short-Run Outcomes for the Firm



In the short run, the firm might break even (make zero economic profit), make an economic profit, or incur an economic loss. In part (a), the price equals minimum average total cost. At the profit-maximizing output, the firm breaks even and makes zero economic profit. In part (b), the market price is $25 a sweater. At the profit-maximizing output, the price exceeds average total cost and the firm makes an economic profit equal to the area of the blue rectangle. In part (c), the market price is $17 a sweater. At the profit maximizing output, the

price is below minimum average total cost and the firm incurs an economic loss equal to the area of the red rectangle.

13.Competitive firm and equilibrium of the industry in long run and supply of the industry

Plan

13.1. Long-Run Production

13.2. Properties of the Equilibrium of a Perfectly Competitive Market

13.3. Supply of the industry

Output, Price, and Profit in the Long Run

In short-run equilibrium, a firm might make an economic profit, incur an economic loss, or break even. Although each of these three situations is a short-run equilibrium, only one of them is a long-run equilibrium. The reason is that in the long run, firms can enter or exit the market.

Entry and Exit

Entry occurs in a market when new firms come into the market and the number of firms increases. Exit occurs when existing firms leave a market and the number of firms decreases. Firms respond to economic profit and economic loss by either entering or exiting a market. New firms enter a market in which existing firms are making an economic profit. Firms exit a market in which they are incurring an economic loss. Temporary economic profit and temporary economic loss don't trigger entry and exit. It's the prospect of persistent economic profit or loss that triggers entry and exit. Entry and exit change the market supply, which influences the market price, the quantity produced by each firm, and its economic profit (or loss).

If firms enter a market, supply increases and the market supply curve shifts rightward. The increase in supply lowers the market price and eventually eliminates economic profit. When economic profit reaches zero, entry stops. If firms exit a market, supply decreases and the market supply curve shifts leftward. The market price rises and economic loss decreases. Eventually, economic loss is eliminated and exit stops.

To summarize:

■ New firms enter a market in which existing firms are making an economic profit.

■ As new firms enter a market, the market price falls and the economic profit of each firm decreases.

■ Firms exit a market in which they are incurring an economic loss.

■ As firms leave a market, the market price rises and the economic loss incurred by the remaining firms decreases.

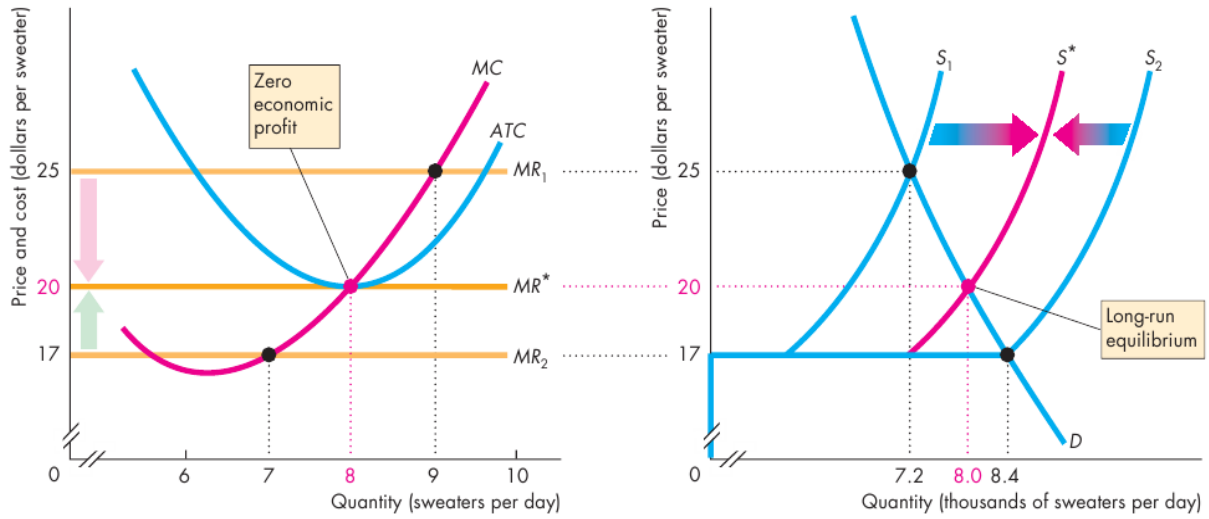
■ Entry and exit stop when firms make zero economic profit. A Closer Look at Entry

The sweater market has 800 firms with cost curves like those in Fig. 12.9(a). The market demand curve is D, the market supply curve is S1, and the price is $25 a sweater in Fig. 12.9(b). Each firm produces 9 sweaters a day and makes an economic profit. This economic profit is a signal for new firms to enter the market. As entry takes place, supply increases and the market supply curve shifts right-ward toward S*. As supply increases with no change in demand, the market price gradually falls from $25 to $20 a sweater. At this lower price, each firm makes zero economic profit and entry stops. Entry results in an increase in market output, but each firm's output decreases. Because the price falls, each firm moves down its supply curve and produces less. Because the number of firms increases, the market produces more.

A Closer Look at Exit

The sweater market has 1,200 firms with cost curves like those in Fig. 12.9(a). The market demand curve is D, the market supply curve is S2, and the price is $17 a sweater in Fig. 12.9(b). Each firm produces 7 sweaters a day and incurs an economic loss. This economic loss is a signal for firms to exit the market. As exit takes place, supply decreases and the market supply curve shifts leftward toward S*. As supply decreases with no change in demand, the market price gradually rises from $17 to $20 a sweater. At this higher price, losses are eliminated, each firm makes zero economic profit, and exit stops. Exit results in a decrease in market output, but each firm's output increases. Because the price rises, each firm moves up its supply curve and produces more. Because the number of firms decreases, the market produces less.

FIGURE 12.9 Entry, Exit, and Long-Run Equilibrium



(a) Campus Sweaters (b) The sweater market

The firm makes a short-run profit. However, what happens in the long run? There are three different possibilities: The firm could make a profit, make a loss, or break even. The first is called **excess profit** or **supernormal profit**, and the last is called **normal profit**. No firm can allow itself to make a long-run loss. **Excess profit / supernormal profit**: The firm is paid more for the good than it costs to produce it. **Normal profit**: The firm is paid what it costs to produce the good.

In the long run, a firm in a perfectly competitive market will make normal profits, i.e. break even. To see that, look at Figure 9.3. Here, we have the same initial situation as in Figure 9.2. Since the firm makes a profit, this market will attract new firms. Moreover, since there are no barriers to entry, new firms will establish themselves as soon as possible; i.e. in the long run. As more and more producers establish themselves in the market, larger and larger quantities will be supplied at each given price, and the market supply curve will shift to the right, from *S1* towards *S2*. Consequently, the price will be pushed down, from *p1** towards *p2**.

For the individual firm, the decrease in the price means that it will reduce the quantity it produces, from *q1** to *q2**. Remember that the firm chooses to produce the quantity where *MR (= p) = MC*. This process, with new firms and reductions in prices, continues as long as there are any profits to be made in the market. When the price reaches *p2**, and the firm produces the quantity *q2**, we are exactly at the point where the *MC* curve intersects the *ATC* curve. In the previous section, we showed that p = *q*(MR - ATC)*, and a quick look at that expression gives that if *MR = ATC* then the profit must be zero, regardless of the quantity produced.

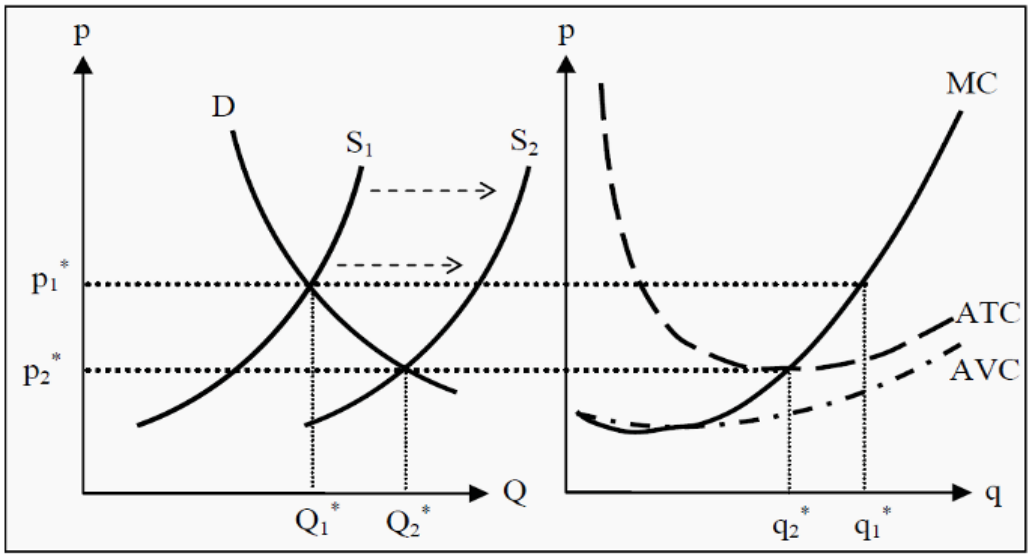


Figure 9.3: Long-Run Equilibrium for the Market and an Individual Firm

When the price has reached *p2**, there are no longer any excess profits to be made in the market. No more firms establish themselves and the downward push on the price stops. The market is then in long-run equilibrium. Note that the individual firm *reduces* the quantity it produces, while the total quantity produced in the market *increases*. The reason for this is that enough many new firms establish themselves to counterweight the reduction in production for the individual firm.

In the short run, we can also have the opposite case: The individual firms can make short-run losses. That will cause some firms to leave the market in the long run and total supply decreases, which causes the equilibrium price to rise. That process will continue until no firm makes a loss, and the end point of that process is the same as before: *p2** and *Q2*

Many people find the result that firms in a perfectly competitive market make zero profits, hard to accept. Remember, however, that by a cost in this context we mean *opportunity cost*. Therefore, the revenues are as large as the opportunity costs. In the opportunity costs, we include what the firm loses by not investing in the best alternative. If the best alternative is a very good one, the situation here will also be good for the firm. Also, remember that, there are very few real-life examples of a perfectly competitive market, so it might be difficult to have a good intuition for this result.

The Long-Run Supply Curve

For the individual firm, the long-run supply curve is found in exactly the same way as the short-run, only with long-run marginal cost, *LRMC*, and average cost, *LRAC*, instead. The supply curve is, consequently, that part of *LRMC* that lies above *LRAC*.

When it comes to the whole market's long-run supply curve, the situation is much more complicated. Remember that, for the short run we found the market's supply by summing up all existing firms' supply curves. That was possible because in the short run the number of producers is constant. This is not the case in the long run. If the price changes, then, in the long run, the number of producers also changes. The market long-run supply curve instead depends on how the cost of production changes with the size of production for the whole market.

• *Constant production cost*. If it is possible to establish new firms and they will have exactly the same cost of production as existing firms, then the industry has constant costs. If this is the case, the long-run supply curve will be a horizontal line. The reason for that is that, if the price would be higher at some quantity, new firms would establish themselves. Moreover, the cost for the new firms is the same as for the old firms, so this will push down the price to the marginal cost.

• *Increasing production cost*. If it costs more and more to produce more units, the industry has increasing costs. To produce more, the firms have to increase the price per unit. The supply curve will therefore slope upwards (i.e. in the opposite direction of any of the supply curves in this book).

• *Decreasing production cost*. In the opposite case, if it costs less and less to produce more units, the supply curve will slope downwards.

Properties of the Equilibrium of a Perfectly Competitive Market

Several central properties of the perfectly competitive market equilibrium deserve to be pointed out. These properties are the primary reasons why many economists (normatively) view a high level of competition as a good thing.

• The equilibrium is efficient. The market price will be at the same level as the long-run average cost of production. There is consequently no other way to produce the same quantity of goods that is cheaper. There is, in other words, no waste of resources.

• All firms have normal profits, i.e. no profits. The consumers, consequently, pay only what the production costs.

• Total utility is maximized.

Note also that these results, that are positive for society, are achieved without any form of central planning or ruling. This phenomenon, that the resources automatically are allocated such that these results are achieved, is often called *the invisible hand*.

However, remember that to reach these results, we have assumed a perfectly competitive market, i.e. that all the assumptions are satisfied. We will soon look at other markets forms.

Market Interventions and Welfare Effects

There are many different opinions about what welfare is. When one talk of welfare effects in microeconomics, then it is most often about how much utility different groups of people get from different allocations of goods. Usually, welfare analyses separate between producers and consumers, and make the following distinctions:

• *Consumer surplus* (*CS*). The consumers have a certain valuation of a good and pay a certain price to get it. The consumer surplus consists of the difference between how high their valuation is and how much they pay. In Figure 10.1, this corresponds to the triangular area labeled *CS*, i.e. the area between the demand curve and the price.

We can get an intuition of why this area is interesting in the following way. Suppose we are the customer with the highest valuation of the good. We would then be the customer that is willing to pay the highest price for it. In other words, we are the customer who defines the left-most point on the demand curve, *D*. If the price were so high that only one unit was sold, we would be the buyer. However, at the equilibrium we do not have to pay that high price. We only have to pay p^*. That means we get a surplus, as compared to what we are willing to pay, corresponding to the difference between the point on D and p^*. If we apply the same reasoning to the consumer with the second highest valuation, and so forth for all consumers who buy the good, we get the result that the total consumer surplus corresponds to the area *CS* in the figure.

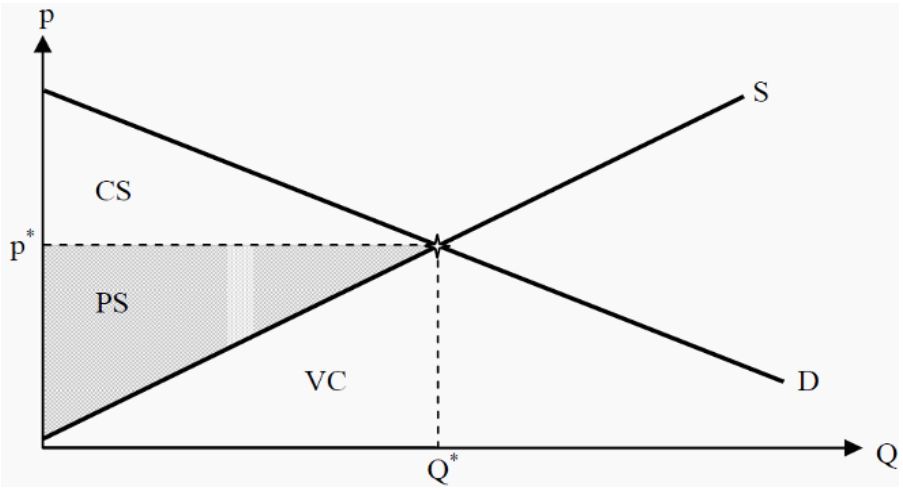


Figure 10.1: Consumer and Producer Surplus

• *Producer surplus* (*PS*) is the difference between what the producers are paid for a good and the lowest price at which they would have supplied it (i.e. the marginal cost of production). In Figure 10.1, this corresponds to the triangular area labelled *PS*, i.e. the area between the price and the supply curve.

The reasoning behind why this area is interesting parallels the one for the consumers.

• *Social surplus* is the sum of consumer and producer surplus: *CS* + *PS*.

One may note that *PS* is directly related to profit. The area below the supply curve, *S*, i.e. the triangle labeled *VC*, corresponds to the variable cost of production. The producers' total revenue, *TR*, is the price times the quantity sold. From the figure, we see that

p*Q*=TR=PS+VC

Furthermore, we know that profit is revenues minus costs. We can therefore get an expression for the profit:

$$\begin{aligned}\pi &= TR - TC \\ &= TR - (VC + FC) \\ &= (PS + VC) - (VC + FC) \\ &= PS - FC\end{aligned}$$

In the short run, profit consequently equals *PS* minus fixed costs. In the long run, there are no fixed costs, and *PS* and profit are equal to each other.

Welfare Analysis

CS, *PS*, and social surplus are often used to evaluate the effects of market interventions. Such an analysis is called a welfare analysis.

Let us use an earlier example. We studied the effect of a maximum price in a perfectly competitive market. With the help of Figure 10.2, we can now compare the social surplus with and without the maximum price.

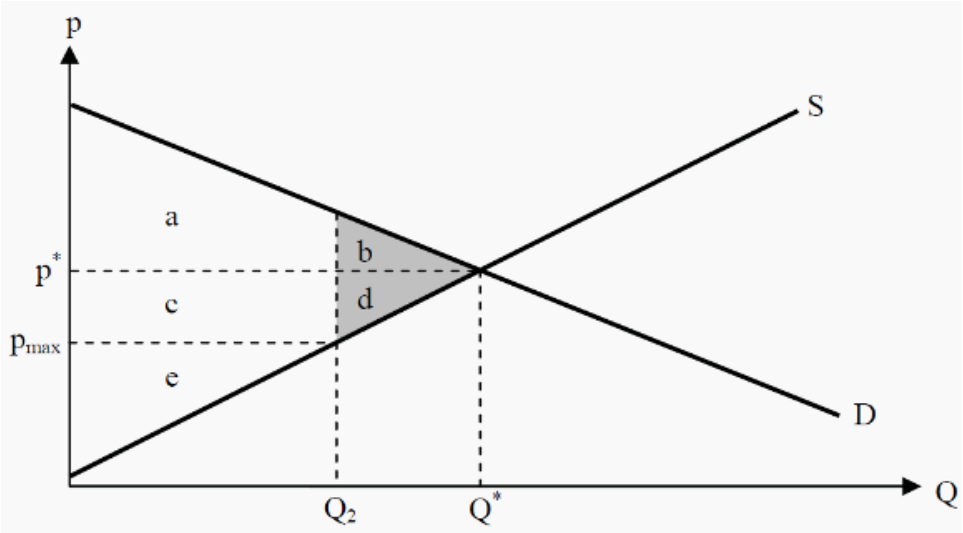


Figure 10.2: Social Effects of a Maximum Price

The maximum price decreases the market price from *p** to *pmax* and the quantity from *Q** to *Q2*. Before the maximum price was introduced, *CS* = *a* + *b*, *PS* = *c* + *d* + *e*, and the social surplus equaled *a* + *b* + *c* + *d* + *e*. After the maximum price is introduced, *CS* = *a* + *c*, *PS* = *e*, and the social surplus is *a* + *c*

+ *e*. The producers have consequently lost *c* + *d,* and the total welfare has decreased by *b* + *d.* The consumers have lost *b* but gained *c*.

Whether the consumers are better or worse off depends on if the area *c* is larger or smaller than *b*. However, social surplus is always diminished by introducing a maximum price in a perfectly competitive market. The amount of social surplus that is lost, *b* + *d*, is called the **deadweight loss**.

14.Competition and Monopoly

Plan

14.1. Natural monopoly
14.2. Monopolistic Competition
14.3. Oligopoly and game theory

Why do monopolies exist? Under what circumstances will there be only one firm in an industry? Why, if revenue is greater than cost, do not other firms choose to start producing the same product?

One answer may be that if they do, the monopolist will call the police. The original meaning of monopoly was a government grant of the exclusive right to sell something. Typically such monopolies were either sold by the government as a way of raising money or given to people the government liked, such as the king's mistresses (or their relatives). Monopolies of this sort are still common. One obvious example is the Post Office — a monopoly that is not only protected by the government (the Private Express Statutes make competition illegal) but also run and subsidized by it.

A second possibility is a *natural monopoly*. This occurs when the shape of the firm's cost curve is such that a firm large enough to produce the total output of the industry can do so at a lower cost than could several smaller firms. Figure 10-10a shows an example of such a cost curve. A firm producing q_1 at price P has positive profits (price is greater than average cost), but a firm producing $q_2 = q_1/2$ at the same price does not. If one large firm is formed and sells at P, smaller firms will not find it worth their while to enter the market.

Another case very similar to the natural monopoly is the natural cartel. A *cartel* is a group of firms acting together as if they were a single monopoly. Cartels are most likely to occur in industries where *economies of scale* (advantages that allow large firms to produce more cheaply than small ones) are not quite sufficient to allow one giant firm to produce more cheaply than several large ones; such an industry is likely to consist of a few large firms. Figure 10-10b shows the sort of cost curves that might lead to a cartel; what is important is not simply the shape of the cost curves but their relation to the market demand curve — the fact that minimum average cost occurs at a quantity that is a large fraction of the quantity demanded at a price equal to minimum average cost. This guarantees that any firm producing less than (in this example) about one third of the industry's total production will have higher average costs than larger firms and so be at a competitive disadvantage.

Monopolistic Competition

We ended last chapter by noting that a firm might be able to increase its profit by differentiating its products from those of its competitors. Most often, however, the products will still have many properties in common, which makes them close substitutes. Popular examples include Coca Cola and other cola- or soft drinks, and different brands of laundry detergent.

This behaviour makes the firm a monopolist on their own product, for instance on Coca Cola, but with customers that have close substitutes to choose from, for instance Pepsi Cola. If the firm raises the price, some customers would move to the substitute, but not all of them. Similarly, if the firm would lower the price, they would attract some of the competitors' customers, but not all of them.

Note that, if the products were identical, we would have an oligopoly. If the firms, in addition, compete with prices, we would have a Bertrand situation and none of the firms would make a profit.

Conditions for Monopolistic Competition

Criteria for monopolistic competition include

• There are several producers in the market

• The products are not identical, but they are close substitutes.

• There are no barriers to entry.

These conditions imply that each firm will face a downward sloping demand curve: If they increase the price, they will sell less and if they decrease it, they will sell more. However, the demand curve is very elastic since there are close substitutes, so the customers will react quite strongly to price changes and quickly shift over to (or from) the competitors.

Monopoly can be viewed as the opposite of perfect competition. Instead of many firms, there is only one: the monopolist. This has important consequences for both price setting and the quantity produced.

Barriers to Entry

Why do monopolies arise? There are many different reasons, but all of them have to do with barriers to entry in the market. The reasons for these barriers could be

• *Structural*. There are properties of the market that automatically shut competitors out:

-- *Economies of scale*. If there are economies of scale, large-scale advantages, the size of the firm is crucial for average cost. A situation can then arise in which only one firm can recover its costs. This is called a natural monopoly and an example of this is railroads.

-- *Cost advantages*. If the monopolist has access to a cheaper way of producing the good, for instance if she has a patent on a cheaper technology, she can push competitors out of the market.

• *Strategic limitations*. The monopolist can create barriers to entry. An example is **limit pricing**, where the monopolist sets the price so low that it becomes unattractive for competitors to enter.

• *Political*. The government may decide to grant a firm a monopoly in a certain market. A common example is for pharmaceutical goods.

• *Patents and exclusive rights*. If a firm has a patent on a certain good, other firms are shut out during the life span of the patent. It is also possible to have exclusive right to extracting, for instance, oil or metals.

Limit pricing: The monopolist sets a price lower than the monopoly price in order to keep competitors out.

Demand and Marginal Revenue

In this chapter, we will assume that the monopolist charges all customers the same price. The monopolist faces the whole demand of the market. We can compare with a perfectly competitive market by looking again at Figure 9.2. The individual firm in a competitive market only faces a small part of the market. Therefore, it can be represented as in the right-hand side of the figure.

A monopolist *is* the whole market. Therefore, it looks like the left-hand side of the figure. In order to sell more goods, the monopolist has do reduce the price, and the demand curve it faces will therefore slope downwards.

Now, note that the demand curve is decided by the consumers and not by the firm. It answers the question: *if* we would offer a certain price, how many units would we then be able to sell? In the perfectly competitive market, marginal revenue was equal to the price. That is not the case for a monopolist. For the monopolist to be able to sell an additional unit of the good, she must lower the price of *all* units. The total effect of selling one more unit then consists of both what she is paid for the last unit *and* of the reduction of revenue from all the other units that she now has to sell at the lower price. Consequently, the marginal revenue will be lower than the price.

Let us see what this means for a good with linear demand. If the demand curve is a straight line, the *MR* curve will also be a straight line with the same intercept on the Y-axis as the demand curve. However, it will have a slope with twice the magnitude.

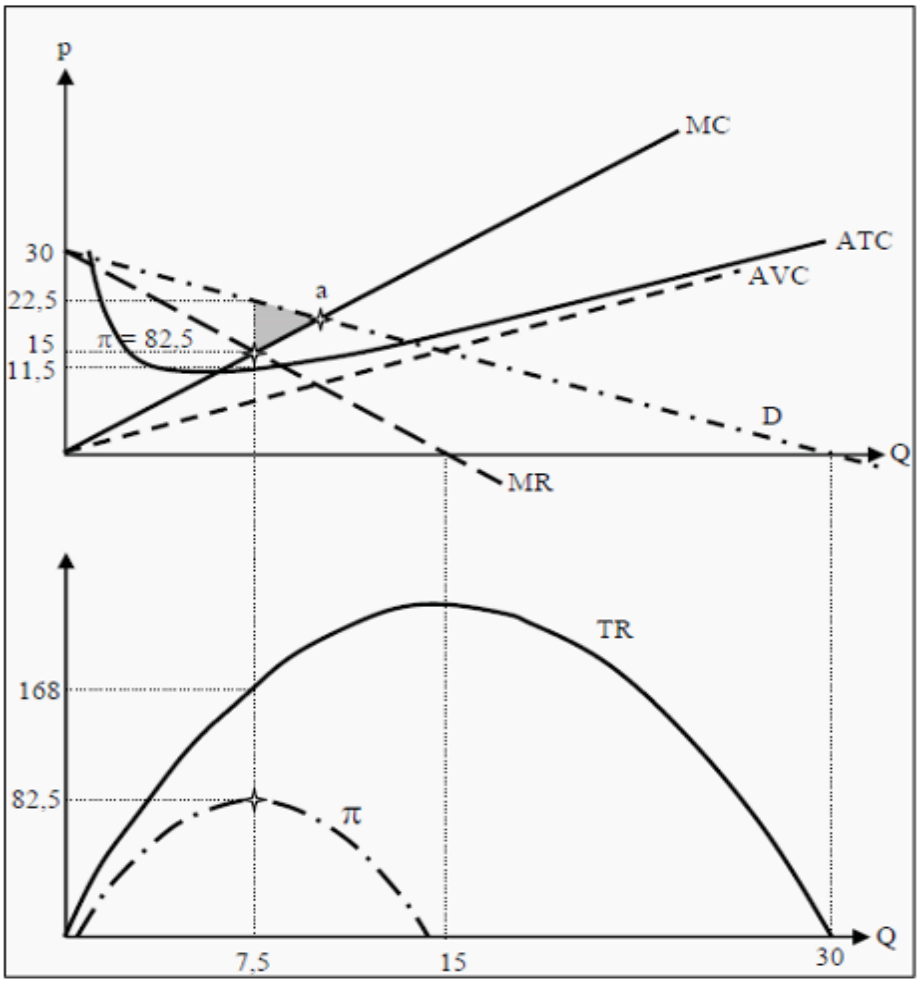


Figure 11.1: The Profit Maximum for a Monopoly

We will use the demand curve $QD = 30 - p$, or if we solve for p: $p = 30 - QD$ (see Section 2.3.1). If the *MR* curve is to start in the same point and have a slope that is twice as large, its functional form must be $MR = 30 - 2*QD$. (The constant is the same, 30, and the slope is changed from - 1 to - 2). In Figure 11.1 the curves are drawn as *D* and *MR*. We have also drawn a marginal cost curve, *MC* (= 2**Q*), an average cost curve, *ATC*, and an average variable cost curve, *AVC* (= *Q*), and, in the lower part of the figure, total revenue, *TR*, and profit, p.

Profit Maximum

The monopolist wants to maximize her profit. She does that by producing the quantity, *Q**, atm which *MC* = *MR*:

MC(Q*)=MR(Q*)

In Figure 11.1, this corresponds to the quantity 7.5, where both *MR* and *MC* equal 15. To see that this choice maximizes the profit, think of what would happen if she would produce more than that quantity. If she would produce one more unit, she would get paid *MR* but also incur a cost of *MC*. Moreover, since *MC* > *MR*, the cost is larger than the revenue and she would reduce profit; similarly if she would reduce the production.

The profit at a quantity of 7.5 is, according to the lower diagram, 82.5. The price the monopolist will charge is the one that the consumers, according to the demand curve, are prepared to pay when the total production is 7.5, i.e. 22.50. The corresponding *ATC* is 11.50. In other words, the monopolist makes 22.50 - 11.50 = 11 per unit sold, totaling to 11*7.5 = 82.5. This corresponds to the grey rectangle in the upper part of the figure.

Similarly to the firms in a perfectly competitive market (see Section 9.3.2), the price must also be above the average variable cost, *AVC*. If it is not, it is better to produce nothing at all. In the long run, the firm must also cover its fixed cost, and then the price must be above the average total cost, *ATC*.

In Figure 11.1, we have also indicated where total revenue is maximized. This occurs at the quantity $Q = 15$ and corresponds to the point in the upper part of the Figure where $MR = 0$. Note that this point does *not* maximize the profit. In the example, the firm makes a loss at that quantity.

The Deadweight Loss of a Monopoly

To have a monopoly firm is often very beneficial for the monopolist, who can make a profit, but it is negative for society. To see why, look at point a in the upper part of Figure 11.1. In that point $MC = D$. The marginal cost is the cost of the last produced unit, and the demand is the consumers' corresponding valuation of that unit. At point a, the cost of producing the last unit and the valuation of that unit are the same. To the left of that point, the consumers' valuation is higher than the cost of producing additional units. Society therefore loses production of goods that cost less than what they are worth, according to the consumers' valuation. Then the quantity that the monopolist produces cannot be efficient. The deadweight loss that arises corresponds to the dark grey triangle in the figure.

Let us look closer at the consequences. In Figure 11.2, we have drawn the supply curve, i.e. the *MC* curve. (Remember that the supply curve of a firm corresponds to the part of the *MC* curve that is above the average cost.) Furthermore, we have drawn the demand curve, *D*, and the marginal revenue curve, *MR*. Under perfect competition, equilibrium had been reached at the price *pC* and the quantity *QC*, but in a monopoly market, equilibrium is reached at the price pM and the quantity *QM*. The producer surplus (*PS*) in a monopoly market corresponds to the area $B + D$, and the consumer surplus (*CS*) corresponds to the area *A*. The social surplus will therefore be $A + B + D$. If the market had been perfectly competitive instead,

PS had been $D + E$ while *CS* had been $A + B + C$ and the social surplus $A + B + C + D + E$.

In other words, society, particularly the consumers, loses utility: The deadweight loss is $C + E$. The monopolist, on the other hand, will lose if competition is increased. Note that the monopoly is not efficient (see Section 18.2): It would have been possible to produce the quantity QC to the price pC and then compensate the firm by transferring the area B back from the consumers. The consumers would still get an increase in utility corresponding to the area C (they would now get $A + C$), and the producers would get an increase in utility corresponding to the area E (they would now get $B + D + E$). No group would lose anything. Therefore, the monopoly does not fulfill the Pareto criterion.

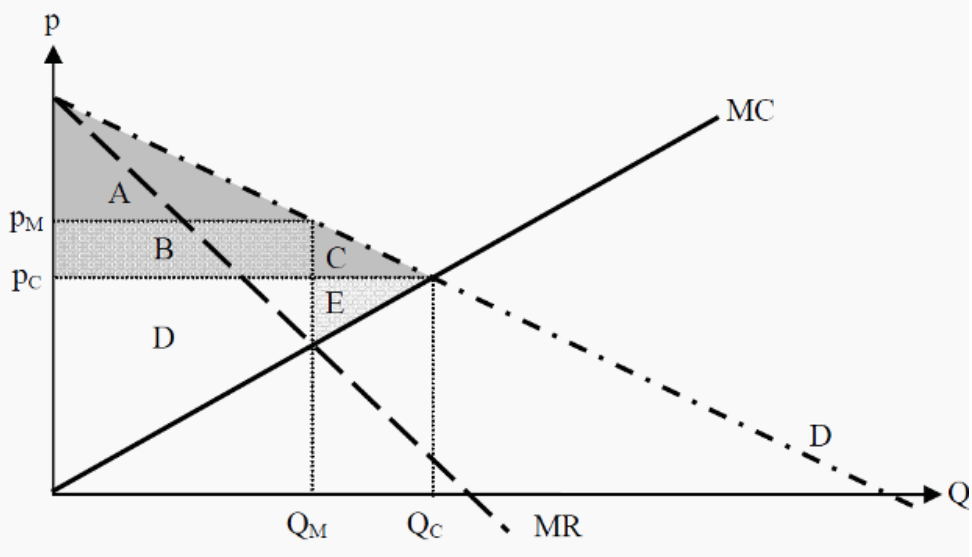


Figure 11.2: Deadweight Loss of a Monopoly

Ways to Reduce Market Power

To reduce the negative impact on society, governments often try to limit the **market power** of monopolists. Some popular measures include

• *Price regulations*. If it can be known what the market price would have been under perfect competition, or if the cost of production is known, the government can decide on a price ceiling at that price. Thereby, the equilibrium point is moved to the optimal point from society's viewpoint. It is, however, very difficult to estimate the optimal price.

• *Increase competition*. If the monopoly has been created through political decisions, the regulation can be changed.

Game Theory

Before we go on to the other market forms, oligopoly and monopolistic competition, we will introduce a tool called *game theory*. Game theory is a much younger tool than most of the others we have discussed so far and has become a large field of research. Here, we will just present two different games. These will get to represent the two different groups of games: normal form

games and extensive form games. We will later use these tools in the analysis of oligopolies.

The Basics of Game Theory

Game theory is used for analyzing how individual agents interact with each other. Depending on the structure, they may take into account how the other agents are choosing (or how they believe that they will choose), and then decide on their own strategy. This closely resembles the situation in many parlor games. Think, for instance, how the players act in chess: They only decide on their own moves, but they do so depending on how they believe that the opponent will respond. It is most often a bad strategy to hope that the opponent will not discover a trap.

A better strategy is to assume that the opponent understands everything that one understands oneself, and then base one's strategy on that.

To turn this into a theory, we need to first define the basic building blocks. For a game to be a game in the relevant sense, we need players, rules, outcomes, and preferences over the outcomes. With chess, the players are "white" and "black," the rules are the rules for chess, the usual outcomes are "white takes black's king," "black takes white's king" or "draw." The players' preferences are usually that they prefer that they take the opponent's king to a draw, and lastly that the opponent takes their king. In most games of game theory, we need to specify:

• *The players*. It could be individuals, firms, or countries. Often, there are only two or three players.

• *Actions*. All possible actions the different players can choose to do, for instance decide on quantity or price.

• *Information*. What each player knows at different stages of the game.

• *Strategies*. A strategy is a complete description of what a player will choose at each possible situation that could arise in a game. One can think of a strategy as a list. The list should be so exhaustive that another person could play instead of the player, and never actually have to decide anything by herself.

• *Payoffs*. The utility a player gets, given a certain outcome of the game.

The Prisoner's Dilemma

The game called The Prisoner's Dilemma is probably the most well known example of game theory. It is also an example of a **normal form game** (or **strategic form game**), which means that the players choose simultaneously. (Formally, a normal form game is a game that can be defined by only specifying the players, the strategies, and the payoffs.)

Normal / strategic form game: A game in which the players play simultaneously

One way to construct the game is the following. Two players, A and B, have been arrested (somewhere where the rule of law is somewhat substandard) and are kept in isolation. A prosecutor suggests A the following:

• If you confess and B does not, you will be set free as a sign of our gratitude. B will then get 10 years in prison.

• If the both of you confess, you each get 2 years in prison.

• If B confesses and you do not, you get 10 years in prison while B is set free.

• If none of you confesses, we will frame you for a petty crime and you will each have to pay a small fine.

At the same time, B gets the same suggestion. The two players cannot communicate with each other and therefore must consider a solution in solitude. Let us now identify the different elements that make this a game, in the game theoretical sense of the word.

• *The players*; Individuals A and B.

• *Actions*; For A: choose "Confess" or "Do not confess"; and similarly for B: choose "Confess" or "Do not confess."

• *Information*; Both A and B know that the other has received the same offer, but they do not know how the other chooses.

• *Strategies*. Both A and B can only choose one of two different actions. Possible strategies for A are then "choose confess" or "choose not to confess", and similarly for B.

• *Payoffs*; Here we need to know the two players' preferences. For simplicity, we assume that they have the same preferences and that they are as follows: 10 years in prison (- 10), 2 years in prison (- 2), a small fine (- 1), and freedom (+1).

Many normal form games can be represented with a so-called **payoff matrix**, where one player's strategies are displayed in the vertical direction and the other's strategies in the horizontal direction. Their respective payoffs that correspond to certain strategy pair are then indicated in the squares. If we do this for the present game, we get the payoff matrix in Figure 13.1. Note that player A's payoffs are to the left in the squares and player B's are to the right.

		Player B	
		"Confess"	"Do not confess"
Player A	"Confess"	-2, -2	+1, -10
	"Do not confess"	-10, +1	-1, -1

Figure 13.1: Payoff Matrix for the Prisoner's Dilemma

Let us first look at the game from the perspective of player A. She does not know how player B will choose, but she does know that player B will choose either “Confess” or “Do not confess.” Say that player B would choose “Do not confess.” Then, obviously, the best thing player A can do is to choose “Confess,” since she will then get a utility of +1 (freedom) instead of - 1 (a small fine). Now, say that player B chooses “Confess” instead. Then the best thing player A can do is still to choose “Confess,” since she will then get a utility of - 2 (2 years in prison) instead of - 10 (10 years in prison). Consequently, player A has a strategy that is the best one, independently of what player B chooses. Such a strategy is called a **dominant strategy**.

Player B’s problem is the same as player A’s, and hence it is a dominant strategy for player B as well to choose “Confess.” As a result, they both choose “Confess” and get two years in prison. This is so, even though it is possible for them both to get away with a small fine (if they both choose “Do not confess”). This is the dilemma. For both player A and B it is individually rational to confess, but acting that way they achieve an outcome worse than what is “collectively” possible. If they had been able to cooperate, they would both have been able to reach a higher utility level.

Games that have properties such as this one are called Prisoner’s Dilemma-games. It could just as well be two countries deciding on whether to wage war on each other, two firms deciding on whether to start a price war or not, or two fishers deciding on whether to restrict their fishing or take the risk that the fish will go extinct. The players are kept from a rather good solution, because they choose their own individual best.

Nash Equilibrium

In the last section, we presented a solution of the Prisoner’s Dilemma. With “solution”, we here mean a prediction of how the players will play.

How does one generally solve a game? This is far from self evident, and in many games, there are several different reasonable solutions. The most popular concept for solving games is the **Nash equilibrium**. There are, however, several other ways in which to solve games, but most often, they are variations of a Nash equilibrium. Note also that, there can be more than one Nash equilibrium in a game.

A Nash equilibrium is:

• A set of strategies, one for each player.

• The strategies should be such that no player can improve her utility by unilaterally changing her own strategy.

Finding the Nash Equilibrium in a Game in Matrix Form

It is often easy to find the Nash equilibrium for a game in matrix form. Look at the game in Figure 13.1 again. We have four squares in the matrix. We can then find the Nash equilibrium by checking each square separately:

• {Do not confess, Do not confess}, i.e. the lower right square. Can any of the players improve her situation by unilaterally changing her own strategy? If, for instance, A changes to "Confess" she will get +1 instead of - 1. (Similarly for B.) Consequently, she can improve her situation and this cannot be a Nash equilibrium.

• {Do not confess, Confess}, i.e. the lower left square. If A changes to "Confess", she will get - 2 instead of - 10. Consequently, this cannot be a Nash equilibrium either.

• {Confess, Do not confess}, i.e. the upper right square. If B changes to "Confess", she will get - 2 instead of - 10. Consequently, this cannot be a Nash equilibrium.

• {Confess, Confess}, i.e. the upper left square. If A would change to "Do not confess", she would reduce her utility from - 2 to - 10, and if B would change she would also reduce her utility from - 2 to - 10. None of the players can therefore improve on her situation by unilaterally changing her strategy, and this must be a Nash equilibrium.

The only Nash equilibrium in the Prisoner's Dilemma is that both players choose "Confess."

A Monopoly with No Barriers to Entry

We will now describe a game on so-called **extensive form**, where the question is whether a monopolist can uphold her monopoly if there are no barriers to entry. In a game on extensive form there is, in contrast to games on normal form, an order to the choices. One could say that we have added a time dimension.

There are two firms, The Incumbent (J) and the Entrant (E). J has, at the beginning, a monopoly in the market and E has to choose whether to enter the market or not. If she decides to enter it, J can choose to start a price war, i.e. lower the price to punish E, or to accept the competitor. The problem with a price war is that it also hurts J herself.

• The players; The Incumbent (J) and the Entrant (E).

• Actions; For E: choose "enter" or "not enter"; for J: choose "price war" or "accept."

• Information; E knows what the game structure looks like, but not how J will decide later on. J, on the contrary, knows how E has chosen when it is her time to choose. J consequently has more information than E.

• Strategies. For E there are two strategies:

1. Choose “enter.”

2. Choose “not enter.”

For J, there are also two strategies:

1. Choose “price war.”

2. Choose “accept.”

• Payoffs. Here we need to know the players’ preferences. Assume these are as in Figure 13.2.

This type of game is usually represented with a so-called **game tree**. The present game will look like in Figure 13.2.

In the game tree, we have indicated where E and J decide, and what they can decide between at that point. At the far bottom, there are two rows of numbers. The number in the first row indicates the first player’s (E’s) payoff and the number in the second row the second player’s (J’s).

The game tree is read from top to bottom. It begins with E choosing between “not enter” and “enter.” If the she chooses “not enter,” the game ends and E gets 50 while J gets 100. If E, instead, chooses “enter,” J gets to choose between “price war” and “accept.” If she chooses “price war,” the game ends and E gets 25 and J gets 50. Compared to the case when E chooses not to enter, both E and J get a lower payoff. If J, instead, chooses “accept,” the game ends with E and J sharing the market and both getting a payoff of 75.

It is clear that J prefers that E does not enter the market (which gives J 100) to accepting (75), and both of these to a price war (50). E prefers to be accepted (75) to not entering (50), and both of these to a price war (25).

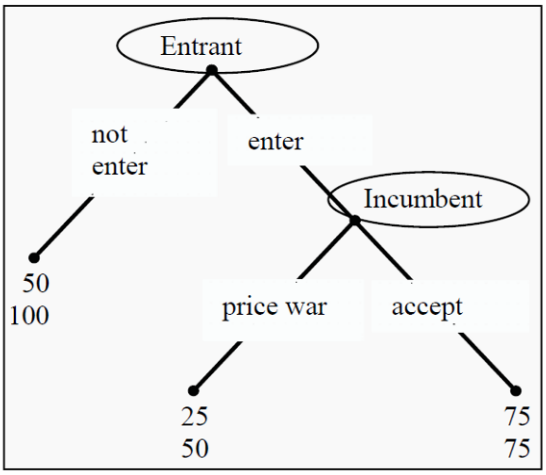


Figure 13.2: Game Tree

Finding the Nash Equilibrium for a Game Tree

To find the Nash Equilibrium for a game tree, we compare all different combinations of strategies. In the example in Section 13.4, E has two strategies and J has two. It is then possible to “translate” the game tree to a game on matrix

form, as in Figure 13.3. Each strategy is translated into a row or a column. It now looks similar to the game from Section 13.2, but with other payoffs and strategies.

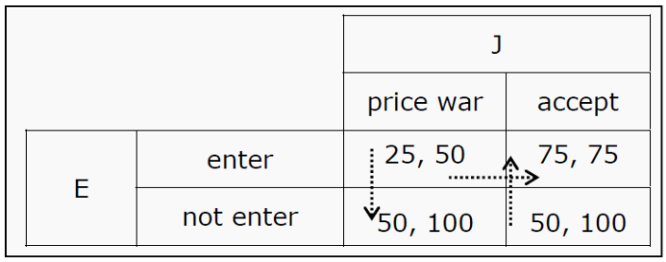


Figure 13.3: Payoff matrix for the Game Tree

Note that in the case when E chooses "not enter", it does not matter what J chooses. Looking at the game tree in Figure 13.2, this is obvious since the game ends after such a choice and J never gets to choose. In the matrix, this translates into identical payoffs in all columns of the corresponding row, i.e. (50, 100).

To find the Nash equilibrium, we use the same method as in the last section and check each square separately. E chooses in the vertical direction and J in the horizontal. In Figure 13.3, we have inserted arrows from squares that have a better alternative to that alternative. Squares that have no arrows going *out* will then be Nash equilibria. In this case, there are two Nash equilibria:

• E chooses "enter" and J chooses "accept." If E unilaterally changes her strategy, she will diminish her payoff from 75 to 50, and if J does so, she will diminish her payoff from 75 to 50.

• E chooses "not enter" and J chooses "price war." If E changes her strategy, she will diminish her payoff from 50 to 25, and if J does so, she will get the same as before, i.e. 100. The latter is due to the fact that it does not matter what J chooses when E has chosen "not enter."

There is something odd with the latter Nash equilibrium. E chooses not to enter since J implicitly threatens with a price war. However, if E had established herself, J would have lost utility by actually starting a price war. According to the definition, this is a Nash equilibrium, but this objection leads us to introduce an alternative method of solving games on extensive form.

Backward Induction

For game trees, such as the one in Section 13.4, there is another, often used, solution method. The main idea is to start at the end of the tree, and then solve it backwards.

An example will make this clear. Consider the game tree in Figure 13.2 again. The last thing that happens in the game tree is that J chooses "price war" or "accept." If she chooses the first option, she gets 50 and if she chooses the

second, she gets 75. Obviously, it cannot be optimal to choose the first. Consequently, given that E has chosen "enter," J will choose "accept." We can then reduce the game tree by omitting the alternative that J will not choose, and just keep the payoffs of the alternative that she does choose. The game tree will then look like in Figure 13.4.

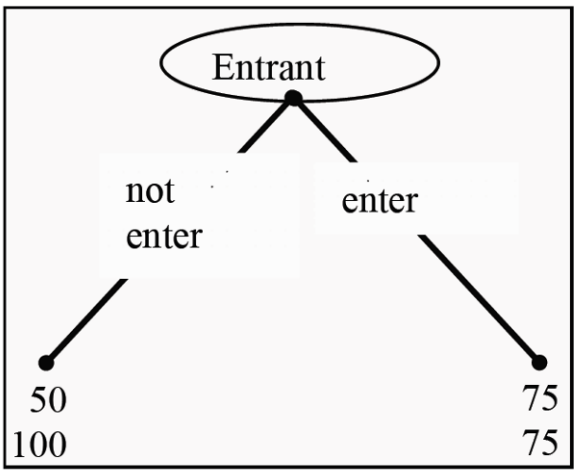


Figure 13.4: Reduced Game Tree

Given that J will chose "accept," the choice for E is simpler. If she chooses "not enter" she will get 50 and if she chooses "enter" she will get 75. Consequently, she chooses the latter. The solution, using backward induction, is then

• E: "enter"; J: "accept."

Comparing this solution to the one in Section 13.4.1 (that had two different solutions, one of which is the same as the one here) this one seems more reasonable. Earlier, we found a Nash equilibrium in which E chose "not enter" and that included a (never realized) threat from J to start a price war. Using backward induction, the threat reveals itself as being empty, and the only solution is that E establishes herself and J chooses to accept. The solution one obtains by using backward induction is called **subgame perfect equilibrium**.

Oligopoly

An **oligopoly** is a market in which there are only a few sellers. Most of the models in the literature only cover cases in which there are two sellers. Such markets are also called **duopolies**. As you will see, the analysis of oligopolies is quite complicated. Furthermore, there are several different models that all yield different results. This can be quite confusing. Take some time to see what the differences are in the assumptions and *why* they give different results. Which model to use, depends on what the situation is in a particular case. Different structures can have dramatically different effects on the market.

Kinked Demand Curve

Assume there are only a few firms in a market and that they all produce exactly the same good. Furthermore, assume that there is already a price has already been set. (For now, we will ignore the question from where this price has come.) If we were one of the firms, how would we reason regarding our own price setting?

What would happen if we would raise the price? Most of the customers would then buy from our competitors instead, to get the good at a lower price. The competitors would probably not lower their prices, as they would gain a larger market share instead. Consequently, we would sell *much* fewer goods. Conversely, what would happen if we lowered our price? If the competitors did not also lower their prices, we would gain a large part of their market shares. Since that would mean that they would reduce their profits, they would probably lower their prices as well.

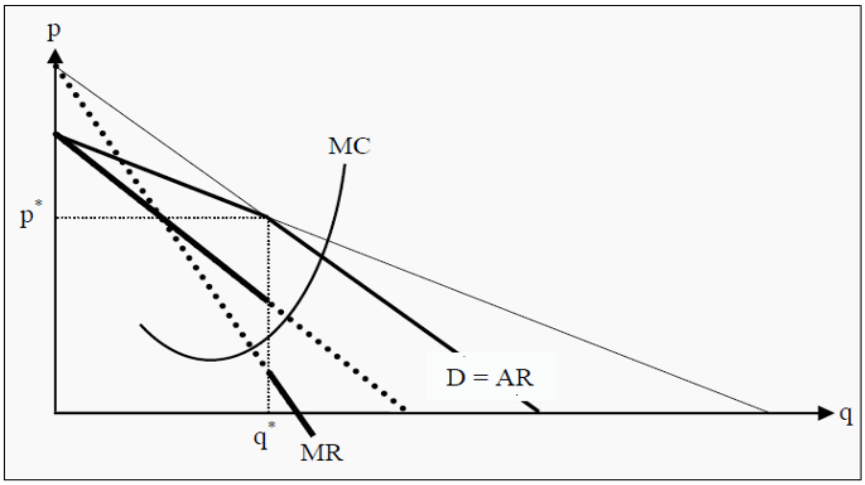


Figure 14.1: Kinked Demand Curve

The slope of the demand curve that our firm faces is therefore different depending on whether we increase or decrease our price. This results in a so-called *kinked demand curve*, where the bend occurs at the existing price, p^*, and the corresponding quantity, q^* (see Figure 14.1).

The bend in the demand curve makes the construction of the *MR* curve more complicated. To find the *MR* curve, we extend the two parts of the demand curve, *D*, until they reach the two axes. (The extensions are the thin lines in the figure.) As the (real and imagined) demand curves are downward sloping, their corresponding *MR* curves will also be downward sloping, intercept the Y-axis at the same points, but have a slope which is twice as large. (Compare to the reasoning regarding the *MR* curve of a monopoly, Section 11.2.) Since *D* now has two parts, we do this for each part separately.

Since the demand curve is bent at the quantity q^*, the *MR* curve will also change at that quantity. To the left of q^*, we use the *MR* curve that is derived from that part of the demand curve that is valid to the left of that quantity. To the

right of q^*, we instead use that *MR* curve that is derived from the part of the demand curve that is valid to the right of it. This causes the final *MR* curve to make a jump at q^*. In Figure 14.1, the final *MR* curve is indicated with thick full lines. The parts that are not used, since they correspond to the extensions of the demand curve, are indicated with thick dotted lines.

Just as before, a criterion for profit maximization is that the firm sets the quantity where $MR = MC$. In the models we have used this far, that criterion singled out exactly one point. However, since the *MR* curve now makes a jump at the quantity q^*, the *MC* curve can intersect the *MR* curve in that interval. At the prevailing price, it must do so by construction. This means that if the marginal cost, *MC*, only changes a little bit, for instance because a small tax is introduced on each unit sold, the firm might not change its produced quantity, and consequently not the price. As long as the *MC* curve still intersects the *MR* curve at the jump, the firm will produce the same quantity, q^*. However, the increase in *MC* will lead to a reduction in profit for the firm.

This is one way that the real-world phenomenon of **sticky prices** can be explained. According to the previous market-models (perfect competition and monopoly), prices should change immediately if quantities change. However, often we see that prices change more seldom; they seem to be stuck at a certain level for a while. If prices and quantities are set according to the kinked demand curve-model, however, this is exactly what we should expect.

How does the Price in the Kinked Demand Curve Arise?

In the analysis in last section, we ignored the question of how the price had arisen. One idea is that the sellers can have agreed on the price. If sellers can cooperate on the price setting, they will optimally agree to set a price that corresponds to the quantity a monopoly would have chosen, since the monopoly profit is the largest one can possible make in a market. Then they could split the monopoly profit between themselves.

However, that would amount to setting up a cartel, and that is against the law. Many people argue, however, that firms can have tacit agreements. There is no real cartel, but there is a sort of silent agreement that each seller should set a high price. A frequently used example is the way gasoline distributors set their prices. Often, one firm announces that they will increase their price. Then the other firms follow immediately. Note however, that this type of behaviour can also be against the law.

Cournot Duopoly

The Cournot model is a model of duopolies and is developed in line with the game theoretical approach we presented in last chapter. The Cournot model assumes that:

• We have two firms.

• They set quantities (and the price is then set by the market, given the quantity).

• They choose simultaneously, without knowing which quantity the other chooses.

How would these two firms reason? Both of them want to maximize their own profit. However, each firm's profit partly depends on the quantity set by the other firm, as total quantity determines the market price.

If a firm knows the quantity the other firm has chosen, then it is able to decide exactly which quantity that would maximize their own profit. There is an optimal response to each choice of the other firm. Let us use that observation, and determine that best response for each choice of quantity the other firm can possibly make. If we do that, we get a so-called **reaction function**. In Figure 14.2, *r1* is firm 1's reaction function and *r2* is firm 2's.

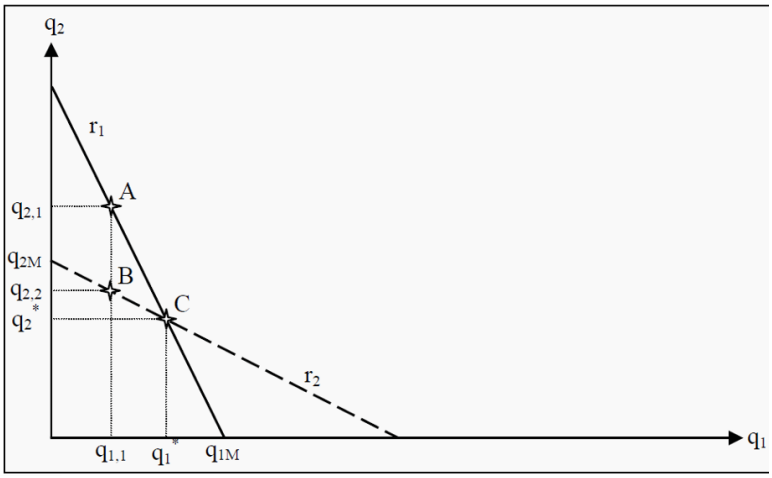


Figure 14.2: The Cournot Model

To give an example of how to interpret the reaction function, suppose that firm 2 chooses to produce the quantity *q2,1*. Which is firm 1's optimal response? Indicate *q2,1* on the Y-axis, go to line *r1* (point A) and read off the corresponding value on the X-axis: *q1,1* is firm 1's optimal response.

Note however that if firm 1 chooses the quantity *q1,1*, then the quantity q2,1 is not optimal for firm 2. Instead, the quantity *q2,2*, at point B, is optimal for firm 2. However, then *q1,1* is not optimal for firm 1… and so on.

It is possible to show that the only point where both firms simultaneously respond optimally to the other's choice is point C, where the two reaction curves intersect each other. As no agent can achieve a better outcome by unilaterally changing her strategy, we have a Nash equilibrium. The conclusion of the Cournot model is then that, both firms will choose the Nash equilibrium quantities, *q1** and *q2**. Note that, if you continue to use the method of finding

successive optimal responses as we did above, you will tend to get closer and closer to the Nash equilibrium in each round.

One should also note another thing in Figure 14.2. If firm 2 would produce nothing at all, firm 1 would be a monopolist in the market. The optimal quantity would then be the monopoly quantity. Similarly for firm 2. The reaction function of each firm must consequently hit the firm's own axis at the monopoly quantity. In the figure, these points are labeled *q1M* and *q2M*.

Stackelberg Duopoly

In the Cournot model, both firms made their decisions simultaneously and without knowing the other's decision. In the Stackelberg model, they decide one *after* the other. We call the one that chooses first, the *Leader* and the other one the *Follower*.

- We have two firms.
- They set quantities (and the price is set by the market).
- *Leader* first decides on her quantity, and then *Follower* decides on hers.

We will use the same reaction function as in the Cournot model, but the analysis will now be different since they do not choose simultaneously. *Leader*, who sets her quantity first, has an advantage. She knows that *Follower* will later set her quantity according to her reaction function. Therefore, *Leader* sets her quantity to maximize her own profit, given *Follower's* optimal response.

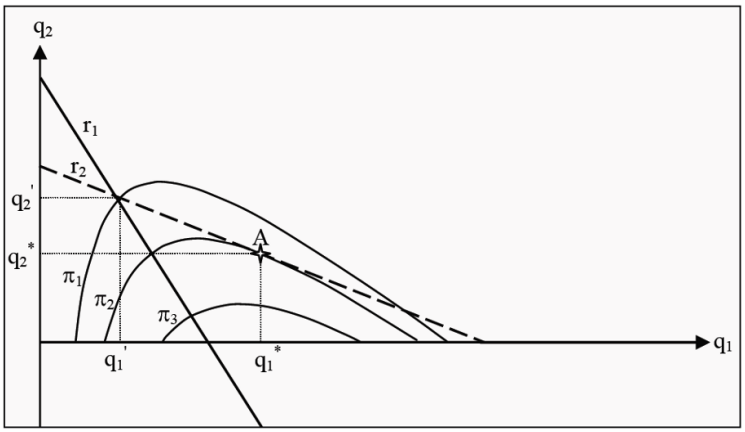


Figure 14.3: The Stackelberg Model

One way to illustrate this game is presented in Figure 14.3. We have drawn the reaction functions, *r1* and *r2*, but we have also added a few curves indicating *Leader's* profit, π1, π2, and p3; so-called **isoprofit curves**. Such curves show different combinations of *q1* and *q2* that give *Leader* the same profit. For instance, all combinations along π1 give *Leader* a profit of π1, etc. Note that *Leader's* profit increases *inwards*, the closer to the monopoly quantity (the point where *r1* intersects the X-axis) we get. The profit at π2 is consequently higher than at π1, and even higher at π3.

Leader knows that *Follower* will choose her quantity along the reaction function *r2*. *Leader* therefore finds an isoprofit curve that touches *r2* and that is as close to the monopoly quantity as possible. In the figure, the isoprofit curve $\pi 2$ touches *r2* in point A. *Leader* then chooses the quantity that corresponds to point A, i.e. *q1**. As a response, *Follower* later chooses the quantity *q2**.

Note that every other choice of quantity for *Leader*, higher or lower, must result in a lower profit for her. If she, for instance, would choose the quantity *q1'* instead, *Follower's* reaction would be to choose *q2'* and *Leader's* profit would be $\pi 1$, which is less than $\pi 2$.

Bertrand Duopoly

In the two preceding models, we have assumed that the firms set quantities. What happens if, instead, they set prices? The Bertrand model assumes that

- We have two firms.
- They set prices (and quantities are set by the market).
- They set prices simultaneously, without knowing which price the other one sets.

The previous models produced results that were very favorable for the firms but less so for the consumers. The Bertrand model, however, puts the two firms in a Prisoner's Dilemma-type of situation (see Section 13.2), and forces them to set $p = MC$, i.e. they set the same price as firms would do in a perfectly competitive market. This is, of course, unfavorable for the firms, but an improvement for consumers and society.

To see that the firms will set $p = MC$, suppose that we know that the other firm has set a high price. Which is then the best price we can set? Remember that we have homogenous (meaning identical) goods, so the consumers will not care from whom they buy it. Furthermore, they have perfect information about all prices. If we choose a price that is just below our competitor's, all customers will buy from us. This is a good situation for us, but far from optimal for the other firm. If they reason in the same way, they will want to set a price just below ours. Then we would lose all customers… and so forth.

No price above *MC* can consequently be an equilibrium. Regardless of which price the firm has set, the other will always want to undercut it and set a price just below its competitor. The only price that can be an equilibrium is then $p = MC$. At that price, none of the firms can lower their price since they would then make a loss. None of them would be able to make a profit by increasing the price either, since they would then lose all customers.

The surprising result is then that, since $p = MC$, we get the same outcome as in a perfectly competitive market, even though there are only two firms. If

society is able to construct an oligopoly such that it becomes a Bertrand duopoly, there will be no loss of efficiency.

One way for the firms in a Bertrand market to increase profits anyway, is to try to differentiate their products. The customers will then not be indifferent between from whom they buy and the firms become two monopolists, however with goods that are very close substitutes.

15.The principles of Pricing in the market economy

Plan

15.1. Price discrimination
15.2. Market Equilibrium

There are more possibilities for a monopolist to take advantage of her situation: She can charge different prices from different customers. This is called **price discrimination**, and we distinguish between price discrimination of the first, second, and third degrees. **Price discrimination**: Charging different prices from different consumers

Degree Price Discrimination

Remember that the demand curve corresponds to the consumers' valuation of different quantities of the good. Suppose, for example, that we have four presumptive consumers who want to buy a maximum of one unit of the good. The first is willing to pay 4 for one unit of the good, the others 3, 2, and 1, respectively. We then get a demand curve as *D* in Figure 12.1: If the price is 4, we sell one unit to the first customer, if it is 3 we sell one unit to each of the first two, and so on. We have indicated the **reservation prices** of each customer with a star and then joint them with a straight line. **Reservation price**: The maximum price a buyer is willing to pay.

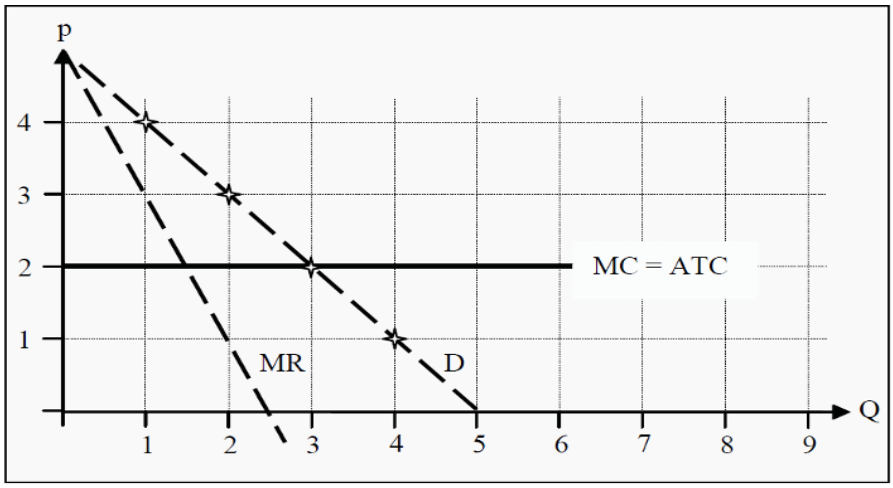


Figure 12.1: First Degree Price Discrimination

Furthermore, assume that the monopolist has a constant marginal cost, *MC* = 2, and no fixed cost. Then *AVC* = *ATC* = *MC*. In a perfectly competitive market, the equilibrium price would have been $p^* = 2$ and the quantity sold

would have been $Q^* = 3$. The firm's revenue would have been 3*2 = 6 (Q^*p), and its cost 3*2 = 6 (Q^*ATC). Its profit would therefore have been zero. The consumer surplus (CS) would have been the sum of each customer's surplus, i.e. the difference between his or her valuation and how much he or she pays. For the first customer, the surplus is 4 - 2 = 2, for the second 3 - 2 = 1, and for the third 2 - 2 = 0. Therefore, we get a total consumer surplus of $CS = 3$.

In a monopoly market the firm would have found the quantity at which $MC = MR$, i.e. $Q = 1.5$. If it can only sell whole units, it would have chosen to produce only one unit that it would have sold at a price of 4. The profit (= PS) would then be 1*(4 - 2) = 2, which is higher than in the perfectly competitive case. CS would be 4 - 4 = 0.

Suppose now instead that the monopolist knows the valuation of each consumer, and that the consumers cannot sell the goods to someone else if they have bought it. The monopolist can then use price discrimination of the first degree (also called *perfect price discrimination*): She charges a price from each customer that is equal to the maximum amount that customer is willing to pay. The first customer has to pay 4, the second 3, and the third 2. Since the monopolist has a marginal cost of production equal to 2, her surplus will be PS = (4 - 2) + (3 - 2) + (2 - 2) = 3. CS will be 0. Compared to a perfectly competitive market, the monopolist has won over all the CS.

Note that in this case, with first-degree price discrimination, the social surplus is as just large as in the case of perfect competition. The surplus has just been reallocated from the consumers to the producers. This means that this situation is actually efficient. It is another question whether it is fair.

Second Degree Price Discrimination

If the monopolist does not know the different valuations of different customers, she can instead use second-degree price discrimination. This amounts to offering different package solutions at different prices, and then the customers get to choose which package they prefer.

By choosing the composition of the packages in a clever way, she can get the customers to sort themselves into different groups. The goal of making them perform this type of self-sorting is to get the ones with high valuation to pay a high price and the ones with low valuation a lower price. An example of this type of price discrimination is quantity discounts.

Third Degree Price Discrimination

The third type of price discrimination amounts to dividing the market into two or more submarkets, where the valuations in the submarkets are different. Examples are different prices for children and grownups, or discounts for

students and the unemployed. For this to work, it has to be possible to identify the consumer as actually belonging to a certain group.

The criterion for profit maximization under third degree price discrimination is, in principle, the same as before, but we have to separate demand and marginal revenue in the two (or more) submarkets. Mathematically, this can be written as

MC(Q1+Q2)=MR1(Q1)=MR2 (Q2)

In other words, the marginal cost of producing the total quantity has to be as large as the marginal revenue from the first submarket, and simultaneously as large as the marginal revenue from the second submarket. With constant *MC* and linear demand in both submarkets, this can be illustrated as in Figure 12.2. The firm chooses to produce the quantity *Q1 + Q2*, and then sell the quantity *Q1* at a price of *p1* in the first submarket and the quantity *Q2* at a price of *p2* in the second submarket.

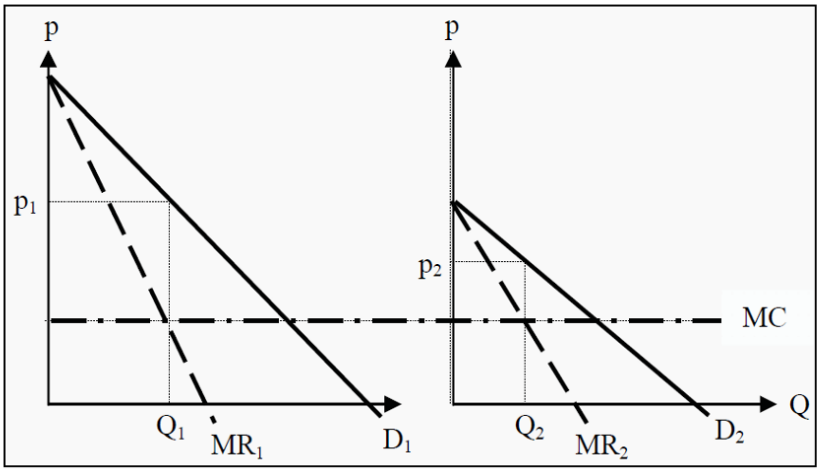


Figure 12.2: Third Degree Price Discrimination

Market Equilibrium

Short Run

In the short run, no new firms can establish themselves in the market (since the quantity of capital, by the definition of the short run, is fixed). To the left in Figure 15.1, *DS* is the short run demand curve an individual firm faces in a market with monopolistic competition, and *MRS* is the corresponding marginal revenue. Similar to a monopoly, the *MR* curve is twice as steep as the demand curve. The firm, as always, maximizes its profit by choosing the quantity,

q1 *, that makes *MC = MRS*. Since the average cost, *AC*, is below the price at that quantity, the firm makes a profit, *q1*(p1* - AC),* corresponding to the grey rectangle in the figure.

Long Run

Since the firms make a short run profit and there are no barriers to entry, new firms will establish themselves in the market. Thereby, the demand curve that the individual firm faces changes so that at each price it is now possible to sell a smaller number of goods. This means that to the right in Figure 15.1, where we have the situation in the long run, the demand curve, *DL*, and the marginal revenue, *MRL*, have shifted inwards (see the arrows in the figure).

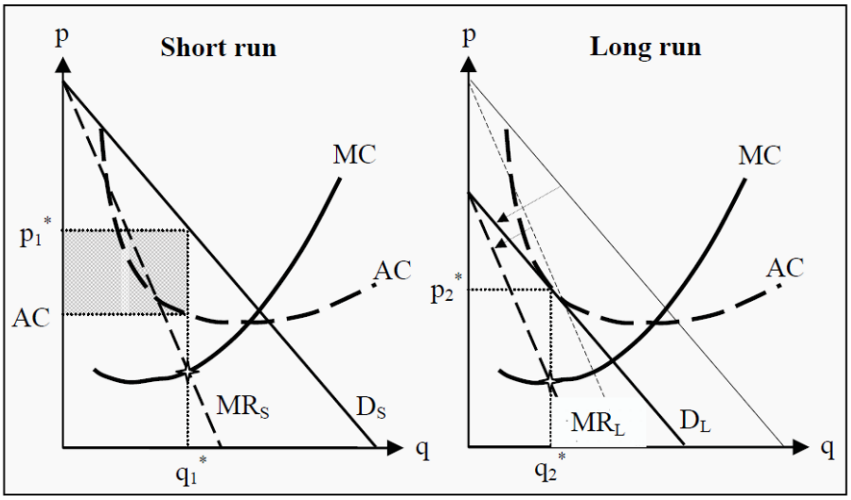


Figure 15.1: Equilibrium in the Short and Long Run for Monopolistic Competition

How far do they shift? They shift until there is no profit. Remember that, the firms choose the quantity that maximizes profit, i.e. the quantity that makes *MC* = *MR*. The demand curve, *DL*, will consequently shift until the quantity where the firm maximizes its profit, *q2* *, is such that the price the firm can take for the good, p2 *, is exactly equal to the average cost, *AC*. At that point, the profit is *q2* *(*p2* * - *AC*) = 0. Note that the production is not efficient. Even in the long run we have that *p* > *MC*, which means that the cost of producing additional goods is lower than the consumers' valuations. If we compare to the results for perfect competition in the long run (see Section 9.5), we see that one difference is that long-run production in the case of monopolistic competition does not end up at the lowest point of the *AC* curve. This, in turn, means that there are unexploited economies of scale (compare to Section 8.3). Had we had fewer firms in the market, and thereby larger firms to satisfy the demand, they would have come closer to the lowest point on the *AC* curve. On the other hand, we would then have had fewer (close substitute) products between which to choose. It is not possible, without a more detailed analysis, to say what balance between these two – lower unit costs or more products to choose from – that is the best for the consumers.

16.The Labour market and the use of labour resources in enterprises

Plan

16.1. The Supply of Labour
16.2. The Marginal Revenue Product of Labour
16.3. Monopsony in the Input Market

To produce goods and services, a firm uses raw materials, labour , and capital. We will now looking at the market for labour . The workers sell their labour , or alternatively the sell their leisure time, for a wage, and their supply depends on their valuations of leisure and wage, respectively.

From the firm's perspective, it buys labour as long as that gives a positive contribution to its profit. The firm's cost of labour is the wage, and its revenue of labour is the price at which they can sell the goods. The firm will consequently hire workers until the last produced unit of the good costs as much to produce as the firm is paid for it.

This means that the structure in the output market, i.e. the market where the firm sells its goods, will also affect what the firm will be willing to pay in wages, since it is in the output market that the price is set. We will study the cases when the output market is a perfectly competitive market and when it is a monopoly market. Furthermore, the structure of the labour market also affects the outcome. We study cases in which either the firm, or the workers, or both of them are in a monopoly position or in a perfectly competitive situation.

The Supply of Labour

We will assume that the workers prefer leisure to work and that they work for, and only for, the wage. There are 24 hours in a day, which sets an upper bound for how much labour a worker can sell. To analyze the supply of labour , it is useful to redefine the question: Instead of studying the supply of labour , we will study the demand for leisure. The supply of work will then be 24 minus the amount of leisure. Then, we can analyze the situation as in Figure 16.1.

The situation here is a variation of the analyses we have learned. As we are studying the consumption of two goods, leisure and wage (where, again, it is useful to think of money, the wage, as "all other goods than leisure"), increases and decreases in wage will have both substitution- and income effects.

To see the similarity with the analysis above, note that one can view an increase in wage as a decrease in the price of "all other goods." The budget line will then rotate around a fixed point at 24 (as a day has exactly 24 hours) on the X-axis and intersect the Y-axis at different points depending on the wage. Compare, for instance, to Figure 5.1. (However, note one thing: Here, the price

of the *other* good changes (i.e. wage, not leisure), not the price of the one we are analyzing.)

In Figure 16.1, we have drawn four budget lines, corresponding to four different levels of income, *w* (for wage), and four indifference curves. The indifference curves, as always, indicate combinations of the two goods that the individual is indifferent between, and she strives to maximize her utility given the budget restriction. As before, the point of maximization occurs where an indifference curve just barely touches a budget line. We have indicated four such points of tangency in the figure, and then connected them to a curve. That curve corresponds to the individual's demand for leisure, and indirectly (if you take 24 minus her demand for leisure) to her supply of labour. The odd thing about the supply curve for labour is that it slopes back again at high wages. Remember that the effect of a price change can be divided into a substitution effect and an income effect. At initially low wages, an increase in the wage often leads to an increase in the labour supplied. That is due to the substitution effect dominating over the income effect. The substitution effect makes the wage more attractive relative leisure, whereas the income effect makes the individual wealthier. The increase in wealth can lead to an increased consumption of both "other goods" (the wage) and of leisure.

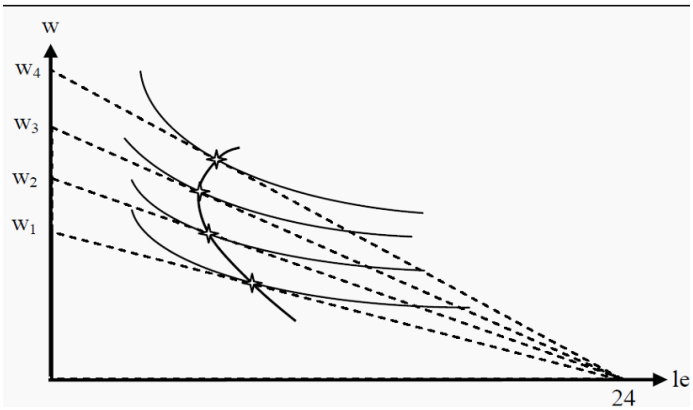


Figure 16.1: The Individual's Supply of Labour

The higher the wage is, the more important the income effect will be, until finally it will start to dominate over the substitution effect. If a well-paid individual has her wage increased even further, she may choose to work less than she used to. This is what makes the supply curve for labour bend backwards for high wages.

The Marginal Revenue Product of Labour

Before we studied the firm's production, and we defined the production function as a function of labour , *L*, and capital, *K*, such that $q = f(L,K)$. In the long run, both *L* and *K* are variable, in the short run only *L* is variable

If the firm buys one more unit (for instance, one more hour) of labour , how will that affect the profit? Remember that we defined the marginal product of labour , *MPL*, in Section 7.2.1. In words, *MPL* is how much more of the good that will be produced if we increase labour by a small amount (say, one more unit), given that everything else is held constant. When the firm decides whether to buy more labour , it first asks how large the *value* of the extra production is, i.e. how valuable is *MPL*? We can express this value mathematically as

$$MRP_L = \frac{\Delta TR}{\Delta L} = \frac{\Delta TR}{\Delta q} \cdot \frac{\Delta q}{\Delta L} = MR \cdot MP_L$$

Here, *MRPL*, is the **marginal revenue product of labour** . It corresponds to how much total revenue, *TR*, changes because of a small increase in *L*. In the third step above, we have divided and multiplied by *Δq* in order to show that *MRPL = MR*MPL*. In other words, if we hire one more unit of labour , the value added is how many additional units of the good is produced during that hour (*MPL*) times at which price can we sell each additional unit (*MR*). That value added is called the marginal revenue product of labour.

Marginal revenue product of labour: If one more hour of work is done, what is the value of the units produced?

The Firm's Short-Run Demand for Labour

As we have mentioned, the firm's demand for labour depends on what the market for the firm's output looks like, as well as on the level of competition in the labour market.

Perfect Competition in both the Input and Output Market

In the simplest case, we have perfect competition in both the input and in the output market. The firm cannot influence the price, *p*, on the good, which, in turn, makes the marginal revenue equal to the price (see Section 9.3.1): *MR = p*. The value of the marginal product of labour is consequently *MRPL = p*MPL*. Furthermore, the marginal cost of labour equals the wage, *MCL = w*. The firm will then hire workers as long as *MRPL > w*, i.e. as long as the revenue is higher than the cost of hiring, and the criterion for equilibrium is

MRP= w.

Note now that this means that the *MRPL* curve will become the firm's demand curve for labour. Furthermore, remember that we have the law of diminishing marginal returns (see Section 7.2.2). *MRPL = p*MPL* will therefore, eventually, start to diminish the more workers we hire (since *MPL* will diminish

while *p* is constant). We will then get a downward sloping demand curve for labour, as in the left part of Figure 16.2.

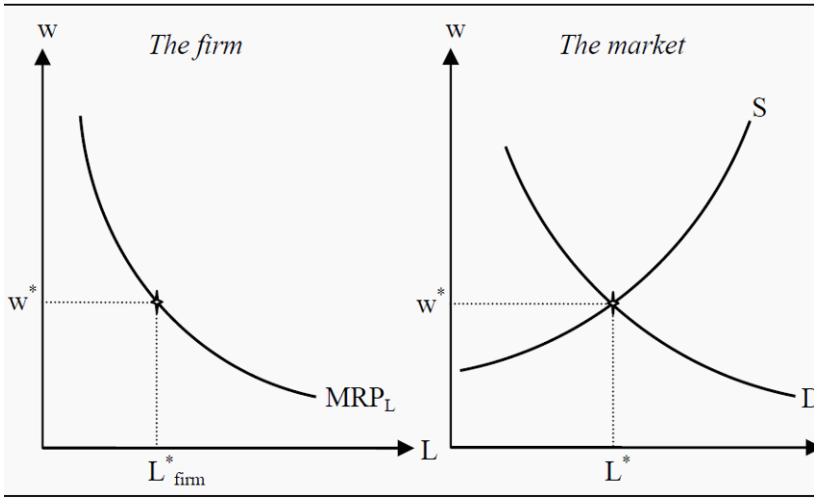


Figure 16.2: The Firm's Demand for Labour and the Market Equilibrium

Since we have perfect competition in the labour market, both the firm and the workers take the wage, *w*, as given, and as we have perfect competition in the output market as well, the firm takes *p* as given. The market's demand for labour is the sum of all firms' demand curves, and the market's supply is the sum of all individuals' supply curves (to the right in Figure 16.2). The individual firm will then hire workers until *MRPL = w*.

Monopoly in the Output Market

We continue to assume that there are many buyers and sellers of labour , but now we assume that the good is sold in a monopoly market. The firm maximizes profit in the same way as before, i.e. it hires workers until the cost, w, is as large as the marginal revenue product, *MRPL*. However, since the good is now sold in a monopoly market, MR will not be equal to the price anymore. Instead, *MR (< p)* will fall with increased production (see Section 11.2). This, in turn, means that *MRPL (= MR*MPL)* will be steeper than in the case of perfect competition in the output market (since now both *MRPL* and *MR* are downward-sloping curves). The monopolist produces a smaller quantity than a firm in a competitive market does, and therefore she will hire fewer workers.

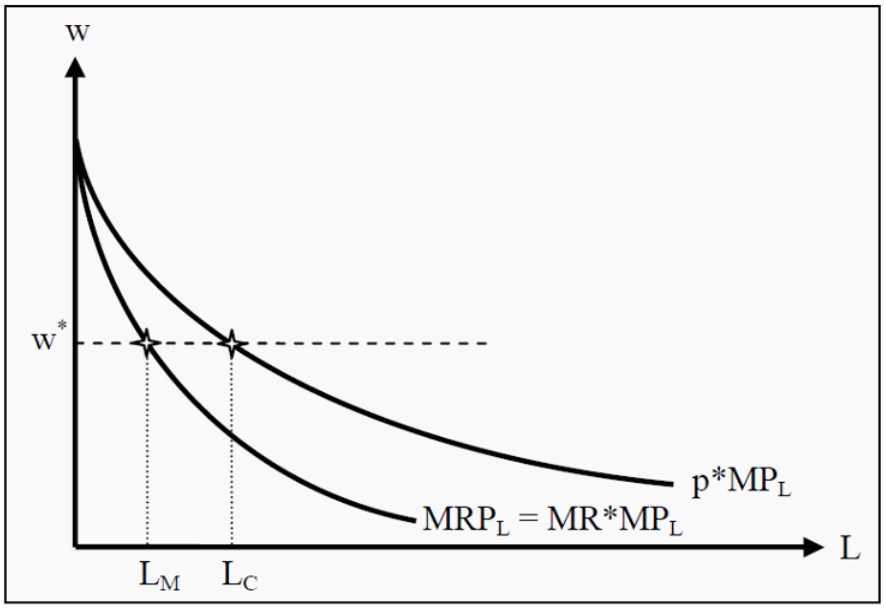


Figure 16.3: The Demand for Labour when the Output Market is a Monopoly

In Figure 16.3, we have drawn the demand curves for labour , both for a monopolist and for a firm in a competitive market. The monopolist's demand curve is *MRPL (= MR*MPL)* and it will lie below the *MRPL (= p*MPL*) for a firm in a competitive market. The wage, *w*, is set in a competitive labour market and cannot be affected by either workers or firms. However, the firm hires fewer workers, *LM*, than it would in a competitive market, *LC*. A monopoly in the output market will consequently create inefficiencies in both the market for goods and in the labour market.

Monopsony in the Input Market

Monopsony (mono = one; opsonia = buy) means that there is only one buyer. In the labour market, this means that there is only one buyer of labour . In countries where the government operates the health care system, it is, in effect, a monopsonist on, for instance, the market for nurses. The analysis of monopsonies parallels the one of monopolies.

Suppose, again, that there is perfect competition in the output market and that that there are many sellers of labour . However, there is only one buyer of labour . If the monopsonist increases the wage, she must do so for all workers, even the ones she has already hired. Thereby, her marginal cost of hiring one additional unit of labour is higher than the wage to the last worker. Since the monopsonist is the only buyer in the market, she faces the whole supply of the market. (Compare to the monopolist, who faces the whole demand of the market.) Her marginal cost of labour , *MCL*, will therefore have a steeper slope than the supply curve (see Figure 16.4).

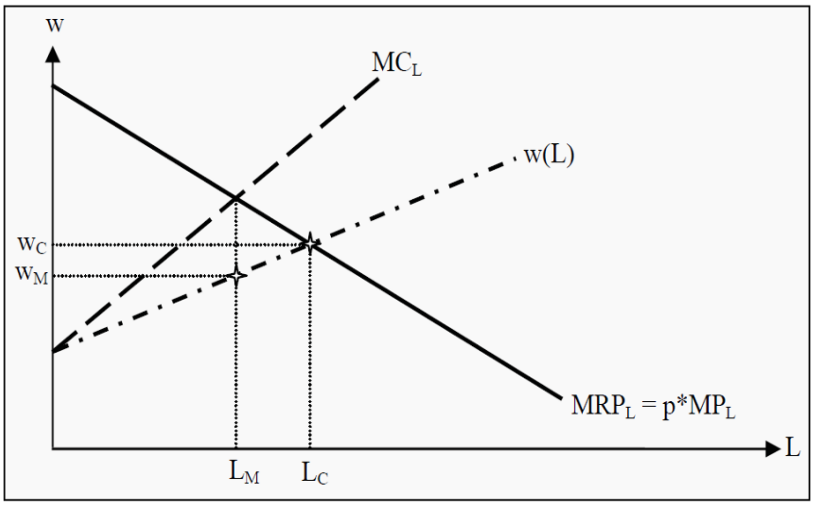


Figure 16.4: Monopsony

As in the other cases, the monopsonist hires workers as long as she gets higher revenues from doing so than she has to pay in wages. Now, since *MC* is not equal to the wage any more, she does so as long as *MRPL* > *MCL*. In equilibrium

MRPL = *MCL*.

Note now that, in the previous sections, 16.3.1 and 16.3.2, we had that *MCL* = *w*. Now, however, we have that *MCL* > *w*. In Figure 16.4, the monopsonist hires *LM* workers and pays a wage of *wM*. Comparing to the case when we have competition in the labour market, we see that the wage in a monopsony, *wM*, is lower and that the firm hires fewer workers, *LM* < *LC*. This parallels the results from the monopoly market, where the monopolist produced a smaller quantity than a perfectly competitive market did, and charged a higher price per unit.

Bilateral Monopoly

A **bilateral monopoly** is a situation in which there is only one buyer and one seller. Both parties will then have market power, and the outcome depends largely on negotiations, the business cycle, etc. This resembles the situation in some countries where there are centralized negotiations between unions representing the workers and other organizations representing the employers.

17.Capital investments and capital market

Plan

17.1. Capital Rental Markets
17.2. Correction for Risk
17.3. Pricing Business Projects

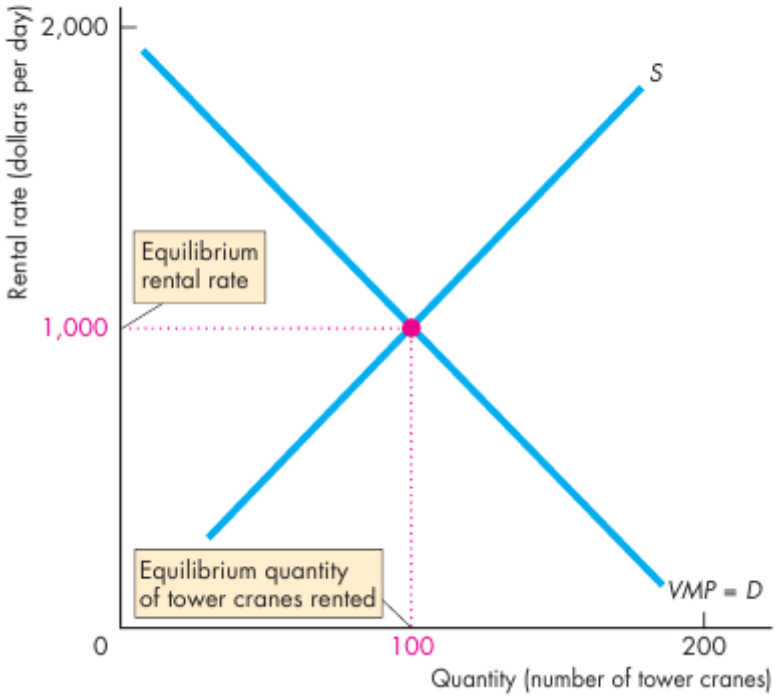
Capital Rental Markets

The demand for capital is derived from the value of marginal product of capital. Profit-maximizing firms hire the quantity of capital services that makes the value of marginal product of capital equal to the rental rate of capital. The lower the rental rate of capital, other things remaining the same, the greater is the quantity of capital demanded. The supply of capital responds in the opposite way to the rental rate. The higher the rental rate, other things remaining the same, the greater is the quantity of capital supplied. The equilibrium rental rate makes the quantity of capital demanded equal to the quantity supplied.

Figure below illustrates the rental market for tower cranes—capital used to construct high-rise buildings. The value of marginal product and the demand curve is VMP = D. The supply curve is S. The equilibrium rental rate is $1,000 per day and 100 tower cranes are rented.

Rent-Versus-Buy Decision Some capital services are obtained in a rental market like the market for tower cranes. And like tower cranes, many of the world's large airlines rent their airplanes. But not all capital services are obtained in a rental market. Instead, firms buy the capital equipment that they use. You saw that the cost of the services of the capital that a firm owns and operates itself is an implicit rental rate that arises from depreciation and interest costs. Firms that buy capital implicitly rent the capital to themselves.

FIGURE A Rental Market for Capital



The decision to obtain capital services in a rental market rather than buy capital and rent it implicitly is made to minimize cost. The firm compares the cost of explicitly renting the capital and the cost of buying and implicitly renting it. This decision is the same as the one that a household makes in deciding whether to rent or buy a home. To make a rent-versus-buy decision, a firm must compare a cost incurred in the present with a stream of rental costs incurred over some future period. The Mathematical Note explains how to make this comparison by calculating the present value of a future amount of money. If the present value of the future rental payments of an item of capital equipment exceeds the cost of buying the capital, the firm will buy the equipment. If the present value of the future rental payments of an item of capital equipment is less than the cost of buying the capital, the firm will rent (or lease) the equipment.

If the firm rents its capital, the problem of how much to rent is, more or less, the same as the problem of how much labour to use. It rents precisely so much that the rental rate becomes equal to the marginal revenue product of capital, i.e. until

$MRP\ K = r$,

where r is the rental rate. We used the rental rate to price capital.

If instead the firm is to *invest* in capital, the problem is very different. The quantity of capital is not variable in the short run. Often, the firm decides about investments that are to remain in place during many years and that are expected

to generate future profits. It is therefore necessary to compare flows from different points in time with each other: Is it ok to spend a large sum today to get access to future profits of certain expected size and that would come scattered over several years. How should one deal with the risk that the future profits will be lower than expected?

Present Value and Discounting

Rent-Versus-Buy Decision

To decide whether to rent an item of capital equipment or to buy the capital and implicitly rent it, a firm must compare the present expenditure on the capital with the future rental cost of the capital.

Comparing Current and Future Dollars To compare a present expenditure with a future expenditure, we convert the future expenditure to its "present value."

The present value of a future amount of money is the amount that, if invested today, will grow to be as large as that future amount when the interest that it will earn is taken into account. So the present value of a future amount of money is smaller than the future amount. The calculation that we use to convert a future amount of money to its present value is called discounting. The easiest way to understand discounting and present value is to first consider its opposite: How a present value grows to a future amount of money because of compound interest.

Compound Interest

Compound interest is the interest on an initial investment plus the interest on the interest that the investment has previously earned. Because of compound interest, a present amount of money (a present value) grows into a larger future amount. The future amount is equal to the present amount (present value) plus the interest it will earn in the future. That is,

Future amount = Present value + Interest income.

The interest in the first year is equal to the present value multiplied by the interest rate, r, so

Amount after 1 year = Present value + (r x Present value).

or

Amount after 1 year = Present value x (1 + r).

If you invest \$100 today and the interest rate is 10 percent a year (r = 0.1), one year from today you will have \$110—the original \$100 plus \$10 interest. Check that the above formula delivers that answer:

\$100 x 1.1 = \$110.

If you leave this \$110 invested to earn 10 percent during a second year, at the end of that year you will have

Amount after 2 years = Present value x (1 + r)2.

With the numbers of the previous example, you invest $100 today at an interest rate of 10 percent a year (r = 0.1). After one year you will have $110—the original $100 plus $10 interest. And after the second year, you will have $121. In the second year, you earned $10 on your initial $100 plus $1 on the $10 interest that you earned in the first year.

Check that the above formula delivers that answer:

$100 x (1.1)2 = $100 Ч 1.21 = $121.

If you leave your $100 invested for n years, it will grow to

Amount after n years = Present value x (1 + r) n.

With an interest rate of 10 percent a year, your $100 will grow to $195 after 7 years (n = 7)—almost double the present value of $100.

Discounting a Future Amount

We have just calculated future amounts one year, two years, and n years in the future, knowing the present value and the interest rate. To calculate the present value of these future amounts, we just work backward. To find the present value of an amount one year in the future, we divide the future amount by (1 + r). That is,

$$\text{Present value} = \frac{\text{Amount of money one year in future}}{(1 + r)}.$$

Let's check that we can use the present value formula by calculating the present value of $110 one year from now when the interest rate is 10 percent a year. You'll be able to guess that the answer is $100 because we just calculated that $100 invested today at 10 percent a year becomes $110 in one year. So the present value of $110 one year from today is $100. But let's use the formula. Putting the numbers into the above formula, we have to calculate the present value of an amount of money two years in the future, we use the formula:

$$\text{Present value} = \frac{\text{Amount of money two years in future}}{(1 + r)^2}.$$

Use this formula to calculate the present value of $121 two years from now at an interest rate of 10 percent a year. With these numbers, the formula gives

$$\text{Present value} = \frac{\$121}{(1 + 0.1)^2}$$
$$= \frac{\$121}{(1.1)^2}$$
$$= \frac{\$121}{1.21}$$
$$= \$100.$$

We can calculate the present value of an amount of money n years in the future by using the general formula

$$\text{Present value} = \frac{\text{Amount of money } n \text{ years in future}}{(1 + r)^n}.$$

What does time mean for the value of a certain sum of money? Suppose that we want to know how much 100 (of any currency) that we will get one year from now is worth today. We could then reason like this: If it were possible to put 98 in a bank account at an interest rate of 2%, then in a year that would be worth 98*1.02 = 100. Consequently, 100 in one year should be worth 98 today; the **present value** is 98. If we use that formula backwards, 100 in one year is worth 100/1.02 = 98 today, if the interest rate is 2%. Similarly, 100 in two years is worth 100/ (1.02)2 = 96 today, or more generally

Present value: The value today of future cash flows.

$$PV(100; R, n) = \frac{100}{(1+R)^n},$$

where *PV(*100*,R,n)* is the present value of 100, when the interest rate is *R* and the cash flow is in *n* years. If one knows which discount rate to use, it is easy to calculate the present value of future payments.

Bonds

We can use the present value formula to get the price of a bond. A bond is a security that gives the holder the right to a certain sum of money, the principal or face value, in a certain number of years. Often, the bond also pays a smaller amount each year, called the coupon. Some of the most important types of bonds are government bonds and corporate bonds.

Suppose we have a government bond that pays a coupon of 100 each year for ten years and then a face value of 1,000 in the tenth year. That means we will get ten payments. To calculate the present value of the future cash flows, we use the present value formula on each payment:

$$P_B = \frac{100}{1+R} + \frac{100}{(1+R)^2} + \frac{100}{(1+R)^3} + \ldots + \frac{100}{(1+R)^{10}} + \frac{1000}{(1+R)^{10}},$$

where *PB* is the price of the bond. If the discount rate is 2% as before, the bond would be worth 1 719.

Note, however, that bonds usually are *not* priced this way. Instead, the price is decided on the market; either in an auction or is negotiated between buyers and sellers. Then, one uses the formula to back out which discount rate is compatible with the price, the coupons, and the face value. It is usually impossible to find a formula to that. Instead, one uses a numerical method (that is often pre-programmed into calculators or spreadsheet programs) to find the correct discount rate. Suppose that the ten year bond above does not cost 1 719, but is traded at a market price of 1,000. It is then possible to calculate that the discount rate is 10 %. In other words, if you use 0.10 instead of *R* in the formula above, the sum will be exactly 1,000. The discount rate one gets this way is called the **yield to maturity**, and can be viewed as an internal rate of return on the bond.

There is also an odd type of bonds called perpetual bonds, which have no end date. They pay a coupon each year forever. This type of bond is surprisingly easy to price. It is possible to show that the value of perpetual bond that pays 100 each year is

$$P_{Perpetual} = \frac{100}{R}.$$

Conversely, if we know the price but not the yield: $R = 100/P$.

Stocks

Just as in the case of bonds, the price of stocks is usually set in the market. In principle though, one can use the present value formula to price them as well. As owner of a stock, one has the right to future **dividends**. With expectations of how large these will be, the present value of the future cash flows is:

$$P_s = \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \frac{D_3}{(1+R)^3} + \ldots$$

where *PS* is the price of the stock and *Di* is the expected dividend in year i. Unfortunately, this formula is impossible to use since it contains an infinite number of terms and *Di* can vary between periods. However, if one is willing to assume that the dividends will grow at a constant growth rate, *g*, and that *R* is

constant, it is possible to show that the formula can be simplified as (compare to the formula for a perpetual bond)

$$P_s = \frac{D_1}{R-g}.$$

Note, however, that these assumptions are quite unrealistic.

Correction for Risk

How do we get the correct discount rate? We have used *R* for all the discount rates above. However, interest rates for different securities differ substantially, and also change over time. The primary reason why, for instance, different bonds have different yields is that they have different levels of risk. A government bond is usually considered risk free whereas a corporate bond always has a risk that the issuer will not be able to fulfill her commitments. Interest rates for mortgages vary with the risk that the borrower will not be able to pay interest or installments.

Discount rates for stocks are not quoted, but if calculated they differ wildly depending on the underlying risk. The discount rate for a risky asset will consequently be higher than for a risk free asset (such as a government bond). Often, the higher discount rate is called a riskcorrected discount rate.

Diversifiable and Nondiversifiable Risk

Regarding risk, we must differentiate between diversifiable and nondiversifiable risk. Suppose you invest all your savings in stocks in only one firm. You are then exposed to the risk that this stock will rise or fall in value in an unpredictable way. That risk can be quite big. You can decrease the risk by instead investing in a mutual fund. The part of the fund that is invested in a certain stock is still exposed to the risk in that stock. However, since a certain stock is only a small part of the fund, that risk is much smaller. Furthermore, other stocks might tend to move in the opposite way (they have negative **correlation** with each other), thereby offsetting some of the movements. That will reduce risk even more. You have now reduced the risk by **diversifying** your portfolio. All risk that you have discarded is diversifiable risk.

However, not all risk is diversifiable. To see that, imagine that you own all assets in the world. You would then have an enormous portfolio of stocks, bonds, currency, real estate, etc. You would still be exposed to some risk, though: The value of your portfolio would vary with the state of the world economy, for instance depending on the business cycle. The risk you are still exposed to is nondiversifiable (also called systematic risk or market risk). If you own a portfolio that has the same composition as the world economy, i.e. has the same percentage stocks etc., you are also fully diversified and have no

diversifiable risk at all. If you have any other composition in your risky portfolio (and you probably do), you are exposed to both diversifiable and nondiversifiable risk.

To have diversifiable risk is unnecessary and most of those who have a large fraction of diversifiable risk are probably not aware of the problem. It is easy to get rid of that risk, either by diversifying or by investing in a well-diversified fund. One can therefore not expect any risk premium for holding diversifiable risk in ones portfolio. Remember that the risk premium is the sum one has to pay a risk-averse agent to assume a certain risk. Since there is no reason to pay anyone to assume a risk that is possible to do away with, there is no risk premium on diversifiable risk. Only nondiversifiable risk carries a risk premium. The risk premium is the main reason why stock owners in the long run have larger returns than, for instance, people who save only in savings accounts.

CAPM: Pricing Assets

Suppose we have a fund that invests in the world market portfolio described above. That fund will carry no diversifiable risk. It will then generate a certain expected return, *RM* (the market return). Part of that return is a compensation for risk. If one invests in the risk free rate, one gets a certain return of *Rf*. Therefore, the market risk premium must be the difference between the two: *RM* - *Rf*. The risk premium is, consequently, the expected excess return one earns for assuming nondiversifiable risk.

We can use the market risk premium to price other securities. The most fundamental model for pricing financial assets is the *CAPM* (Capital Asset Pricing Model). It states that the risk premium on asset j is proportional to the risk premium on the whole market:

$$R_j - R_f = \beta_j \left(R_M - R_f \right).$$

Here, *Rj* is the expected return on asset j; βj (beta) measures how asset j moves in relation to the market. If, for instance, asset j tends to rise 1 % when the market rises 1%, βj = 1, whereas if it only tends to rise by 0.5%, βj = 0.5. βj is then a measure of the riskiness of asset j, where only nondiversifiable risk is measured. The more nondiversifiable risk a certain asset has, the more it will covary with the market and the higher its β will be. Conversely, an asset with no nondiversifiable risk will have β = 0, so that *Rj* - *Rf* = 0. In other words, the discount rate is then equal to the risk free rate.

Pricing Business Projects

Often, *CAPM* is used to determine whether an investment is profitable or not. The idea is to first estimate how large the future profits will be. Thereafter

one estimates how large the discount rate should be. Finally, one calculates the present value of the investment and determines if it is worth its cost or not.

We assume that we already have estimates of the future profits. We must then determine the riskiness of the project. That is often done by comparing it to other similar projects that already exist. If the new project cannot be considered either more or less risky than other projects in the firm, one can use the firm's own internal rate of return as discount rate. However, suppose the firm is considering starting a new type of project. It is then possible to get an estimate of the riskiness by studying other firms with similar projects. The new project should have about the same (nondiversifiable) risk. Therefore, we use the other firms to get an estimate of β. Then we use that estimate in the *CAPM* formula and solve for what the discount rate, *Rj*, should be: $Rj = Rf + \beta(RM - Rf)$.

To give an example: Suppose we have a project that we expect will make a loss of 10 during the first year and then generate a profit of 200 during each of three consecutive years. Then we can sell the remains for 100. The present value of the future cash flows is

$$PV = \frac{-10}{1+R} + \frac{200}{(1+R)^2} + \frac{200}{(1+R)^3} + \frac{200}{(1+R)^4} + \frac{100}{(1+R)^4}.$$

Furthermore, suppose that the market risk premium, *RM* - *Rf*, is 6%, that the risk free rate of return, *Rf*, is 2% and that β for a firm with a similar project is 1.5. We then estimate the discount rate to 2 % + 1.5*6% = 11%. If we use that value in the formula, the present value is 497.

Should we invest or not? That depends on the price. If the cost of the project is less than 497, we invest; if it is more, we do not. Often, one includes the cost in the present value. This is then called the net present value (*NPV*). The investment criterion is then whether $NPV > 0$ or not. Suppose the investment costs 450. Then $NPV = -450 + 497 = 47$, and we should go on with the investment since it is profitable.

Sometimes, one performs a slightly different analysis. With an estimate of the future cash flows and the investment cost, one can solve for the *R* that makes *NPV* equal to zero. (One would then use the same type of numerical procedure as for calculating the yield a bond.) If the cost is still 450, $R = 14.6\%$. That rate is called the internal rate of return and can also be used as an investment criterion. If a project with the same risk (the same β) demands a return that is lower than 14.6%, we invest, if it demands a higher return we do not.

18. State regulation activity of enterprises

Plan

18.1. Externalities
18.2. Regulations of Markets with Externalities
18.3. Definition of Public and Private Goods

In the remaining chapters, we will look at a few cases of **market failures**. A market failure is a situation in which the market fails to achieve an efficient allocation. A few such cases we have already seen. Both monopolies and oligopolies are, for instance, examples of market failures. In the following, we will briefly discuss externalities, public goods, and asymmetric information.

Our consumption of goods does not occur in a social vacuum. Much of our consumption, perhaps all of it, indirectly affects other people. The most classical example is pollution. It does not have to be a big factory; it could be your neighbours having a barbecue party. You do not participate, but you still get a share of the smell. You might take your car to work; you pay for the fuel but not for the pollution or the congestion to which you expose others. Other examples include the use of penicillin (you are cured, but contribute to making bacteria penicillin resistant), vaccinations, and a well kept garden that your neighbours also enjoy looking at.

An **externality** is a situation in which the consumption or the production of goods has positive or negative effects on other people's utility where these effects are not reflected in the price. **Externality**: A situation in which there are uncompensated costs (or benefits) not reflected in the price of a good.

It is common to distinguish between positive and negative externalities:

• Positive externalities. One person's consumption of a good also increases other people's utility without them having to pay for it.

• Negative externalities. One person's consumption of a good decreases other people's utility without them receiving any compensation.

Note that positive externalities are also a problem. Typically, we get too few goods with positive externalities and too many goods with negative externalities.

The Effect of a Negative Externality

Let us study the classical example of a negative externality: A firm produces a good, but in doing so they also pollute the environment. First, we need to define a few concepts:

• *The marginal cost of the externality*, *ME*. The change in the cost of the marginal effect, when production is increased by one unit. This is similar to the concept of *MC*, but instead of concerning the cost for the firm, it concerns the (uncompensated) cost of the externality.

• *Social cost*. The sum of the cost of producing the good and the cost of the external effect.

• *Marginal social cost*, *MSC*. The sum of the firm's marginal cost and the marginal cost of the externality, i.e. *MC* + *ME*.

We can analyze this situation in a way that is similar to the one in previous chapters. Look at Figure 19.1. The firm operates in a perfectly competitive market, so *MR* = *p*. To maximize its profit, the firm chooses to produce the quantity where *MC* = *MR*, i.e. the quantity *qC*.

However, this firm also emits pollution. The pollution does not cost the firm anything, but there is a cost to society. The more the firm produces, the more it pollutes. In the figure, we have drawn the marginal cost of the external effect, *ME*, and the marginal social cost, *MSC* = *MC* + *ME*. We see that for society, the optimal quantity to produce is qS.

The effect of the firm being able to ignore the cost of polluting is that it produces too much of the good. As an indirect effect of that, there will also be more pollution than at the optimum.

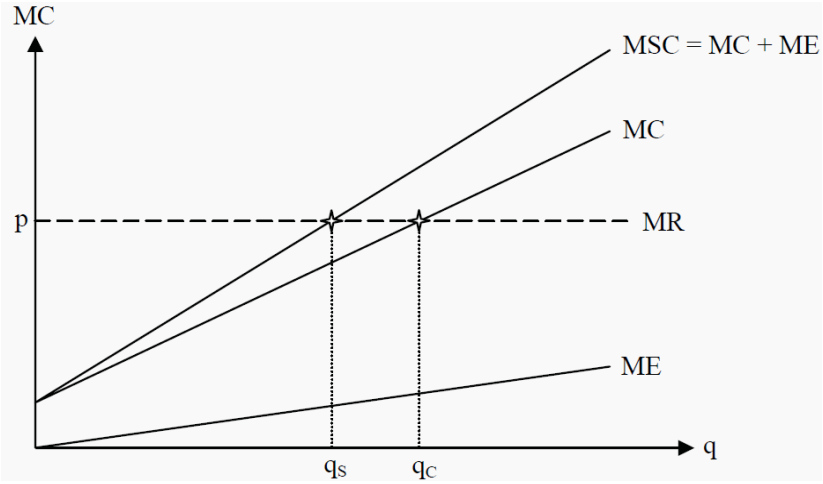


Figure 19.1: The Effect of a Negative Externality

POSITIVE EXTERNALITIES

Although some activities impose costs on third parties, others yield benefits. For example, consider education. To a large extent, the benefit of education is private: The consumer of education becomes a more productive worker and thus reaps much of the benefit in the form of higher wages. Beyond these private benefits, however, education also yields positive externalities. One externality is that a more educated population leads to more informed voters, which means better government for everyone. Another externality is that a more

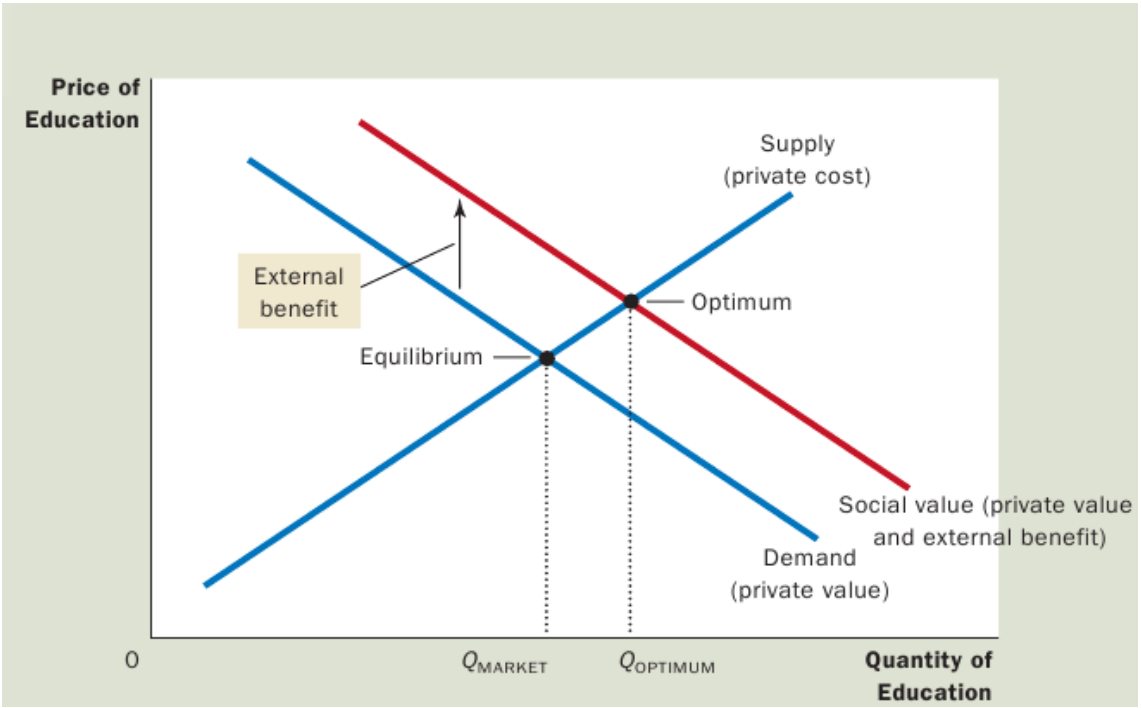
educated population tends to mean lower crime rates. A third externality is that a more educated population may encourage the development and dissemination of technological advances, leading to higher productivity and wages for everyone. Because of these three positive externalities, a person may prefer to have neighbours who are well educated.

The analysis of positive externalities is similar to the analysis of negative externalities. As Figure 3 shows, the demand curve does not reflect the value to society of the good. Because the social value is greater than the private value, the social value curve lies above the demand curve. The optimal quantity is found where the social-value curve and the supply curve (which represents costs) intersect.

Hence, the socially optimal quantity is greater than the quantity determined by the private market. Once again, the government can correct the market failure by inducing market participants to internalize the externality. The appropriate response in the case of positive externalities is exactly the opposite to the case of negative externalities.

To move the market equilibrium closer to the social optimum, a positive externality requires a subsidy. In fact, that is exactly the policy the government follows: Education is heavily subsidized through public schools and government scholarships.

To summarize: Negative externalities lead markets to produce a larger quantity than is socially desirable. Positive externalities lead markets to produce a smaller quantity than is socially desirable. To remedy the problem, the government can internalize the externality by taxing goods that have negative externalities and subsidizing goods that have positive externalities.



Regulations of Markets with Externalities

One way to correct the situation in Section 19.2 is to put a tax on each unit of the product. If one knows the size of *ME* then the tax should be that same amount. Thereby, the marginal cost curve of the firm will coincide with *MSC*, and the firm will automatically correct its production to the optimal quantity, *qS*. An obvious problem with this solution is that one rarely knows *ME*.

Other strategies to regulate the market include quantity regulations and the creation of transferable emissions permits.

Public Policies Toward Externalities

We have discussed why externalities lead markets to allocate resources inefficiently but have mentioned only briefly how this inefficiency can be remedied. In practice, both public policymakers and private individuals respond to externalities in various ways. All of the remedies share the goal of moving the allocation of resources closer to the social optimum.

This section considers governmental solutions. As a general matter, the government can respond to externalities in one of two ways. Command-and-control policies regulate behaviour directly. Market-based policies provide incentives so that private decision makers will choose to solve the problem on their own.

Command-And-Control Policies: Regulation

The government can remedy an externality by making certain behaviours either required or forbidden. For example, it is a crime to dump poisonous chemicals into the water supply. In this case, the external costs to society far exceed the benefits to the polluter. The government therefore institutes a command-and-control policy that prohibits this act altogether.

In most cases of pollution, however, the situation is not this simple. Despite the stated goals of some environmentalists, it would be impossible to prohibit all polluting activity. For example, virtually all forms of transportation—even the horse—produce some undesirable polluting by-products. But it would not be sensible for the government to ban all transportation. Thus, instead of trying to eradicate pollution entirely, society has to weigh the costs and benefits to decide the kinds and quantities of pollution it will allow. The Environmental Protection Agency (EPA) is the government agency with the task of developing and enforcing regulations aimed at protecting the environment. Environmental regulations can take many forms. Sometimes the EPA dictates a maximum level of pollution that a factory may emit. Other times the EPA requires that firms adopt a particular technology to reduce emissions. In all cases, to design good rules, the government regulators

need to know the details about specific industries and about the alternative technologies that those industries could adopt. This information is often difficult for government regulators to obtain.

Corrective Taxes And Subsidies

Instead of regulating behaviour in response to an externality, the government can use market-based policies to align private incentives with social efficiency. For instance, as we saw earlier, the government can internalize the externality by taxing activities that have negative externalities and subsidizing activities that have positive externalities. Taxes enacted to deal with the effects of negative externalities are called corrective taxes. They are also called Pigovian taxes after economist Arthur Pigou (1877–1959), an early advocate of their use. An ideal corrective tax would equal the external cost from an activity with negative externalities, and an ideal corrective subsidy would equal the external benefit from an activity with positive externalities.

Economists usually prefer corrective taxes to regulations as a way to deal with pollution because they can reduce pollution at a lower cost to society. To see why, let us consider an example.

Suppose that two factories—a paper mill and a steel mill—are each dumping 500 tons of glop into a river each year. The EPA decides that it wants to reduce the amount of pollution. It considers two solutions:

- Regulation: The EPA could tell each factory to reduce its pollution to 300 tons of glop per year.
- Corrective tax: The EPA could levy a tax on each factory of $50,000 for each ton of glop it emits.

The regulation would dictate a level of pollution, whereas the tax would give factory owners an economic incentive to reduce pollution. Which solution do you think is better?

Most economists prefer the tax. To explain this preference, they would first point out that a tax is just as effective as a regulation in reducing the overall level of pollution. The EPA can achieve whatever level of pollution it wants by setting the tax at the appropriate level. The higher the tax, the larger the reduction in pollution. If the tax is high enough, the factories will close down altogether, reducing pollution to zero.

Although regulation and corrective taxes are both capable of reducing pollution, the tax accomplishes this goal more efficiently. The regulation requires each factory to reduce pollution by the same amount. An equal reduction, however, is not necessarily the least expensive way to clean up the water. It is possible that the paper mill can reduce pollution at lower cost than the steel mill. If so, the paper mill would respond to the tax by reducing

pollution substantially to avoid the tax, whereas the steel mill would respond by reducing pollution less and paying the tax.

In essence, the corrective tax places a price on the right to pollute. Just as markets allocate goods to those buyers who value them most highly, a corrective tax allocates pollution to those factories that face the highest cost of reducing it. Whatever the level of pollution the EPA chooses, it can achieve this goal at the lowest total cost using a tax.

Economists also argue that corrective taxes are better for the environment. Under the command-and-control policy of regulation, the factories have no reason to reduce emission further once they have reached the target of 300 tons of glop. By contrast, the tax gives the factories an incentive to develop cleaner technologies because a cleaner technology would reduce the amount of tax the factory has to pay.

Corrective taxes are unlike most other taxes. As we discussed most taxes distort incentives and move the allocation of resources away from the social optimum. The reduction in economic well-being—that is, in consumer and producer surplus—exceeds the amount of revenue the government raises, resulting in a deadweight loss. By contrast, when externalities are present, society also cares about the well-being of the bystanders who are affected. Corrective taxes alter incentives to account for the presence of externalities and thereby move the allocation of resources closer to the social optimum. Thus, while corrective taxes raise revenue for the government, they also enhance economic efficiency.

The Coase Theorem

How effective is the private market in dealing with externalities? A famous result, called the Coase theorem after economist Ronald Coase, suggests that it can be very effective in some circumstances. According to the Coase theorem, if private parties can bargain over the allocation of resources at no cost, then the private market will always solve the problem of externalities and allocate resources efficiently.

To see how the Coase theorem works, consider an example. Suppose that Dick owns a dog named Spot. Spot barks and disturbs Jane, Dick's neighbor. Dick gets a benefit from owning the dog, but the dog confers a negative externality on Jane. Should Dick be forced to send Spot to the pound, or should Jane have to suffer sleepless nights because of Spot's barking? Consider first what outcome is socially efficient. A social planner, considering the two alternatives, would compare the benefit that Dick gets from the dog to the cost that Jane bears from the barking. If the benefit exceeds the cost, it is efficient for Dick to keep the dog and for Jane to live with the barking. Yet if the cost exceeds the benefit, then Dick should get rid of the dog.

According to the Coase theorem, the private market will reach the efficient outcome on its own. How? Jane can simply offer to pay Dick to get rid of the dog. Dick will accept the deal if the amount of money Jane offers is greater than the benefit of keeping the dog. By bargaining over the price, Dick and Jane can always reach the efficient outcome. For instance, suppose that Dick gets a $500 benefit from the dog and Jane bears an $800 cost from the barking. In this case, Jane can offer Dick $600 to get rid of the dog, and Dick will gladly accept. Both parties are better off than they were before, and the efficient outcome is reached. It is possible, of course, that Jane would not be willing to offer any price that Dick would accept. For instance, suppose that Dick gets a $1,000 benefit from the dog and Jane bears an $800 cost from the barking. In this case, Dick would turn down any offer below $1,000, while Jane would not offer any amount above $800.

Therefore, Dick ends up keeping the dog. Given these costs and benefits, however, this outcome is efficient. So far, we have assumed that Dick has the legal right to keep a barking dog. In other words, we have assumed that Dick can keep Spot unless Jane pays him enough to induce him to give up the dog voluntarily. But how different would the outcome be if Jane had the legal right to peace and quiet? According to the Coase theorem, the initial distribution of rights does not matter for the market's ability to reach the efficient outcome. For instance, suppose that Jane can legally compel Dick to get rid of the dog. Although having this right works to Jane's advantage, it probably will not change the outcome. In this case, Dick can offer to pay Jane to allow him to keep the dog. If the benefit of the dog to Dick exceeds the cost of the barking to Jane, then Dick and Jane will strike a bargain in which Dick keeps the dog. Although Dick and Jane can reach the efficient outcome regardless of how rights are initially distributed, the distribution of rights is not irrelevant: It determines the distribution of economic well-being. Whether Dick has the right to a barking dog or Jane the right to peace and quiet determines who pays whom in the final bargain. But in either case, the two parties can bargain with each other and solve the externality problem. Dick will end up keeping the dog only if the benefit exceeds the cost.

To sum up: The Coase theorem says that private economic actors can solve the problem of externalities among themselves. Whatever the initial distribution of rights, the interested parties can always reach a bargain in which everyone is better off and the outcome is efficient. **Definition of Public and Private Goods**

A **public good** is a good that fulfils both of the following two criteria:

• *Nonrival*. One individual's consumption of the good does not affect any other individual's consumption *of the same unit* of the good. Examples include lighthouses, television, parks, military defense, and streets with little traffic.

• *Nonexclusive*. It is not possible to exclude anyone from consuming the good. The examples above are usually nonexclusive.

A private good is, instead, a good that does not fulfil any of the two criteria, i.e. one that is both rival and exclusive. Most goods are private goods.

The Aggregate Willingness to Pay

To find the market's demand curve for a public good we must know each individual's demand for it.

Suppose we have two individuals, A and B, and that they each have an individual demand curve regarding, say, a park, corresponding to *DA* and *DB* in Figure 19.1. When we derived the market demand for a private good, we summed the individuals' demand curves horizontally. For public goods we, instead, have to sum them *vertically*.

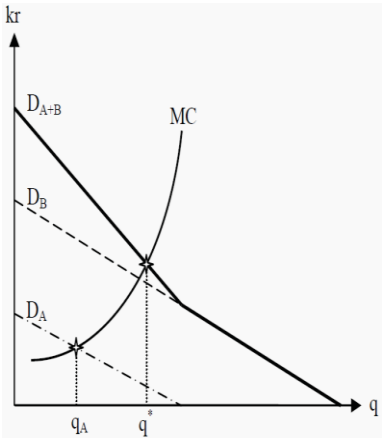


Figure 19.1: Public Goods

To see why this is the case, think of what a public good is. Suppose we produce one unit of the good and that A value that unit to 10, whereas B values it to 15. Had it been a private good, only one of them could have consumed it. However, since a public good is nonrival, both A and B can consume it at the same time. Consequently, the aggregate willingness to pay for this unit is 10 + 15 = 25. Similarly for the second, third, and all following units, and we sum the demand curves in Figure 19.1 vertically. The market demand in this case, corresponds to the thick demand curve *DA+B*.

We see that, the optimal quantity, *q**, is at the point where the marginal aggregate willingness to pay is equal to the marginal cost. As a comparison, we have also indicated what would happen if only one of the individuals had decided on the quantity. If A had done so, the quantity *qA* would have been

produced. As compared to the optimum, q^*, we would have seen a much smaller quantity.

Free Riding

In the last section, we derived the demand curve for the public good by summing the individuals' willingness to pay. The problem is that we usually do not know their willingness to pay. For private goods, this is not a problem, since it is optimal for the consumers to pay a price up to their willingness to pay. For instance, if the price of milk is 10 and an agent buys three liters of milk, her marginal willingness to pay for the last unit is at least 10 and her marginal willingness to pay for additional units is less than 10. We do not need to know it beforehand, as she will reveal it by her behaviour.

However, for public goods it is not optimal for consumers to reveal their willingness to pay. If she will later have to pay an amount equal to the one she states, it is often individually better for her to understate her willingness to pay. If the good is still produced, she will make a sort of profit: She receives more utility than she has paid for. She is then said to be **free riding**. **Free riding**: One lets other people pay by understating one's valuation of a public good.

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