Basic Microeconomics

Adapted from the original work
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1 Introduction to Microeconomics

Archeological and written records of human existence suggest that obtaining the material means to satisfy wants has been a perpetual problem. Food and shelter are requirements of human life. Other goods satisfy a range of human desires and give pleasure or utility to individuals. The study of ways that humans deal with these problems of provisioning is called "economics."

The evolution of processes to solve the provisioning problem takes place in a social context. As a result, the economy is a subsystem and is interrelated with a variety of other social subsystems. These subsystems include (but are not limited to) economic, political, religious, social, geographic, demographic, legal, and moral systems. The psychology of individuals is also fundamental to the social system. From the time of the Greeks (e.g. Xenophon [430-355 BCE], Plato [427-347 BCE] and Aristotle [384-322 BCE]) through the Classical economists (e.g. Adam Smith [1723-1791], Thomas Malthus [1766-1834] and David Ricardo [1772-1823]), economics was treated as part of philosophy, religion and/or moral philosophy.

During the 19th century, social science emerged and separate disciplines were carved out. Economics, psychology, sociology, politics, anthropology and other branches of social science developed as separate fields of study. In the last part of the 19th century, "political economy" became "economics." Since that time, economics has been frequently defined as "the study of how scarce resources are allocated to satisfy unlimited wants." As a professional discipline, economics is often regarded as a decision science that seeks optimal solutions to technical allocation problems. In this text, economics is presented from two perspectives. First, the process of provisioning will be presented. The second perspective is the technical analysis of the processes by which scarce resources are allocated for competing ends.

1.1 Economics as a Study of Provisioning

Provisioning treats economics as a social science. Economics as a study of provisioning includes the historical and philosophical foundations and context of economic behavior. The tradeoffs between the economic and non-economic goals are considered. The interrelationships of economic life with justice, ethics, morality, creativity, security and aesthetic values are of concern. Human societies have attempted a broad array of alternative systems to deal with the problem of provisioning. Some have been more successful and other less so. Some systems have lasted for thousands of years with few changes. Other systems have come and gone quickly. In some cases environmental problems have cause the demise of societies. In other cases, the societies ended abruptly with social revolution. In other cases, the societies adapted to changing circumstances and evolved over time. Mayan, Egyptian, Roman, Incan are only a few of the societies that have come and gone. Archeological studies continually find evidence of societies that flourished and ultimately failed. In some cases they were destroyed from outside forces: the Spanish ended the Aztec and Incan societies. In other cases, the causes were environmental: there is a hypothesis a drought is responsible for a dramatic change in the Mayan society.

Economics as a study of provisioning is concerned with the relationships among individuals, between individuals and the community, and between individuals, society and natural and built environments. Natural environment refers to the geographic (cultural and physical) and meteorological phenomena. The built environment consists of the infrastructure and knowledge that a society has inherited and created. It should be noted that humans have the capacity to alter their natural environment in both positive and negative ways.

1.2 Economics as a Study of the Allocation of Scarce Resources

From a technical perspective, economics is the study of how various alternatives or choices are evaluated to best achieve a given objective. The domain of economics is the study of processes by which scarce resources are allocated to satisfy unlimited wants. Ideally, the resources are allocated to their highest valued uses. Supply, demand, preferences, costs, benefits, production relationships and exchange are tools that are used to describe the market processes by which individuals allocate scarce resources to satisfy as many wants as possible. This increasingly narrow focus is the domain of modern, "neoclassical," microeconomic analysis.

This introductory chapter is intended to introduce some of the fundamental issues in the study of economics.

1.3 Social Science and Economics

There is substantial evidence and general agreement that humans live in social groups. The Western tradition, as framed by the Greeks and the Judeo/Christian tradition, holds that humans are social animals.

Plato [427-347 BCE] and Aristotle [384-322 BCE] offer explanations of the rise of the city-state. In *The Republic*, Plato sees the origins of the city-state in the quest for justice. Plato describes a conversation between Socrates and a group of students. They are pondering the nature of justice. They conclude that justice is each person doing that which they are best suited to do. The person best suited to be a baker should be a baker: the person best suited to be a shepherd should be a shepherd. Once individuals specialize, the city-state arises to facilitate the interactions among the individuals. [*The Republic*, Book II]

In *Politics*, Plato's student, Aristotle, sees an organic composition of society. The state becomes a natural community that is treated as an organism. There is a natural progression from family to village to the city-state. The city-state is then "prior to the family and individual." [*The Politics*, Book I, Chapter 9]

While Plato and Aristotle take different approaches, both see economic behavior as an integral part of society. Plato's focus is on justice and Aristotle's is on the "good life." One of the fundamental problems that both identify is the nature of the proper relationship between the individual and society.

1.3.1 Role of Individual in the Community

In economics (and social sciences more generally), the nature of the role of the individual in the community or state has been a persistent question. Every society must address the question (either implicitly or explicitly), "How can the autonomy (or freedom or liberty) of an individual be maintained and at the same time provide for the commonweal (social welfare)?" In some societies, the individual is regarded as more important than the community. In other societies, the community has priority over the individual. From a practical perspective, the problem is to balance the rights and freedom of the individual with the functions of the community.

There are several perspectives about the most appropriate ways to achieve that balance. While dealing with this balance, the allocation or provisioning problem must be resolved.

1.3.2 Cooperation, Competition and Conscription

Ideally, each individual is free to make choices that are consistent with their desires (preferences, values) and at the same time, these choices are consistent with the commonweal. Competition, cooperation and conscription may be used to coordinate individual actions. Different societies have attempted different approaches at different times.

1.3.2.1 Cooperation and conscription

Cooperation implies voluntary agreements and a coordinated approach to the solution of a problem. Conscription implies a non-voluntary or forced behavioral choice in the allocation process. An economic input (labor, capital, land) or good can be conscripted. Conscription implies the ability of one person or group to force another to make choices they would not prefer. Cooperation and coercion are opposite ends of a spectrum or range of behavioral patterns. The degree to which a choice is voluntary or forced is not always clear. A group of Inuits above the Arctic Circle may use cooperation as an important element of the coordination process. "Cooperation" may be encouraged by strongly held common values or necessity. Each member of the society understands that their chance for survival is reduced if she or he is not a member of the community. A behavior that is not sanctioned by be community (e.g. theft, murder, etc) may be result in the individual being ostracized and expelled from the community, the result being death. Is the acceptance of group values and activities voluntary or coerced? If a government (a formal social institution for allocating power and decision making authority in a community) uses sanctions to force behavior or choice it is clearly coercion or conscription. If I threaten harm if you do not make a given choice or act in a specific way, that is coercion. If a person's mother says, "Your go ahead but it will break my heart!" is that coercion?

Voluntary cooperation and coerced conscription lie at opposite ends of a continuum. It is a variation of the arguments about whether individuals have free will. The shift from voluntary coordinated behavior (cooperation) to coerced coordinated behavior (conscription) is a matter of degrees. In both cases, individuals have an incentive to coordinate their behavior. In the case of coercion, the incentive is the costs created and imposed by other individuals or groups of individuals. A student in high school may feel coerced by their peers, the class bully or the rules of the system. A worker may be coerced by other workers, the management of the firm or government regulations.

1.3.2.2 Competition

Market oriented societies focus on the use of competition to constrain individual behavior. In Western industrial societies, competition is regarded as the optimal way to coordinate economic behavior. A market exchange is a contract between a seller and a buyer. The seller competes to get the highest possible price (or best deal), while the buyer competes to by at the lowest possible price. The competition between the buyer and seller is influenced by the tastes (or preferences) of buyer and seller, information that each has and alternatives that each has.

The word "competition" has at least two meanings in economics. One is to refer to rivalry. In rivalry, there is a winner and a loser. The other is a structural notion of "pure" competition where the sellers do not see themselves as rivals (farmers are often thought of as being engaged in highly competitive markets but do not see themselves as rivals.)

Generally, societies use a mix of cooperation and competition. A firm is a form of cooperation. In 1937, Ronald Coase published an explanation of why business firms exist in a market economy (Coase, pp 33-55) If a competitive market economy were the optimal way of allocating resources, why would firms be desired? Coase argues that there are costs of using a market. He calls these costs "transaction cost." There are also costs of creating and operating an organization. If the transaction costs exceed the cost of organizing a cooperative endeavor, a firm will be created to avoid the use of market transactions.

1.3.3 The Nature of an Economic System and Processes within a System

The study of economics can be approached at different levels. At one level economics is the study of how the economic provisioning, or economic systems, come into being and evolve over time. At another level, economics studies the structure and ways in which a particular system deals with the allocation or provisioning problem.

The study of the structure and evolution of economic systems typically is interdisciplinary. It may use a good deal of history, psychology, sociology, law and philosophy in its analysis of the social process of provisioning. When economics is the study of a particular system, it tends to be narrower and focus is on specific processes. In the Western industrial societies, the current focus is on market oriented economic processes and is referred to as "Neoclassical" microeconomics or "price theory." Its focus is on the competitive behavior of individuals and exchange transactions in a market context.

1.3.4 Social Interaction and Technology

Humans have sought to solve the problem of provisioning through social interaction and the use of technology. Social interaction is used to refer to the relationships between two or more individuals. In this context, an "individual" has the ability to make a decision and carry that decision out. In legal terms, this individual is called an "agent." (One of the important concepts in law and economics is the relationship between a principal and an agent. This concept will be addressed in more detail later in the text.)

An agreement between two individuals or agents is a contract. The agreement may be influenced by social institutions as well as the preferences and values of the individuals. A social institution is a habitual pattern of behavior that is embedded in a social system. Marriage is an example of a social institution. It is a contract between two people. The form of that contract is influenced by commonly held social values and laws of a society. Almost all societies have some form of marriage. Marriage is a social creation that provides a solution to the problem of rearing children. As a social institution, it may change over time as social values, technology, work and environment change. These institutions may vary from place to place.

Money, law (or the legal system), property rights and markets are examples of economic institutions. Institutions simultaneously facilitate and constrain human activities.

Technology is the knowledge about the individuals' relationships with the natural and built environments. This knowledge can be used to alter elements in the environments to satisfy human wants. Technology involves knowledge about alternative ways of solving the problem of provisioning.

1.4 The Problem of Provisioning

Society is confronted with a finite set of resources and a given state of technology at any given point in time. As a result, there is a finite amount of goods and services that can be produced in that time frame. Given human desires and need for food, clothing and shelter, it is not always possible to produce everything that every one would like to have. When individuals want more than can be produced they have the economic problem of scarcity.

The problem of scarcity might be resolved by reducing individuals wants or by increasing the output of goods and services. If the solution is to reduce wants, which wants should be eliminated and which should be retained to be satisfied? The individual would necessarily be required to make a choice. If the solution was to produce more goods, which goods should be produced and how are they to be produced? Again, the individual must make choices. In modern, neoclassical, economic analysis (we will call this "orthodox" economics), the problem is structured so the wants are taken as given and the problem is to produce the goods that satisfy the greatest wants.

Scarcity requires that the individual or agent make choices. An individual in isolation (Defoe's Robinson Crusoe before Friday) would have to make choices since time and resources are limited. It would be necessary to choose whether time was to be spent catching fish, gathering coconuts, reading or building shelter. If the choice were to catch fish, he/she would have to choose between making a net, a fishing pole or trying to catch fish by hand. The choice to spend an hour fishing implies that that hour cannot be used to gather coconuts. The sacrifice of coconuts is called "opportunity cost."

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1.4.1 Social Interaction

In a society, the behavior of the individuals must be coordinated through social interaction. This social interaction takes many forms ranging from cooperation to competition. In the process of resolving the allocation problem through social interaction, a set of institutions, organizations, beliefs, principles, perspectives and commonly held values are created. Society, guided by these values, perceptions and beliefs and constrained by institutions, technology and resource endowment, must solve the problem of provisioning. The specific uses of goods and resources must be determined. These choices involve which resources to use, which goods to produce, who will bear the costs and who will benefit.

The basic problem is the coordination of the choices and behavior of individuals. Finding a way to protect the autonomy of the individual while coordinating their behavior to provide for the commonweal has been an important goal of most great writers on social topics.

1.4.1.1 Specialization

Specialization and the division of labor are two important forms of social interaction that allow two or more individuals to do what an isolated individual cannot do. Both are means to increase the production of goods and services.

Specialization is the case where an individual (firm, organization or country) focuses on the production of a specific good (or group of goods). It can increase the amount of goods that can be produced. It also requires some form of social institution to coordinate the process. If one individual produces food and the other clothing, the two individuals must interact if both are to have food and clothing. This interaction may be facilitated through an institution such as the market or a transfer based on kinship, marriage, religion or government authority. Plato suggests that the city-state is a social construct that is used to facilitate specialization and to improve the welfare of the members of that state.

In *The Republic*, Plato [427-347 B.C.] suggests specialization as an explanation of the origins of the city-state. Plato describes a conversation between Socrates and a group of students. They are pondering the nature of justice. They conclude that justice is each person doing that which they are best suited to do. The person best suited to be a baker should be a baker: the person best suited to be a shepherd should be a shepherd. Once individuals specialize, the city-state arises to facilitate the transfer of goods and the necessary interactions among the individuals. [*The Republic*, Book II]

Plato tries to identify the characteristics of the ideal society. One of the focal points is justice that is achieved by "each person doing what they are best suited to do." Social interaction is required because each person depends on the other members of the community. He devises a meritocracy that is lead by philosopher kings. To prevent nepotism and greed from influencing these philosopher kings, Plato does not allow the philosopher kings to hold private property rights, all of their property is held in common.

1.4.1.2 Division of Labor

The division of labor is another form of social interaction that allows individuals to do what the isolated person cannot. In the division of labor, the production of a good is broken down into individual steps. One person then performs one step in the process. No single person produces the good alone. The actions of each individual in the production process must be coordinated. In modern industrial societies, production often takes place in a business firm. "Management" is regarded as the process of coordinating the activities of the individuals within the production process. A specific application of microeconomics to the process of production within a firm is called "managerial economics."

Adam Smith [1723-1790] in the *Wealth of Nations* proposes that the division of labor is one of the major elements that contribute to economic growth (the increased ability to produce goods and services) [*The Wealth of Nations*, page 1]. The division of labor is the process of dividing a task (work) into its component parts. Smith argues that the division of labor increases production through improved dexterity, saving time in moving from one task to another and improvements in tools.

Smith cautions about the effects of unrestrained use of the division of labor,

> *"In the progress of the division of labor, the employment of the far greater part of those who live by labor, that is, of the great body of the people, comes to be confined to a few very simple operations, frequently to one or two. But the understandings of the greater part of men are necessarily formed by their ordinary employments. The man whose*

> *whole life is spent in performing a few simple operations, of which the effects too are, perhaps, always the same, or very nearly the same, has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become….But in every improved and civilized society this is the state into which the laboring poor, that is the great body of the people must necessarily fall, unless government takes some pains to prevent it.* [Smith, *Wealth of Nations*, p 734-735]

Smith, a professor of moral philosophy, constructed a system to explain a set of forces that would guide social and economic behavior. In *The Theory of Moral Sentiments* [1759] he showed the need for justice and a system of morality. In *An Inquiry into the Nature and Causes of the Wealth of Nations* [1776] he describes the role of self-interest and markets. In a third book that was destroyed at his request at the time of his death, he describes the need for a system of jurisprudence. Two sets of students' notes have been used to show these basic arguments in *Lectures on Jurisprudence* [1762-63 and 1766 published in 1978]. Smith describes a social system that requires morality, markets and jurisprudence to guide and constrain individual action in a social context.

1.4.1.3 Coordination of Efforts

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1.4.2 Economic Activities

John Stuart Mill [1806-1873] divided economic activities into three categories: production, distribution and exchange. It may be helpful to think of an economic system as a process that begins with a set of inputs (or resources) that are used for production that must be distributed for ultimate consumption. (Mill, *Principles of Political Economy*, The Colonial Press, 1900)

In Figure I.1, the economy is shown as a process of altering a set of inputs to satisfy individual wants. In this example, the steps in the economic process are production, distribution and consumption.

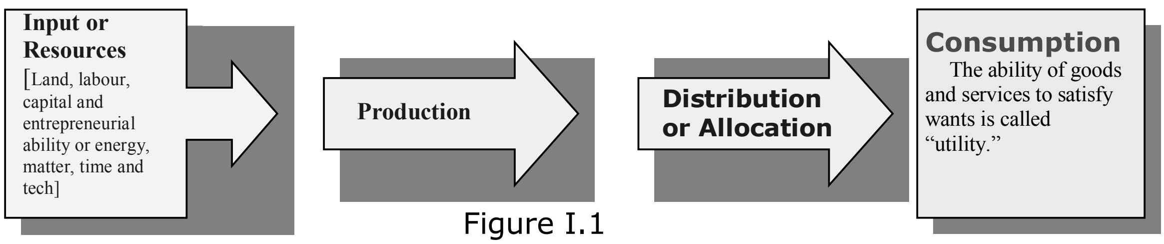

Figure I.1

1.4.2.1 Production

Production is the process of altering inputs to increase their ability to satisfy human wants. Inputs are sometime called "factors of production" or resources. Typically, economists will categorize inputs as land, labor and capital. Superficially, labor is defined as human effort used to produce goods that satisfy human wants. An input that is a "gift of nature" is referred to as "land." Capital is usually considered as an input that is produced by labor but is used for the further production of goods and services. Entrepreneurial ability was the last category of inputs to be added as a factor of production in market oriented economies. It is usually associated with the process of creating and innovating of new processes. The taxonomy of inputs, its relation social structure and the nature of economics will be considered more carefully later in the text.

1.4.2.2 Distribution

Distribution usually describes the process of allocating the goods and services that have been produced. Societies have used market exchange, reciprocity, eminent domain, inheritance, theft and philanthropy to distribute goods and services. The primary means of distribution or allocative mechanisms that are used in most societies are market exchange, reciprocity and eminent domain.

MARKET EXCHANGE

Market exchange involves a *quid pro quo*, i.e. an exchange of private property rights between individual agents. The terms of the exchange are clearly specified: "I will give you this if you will give me that." The goods to be exchanged are clearly specified, as are the terms of the exchange.

The participants in the exchange do not need to know each other: they only need to know the terms of the exchange. The information requirements are quite low. In many cases, the exchange may be made easier by social institutions. Laws that protect buyers and sellers may facilitate the exchange. Trust may be an important element as well.

RECIPROCITY

Reciprocity is a system of obligatory gift giving: I will do you a favor or give you a gift, but you are then obligated to do an unspecified favor or give me a gift at some (possibly unspecified) point in the future.

Reciprocity requires a sense of community. Kinship ties or membership in the community is needed so that the obligation of returning a favor is enforced by social forces. If a friend helped you move apartments one weekend and then helped you fix your car the next weekend, your refusal to help that person would have social repercussions. Your common friends might come to regard you as a freeloader. Social pressure may induce you to return the favor.

EMINENT DOMAIN

Eminent domain is a redistribution of private property rights through the authority of some organization. The individual is required to give up their claims to private property by an authority. Usually the process of eminent domain is legitimized by government, religion or some other authority.

PHILANTHROPY

The act of giving a gift with nothing expected in return is called philanthropy. This is an important method of distribution in blood drives and the donation of organs for transplantation.

INHERITANCE AND THEFT

Inheritance is the process transferring private property rights from a dead person to an agent. The form that the inheritance laws take may greatly influence the accumulation of wealth in a society.

Theft is the process of transferring property rights by illegitimate force. Few societies can function if theft is widely used.

1.4.2.3 Consumption

The end purpose of economic activity is to provide goods and services that can be consumed by individuals to satisfy needs and wants. Modern, neoclassical economists generally do not like to use the word "needs." The use of the word "wants" is an attempt to take subjective judgment out of the analysis.

2 The Problem of Provisioning

2.1 Introduction

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Once humans use the division of labor and specialization, it is necessary for them to coordinate their efforts. They must interact on a variety of levels. Society is a complex set of interactions among groups and individuals. These interactions give rise to social institutions. The study of these interactions and institutions is "*social science*." Human interaction can be studied from a variety of perspectives. Sociology, political science, law, history, psychology, religion, anthropology and economics are examples of social sciences. These are often studied as separate disciplines. However, we should remain aware they are all interrelated perceptions of human behavior. While economics specializes in the study of the processes that coordinate human behavior as it allocates scarce resources to satisfy unlimited wants, its relationship to other social sciences should not be overlooked.

2.6 Economic Activities

John Stuart Mill [1806-1873] divided economic activities into three categories: production, distribution and exchange. It may be helpful to think of an economic system as a process that begins with a set of inputs (or resources) that are used for production that must be distributed for ultimate consumption. (Mill, *Principles of Political Economy*, The Colonial Press, 1900)

In Figure I.1, the economy is shown as a process of altering a set of inputs to satisfy individual wants. In this example, the steps in the economic process are production, distribution and consumption.

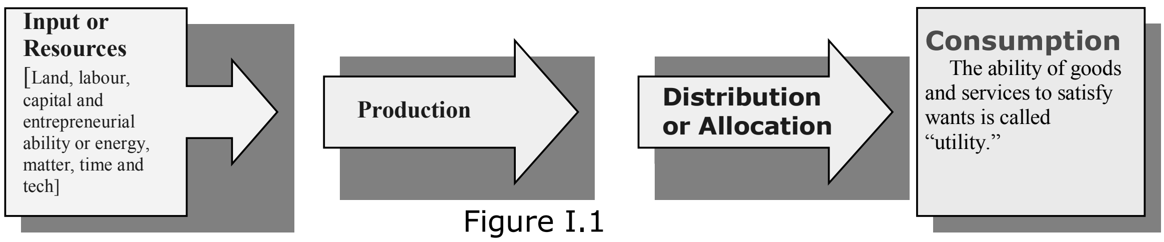


Figure I.1

2.6.1 Production

Production is the process of altering inputs to increase their ability to satisfy human wants. Inputs are sometime called "factors of production" or resources. Typically, economists will categorize inputs as land, labor and capital. Superficially, labor is defined as human effort used to produce goods that satisfy human wants. An input that is a "gift of nature" is referred to as "land." Capital is usually considered as an input that is produced by labor but is used for the further production of goods and services. Entrepreneurial ability was the last category of inputs to be added as a factor of production in market oriented economies. It is usually associated with the process of creating and innovating of new processes. The taxonomy of inputs, its relation social structure and the nature of economics will be considered more carefully later in the text.

2.6.2 Distribution

Distribution usually describes the process of allocating the goods and services that have been produced. Societies have used market exchange, reciprocity, eminent domain, inheritance, theft and philanthropy to distribute goods and services. The primary means of distribution or allocative mechanisms that are used in most societies are market exchange, reciprocity and eminent domain.

MARKET EXCHANGE

Market exchange involves a *quid pro quo*, i.e. an exchange of private property rights between individual agents. The terms of the exchange are clearly specified: “I will give you this if you will give me that.” The goods to be exchanged are clearly specified, as are the terms of the exchange.

The participants in the exchange do not need to know each other: they only need to know the terms of the exchange. The information requirements are quite low. In many cases, the exchange may be made easier by social institutions. Laws that protect buyers and sellers may facilitate the exchange. Trust may be an important element as well.

RECIPROCITY

Reciprocity is a system of obligatory gift giving: I will do you a favor or give you a gift, but you are then obligated to do an unspecified favor or give me a gift at some (possibly unspecified) point in the future.

Reciprocity requires a sense of community. Kinship ties or membership in the community is needed so that the obligation of returning a favor is enforced by social forces. If a friend helped you move apartments one weekend and then helped you fix your car the next weekend, your refusal to help that person would have social repercussions. Your common friends might come to regard you as a freeloader. Social pressure may induce you to return the favor.

2.6.2.1 Eminent Domain

Eminent domain is a redistribution of private property rights through the authority of some organization. The individual is required to give up their claims to private property by an authority. Usually the process of eminent domain is legitimized by government, religion or some other authority.

PHILANTHROPY

The act of giving a gift with nothing expected in return is called philanthropy. This is an important method of distribution in blood drives and the donation of organs for transplantation.

INHERITANCE AND THEFT

Inheritance is the process transferring private property rights from a dead person to an agent. The form that the inheritance laws take may greatly influence the accumulation of wealth in a society.

Theft is the process of transferring property rights by illegitimate force. Few societies can function if theft is widely used.

2.6.3 Consumption

The end purpose of economic activity is to provide goods and services that can be consumed by individuals to satisfy needs and wants. Modern, neoclassical economists generally do not like to use the word "needs." The use of the word "wants" is an attempt to take subjective judgment out of the analysis.

2.6.4 Coordination, Competition and Cooperation

Each society must develop a set of social institutions (behavioral patterns) to coordinate the activities of production, distribution and consumption. There is a wide range of forms these institutions may take depending on the physical environment, state of technical knowledge, social values and other factors. These institutions and behavioral patterns may rely on competition, cooperation or some combination. Market systems tend to focus on competition while other systems may have a larger role for cooperation. A bicycle race is a useful metaphor. In a road race the riders cooperate in the peleton (the large group of riders in a bicycle race) by drafting (using the rider in front to reduce the wind drag). When a group breaks away from the peleton, they typically form a pace line and each shares the work of riding in front of the group. Eventually, the structure of the pace line disintegrates and the riders compete in a sprint to the finish or they fall back into the group. The race is a mixture of cooperation and competition.

Joan Robinson argues that an economic system "… r*equires a set of rules, an ideology to justify them, and a conscience in the individual which makes him (sic) strive to carry them out.*" (Robinson, p 13)

Production, distribution and consumption are interrelated. What to produce is influenced by what individuals want to consume. What people want to consume is influenced by the distribution process and what can potentially can be produced. This coordination may come in the form of cooperative activities, such as the creation of a business firm. The firm usually organizes production internally as a cooperative process but must compete externally. Alternatively, the coordination of activities may be accomplished by competition or some combination of cooperation and competition.

2.7 Technology

Technology is knowledge about how resources, individuals and social organization can be used to accomplish objectives. Technology is more than a set of skills to do things. It is a perspective about the relationships between humans and their world. Technology is the sum total of the ways in which human societies interact with natural and built environments. Humans seek to understand these interactions and develop technology by combining and reorganizing existing technologies.

In economics, technology is the knowledge about the use of scarce resources to produce goods and services that satisfy human wants. The knowledge about how we do things, "technology," is not limited to machines. The discovery of a calendar or the realization that crops can be planted on a three field rotation may be as important as the invention of the padded horse collar, the steam engine or the PC. Knowledge about the use of organizational structure to achieve an objective is, in a sense, a form of technology.

The values and structure of society are connected to the state of technology. Society is shaped by technology and at the same time is an important force in the determination of the course of technological change. This relationship between technology, society and the individual can be driven by curiosity and/or material gain.

Technological change is pervasive. During some periods of history, technology changes at a slow pace. At other times, the rate of change is more rapid and more dramatic. During the medieval period, technological change was slow. With the development of mechanical clocks, the plague, moveable type, gunpowder, new techniques in art and other innovations, the "Renaissance" (usually thought of as the 14th-17th centuries) was a period of dramatic change. During the 17th and 18th centuries, the "age of Enlightenment" was fueled by technological change. The "Industrial Revolution" (which is often dated as about 1750) is another term used to identify a period of rapid technological change. Each of these periods involves changes in ideas, values, knowledge and social institutions. Each altered economic and social processes.

There are opposing views as to the process of technological change. One view is the Thomas A. Edison perspective. In this case, technological development is driven by profits. If a technology is profitable, it will be invented. The other view is that technology is a self-generating process. New technology is the result of old technology(ies) being recombined in new ways and used for new purposes. In the second view, profits cannot create the development of technology but determine its uses.

What an individual perceives as a resource is influenced by the nature of technology. In the 18th century, obsidian was an important resource among the inhabitants of the western United States: uranium was not. In the 21st century, obsidian is not normally regarded as a very important resource while uranium has become a resource.

Factor endowment may influence the direction that technology develops. In a society with an abundance or arable land and a shortage of labor may produce (and consume) different goods and seek different technologies to produce them.

In the Edison view, the light bulb was invented because there was a demand for it and it could be developed and produced for a profit. In the second view, it is not possible to invent high-pressure steam engines, even though they may be profitable, until the technology of metallurgy develops metals to contain the higher pressure. Either view supports the argument that technology builds upon itself. The creation of an internal combustion engine depended on its connections to cannons, oil, Maybach's spray carburetor, levers and gears. Each of these in turn depended on other technologies. When Daimler and Maybach built the automobile, it was the result of a series of connections between technologies that had been developed by many people over a long period. (see Burke, *Connections*, pp 175-183)

It is useful to think about technological change as a process. First, a piece of knowledge emerges or an "invention" occurs. Second, some one finds an application for the new knowledge (innovation) and uses it. Third is the process of dissemination, i.e. the use of the idea is spread through out the social system. Each stage of technological change may produce or require significant changes in values and social institutions. Changes in social structure or the natural environment may encourage technological change.

Technology and the social system are interconnected. Technology has a strong influence on the structure of society and individual behavior. The Industrial Revolution may be thought of as a fundamental change in technology of production that altered society. The development of the mechanical clock was driven by the clergy's desire to satisfy the institution of prayers at specific times of the day.

The perception of and taxonomy of inputs or resources was influenced by social structure. Land was associated with the nobility and the clergy while labor was associated with the serfs. As trade developed, a merchant class arose and became associated with capital.

2.8 Economic Decisions

In a simple taxonomy, individual behavior may be influenced by rules (command), intuition, emotion, habit, reason or some combination. Philosophers and psychologists have struggled with the issue of fate and freewill. The issue has not been resolved. It is not likely that it will be resolved here. The question for economics is to try to understand and explain how humans try to resolve the problems of provisioning and allocation.

2.8.1 Rules

If behavior is constrained or influenced by rules, rules of thumb or habits, the nature of those rules and the process by which the rules evolves is of interest to economists. If the agent's decision is constrained, the nature of those constraints is of concern.

Rules may by implicit or explicit. Explicit rules often take the form of law and maybe imposed by governments or organizations. Generally, explicit rules are conscious creations and must be communicated and enforced. Social groups may also use explicit rules. Business firms, churches, and other organizations may explicitly impose rules. Implicit rules may also be important constraints. Implicit rules are not consciously created but must still be communicated.

Certain types of behavior are expected and influenced by such social constructs as "manners," mores, custom, rules of thumb and traditions. These rules are short cuts to problem solving. If over time a particular problem is always or nearly always resolved by a specific approach, that approach becomes a habit or rule of thumb. These rules and habits provide ready made solutions that do not have to be derived by reason or intuition.

2.8.2 Intuition

In recent years, there has been a growing interest in the interrelationship between psychology and economics. Daniel Kahneman (Nobel Foundation prize winner) has explored intuition and reason as thinking and decision processes. (Kahneman, pp 1449-1475) According to Kahneman, intuition can be powerful and accurate, requires practice and is " rapid and effortless." The reasoning process provides a check on the intuitive process.

2.8.3 Reason and Rational Behavior

Orthodox, modern economic analysis is generally regarded as the study of alternative uses of resources to achieve objectives. At a technical level, economic analysis is used to evaluate rational decisions. Rational behavior that the agent has identified an objective or goal and has evaluated all feasible alternatives to select the alternative that best achieves the objective.

2.8.4 Information

Within any economic system, the agents must have information and there must be a set of incentives to encourage appropriate actions. Whether the economic system primarily uses market exchange, reciprocity, eminent domain or some other allocative mechanism, the agents must have information about preferences, inputs, technology and alternatives.

In different economic systems, the decisions may be made by different agents. In a planned economic system, some type of planning authority would necessarily have to have information about the preferences of the members of the systems, all inputs, all technology and all alternatives that are feasible. This is an enormous requirement. In a market-oriented system based on exchange between individual's, the information requirement is altered. Individuals only need to know about their own preferences and feasible alternatives. What is required is a social system that provides for voluntary exchanges between agents with appropriate information.

In the 1920's and 30's there was a debate (The Socialist Calculation Debate) about the ability of socialist systems to acquire necessary information. One side of the debate lead by the Austrians (Ludwig von Mises (1881-1973) and Friedrich Hayek (1899-1992)) argued that it would be impossible for a centrally planned economy run by rules to have the necessary information to function. Oscar Lange (1904-1965) and Abba P. Lerner (1903-1982) argued that if planners were cost minimizers, the appropriate information could be calculated. This is a simplistic description of the Socialist Calculation Debate but emphasizes the importance of information to the functioning of an economic system.

In the Socialist Calculation Debate, Austrians argued that command economies could not be successful because there was insufficient information to guide decisions in the economic process. They believed that each individual had information about their preferences and what they were capable and willing to do. Markets were seen as the social institution that could provide information about relative values through the voluntary, exchange interactions of individuals. The market system was the process that provided the information for the agents to make decisions. The Austrians argued that the command system had no process by which information would be revealed. Lange accepted this criticism and suggested, "market socialism" as an alternative.

Incentives are the forces that encourage or induce agents to behave in particular ways. Duty, authority or self-interest may guide an agent's behavior. Since neoclassical economics is based on a consequentialist ethic that is expressed through markets, the incentive provided by self-interest is perceived as dominant. Other incentives may be equally as important. Smith believed that self-interest would be constrained by systems of morality and jurisprudence.

2.8.5 Rationality and Information

The allocation of scarce resources requires both information and incentives for the agents. Information about the objectives and feasible alternatives is necessary if "rational choices" are to be made. A rational choice requires that the alternative that "best" satisfies the objective be selected. This requires criteria to evaluate each alternative with respect to the objective. Based on the objective, set of alternatives and the method of evaluation, the optimal or best alternative can be selected. There are three fundamental steps to the process of making "rational" economic choices:

- Identify the objective of the agent.
- Identify all feasible alternatives that are related to the objective.
- Develop the criteria to evaluate each feasible alternative with respect to the objective.

3 Introduction to Ways of Knowing

Knowledge about economic phenomena is imperfect. The problem of knowing is not unique to economics. An understanding of the methods by which knowledge is accumulated aids in the identification of potential biases and weaknesses of any discipline or field of study. Academic disciplines, like individuals, can benefit from introspection. By examining our values, objectives, and methods of achieving those goals, we better understand ourselves, consider other perspectives and hopefully improve the discipline.

The study of methodology and epistemology provides a process by which this introspection of economics as an academic discipline can proceed. Any understanding of the methods used in economics requires some introduction to a few important contributions to the literature on the process of knowing. It is a fundamental part of cultural literacy in a world dominated by ”science” and the “scientific method.” A brief summary of some of the basic concepts and major contributors is presented here.

There is a long history of various approaches to the study of the economy. These approaches are not self contained, isolated bits of knowledge: they are extensions of and reactions to earlier approaches in economics and other fields. The process of “knowing” is difficult. Two questions that should be paramount are:

What do I know?
How do I know what I think I know?

Epistemology is the study of the origin, nature, methods and limits of knowledge. There are several approaches to the study of processes that contribute to knowing: the history of science and the sociology of knowledge are two closely related fields. Methodology is one aspect of epistemology.

Methodology is generally seen as the system of values, beliefs, principles and rules that guide analysis within a given discipline. The methodology(ies) that prevails within a discipline plays a major role in the nature of questions that are asked as well as the answers that are offered.

There is a large and growing body of literature on methodology in philosophy and the sciences (both natural and social). This trend has also influenced economics. Many economists have participated in the explorations into methodology and epistemology. One explanation for a renewed interest in methodology in economics is that the basic processes created to explain the development of market systems and mature industrial economies may need to be adjusted if there are significant structural changes in the economy. The study of the history of economic thought and methodology adds the questions of

"What do I believe?"
"Why do I believe what I believe?"

One of the most difficult tasks in any discipline is to understand the nature of knowledge and the process by which it is acquired within the discipline. In this matter, economics is no different from any other body of knowledge. The methods used to study the phenomena influence the phenomena we select to study and the conclusions we draw.

3.1 Facts, Information, Knowledge and Wisdom

In any period of history, there is a problem of determining the nature of what we think we know. Facts, information, knowledge and wisdom are not the same things. It is possible to engage in long arguments about the meaning of these words. (For our purposes, we will accept facts in the spirit of its Latin roots. *Factum* is something done: *factus* is done: *facere* is to do.) Sometimes data may be considered as facts. Facts alone do not tell us much. It is the organization of those facts into patterns that provides information. The recognition of patterns is aided by the way in which facts are ordered. Categorization (taxonomy) of facts is necessary to establish the relevant patterns and relationships. Information may also include the communication of those facts. Knowledge implies an understanding of the nature of relationships (system of causation) among the facts and information. Wisdom is more complicated and suggests a system of values and the judgment to evaluate and apply knowledge. Wisdom requires a system of ethics. The definitions of facts, information, knowledge and wisdom used here are superficial and subject the reader's interpretation.

3.2 Hypotheses, Theories, Laws and Models

A ***hypothesis*** is a proposition or set of propositions that is an attempt to explain an event or class of phenomena. It is usually thought of as provisional and a guide to further investigation. Hypotheses can be tested but never proven. Hypothesis testing requires the analyst to try to disprove the hypothesis. If it can be shown to be false, then it can be rejected. If it cannot be shown to be false then it is accepted as not yet proven false and may be retained until proven false. It is possible to reject a true hypothesis as false: this is a Type I error. It is also possible that a hypothesis is retained as probably true even when it is false: this is a Type II error. It is not possible to reduce these errors to zero.

A ***theory*** is an explanation about a class of phenomena. Webster's Dictionary defines a theory as a "*as a coherent group of general propositions used as principles for explaining a class of phenomena*." Usually a theory is considered as more reliable than a hypothesis. Theories are used to establish relevant patterns in data and to explain the relationships within those patterns. Newton's theory of gravity or Einstein's theory of relativity are examples of explanations of relationships between masses or the relationships between energy and matter. Theories are used to make sense out of data and information. "Without theory facts are meaningless." (Alfred Marshall)

The term ***law*** is used to represent a widely accepted premise or theory about a particular causal relationship. It is more widely accepted than a theory. In economics some writers refer to a "law of demand." (The belief that demand functions are inverse relationships between price and quantity that will be bought at each price, individuals buy more of a good at lower prices.)

In economics, a ***model*** is a simplification of various relationships among economic variables and is used to explain or predict economic phenomena. It is a way to represent or call attention to a relevant order or pattern in a set of data. It is of necessity an abstraction and includes only the most important aspects of a relationship.

The nature of a model is dependent on the elements it is constructed of and the purposes it's anticipated use. If two groups are given the task of making a model airplane but one of the groups is given paper and the other clay, their models will not look alike. Both models will be abstractions from reality. The elements of reality that are modeled may be different. The shape of a wing to give lift is an important feature. The color of the insignia on the rudder may not be significant (unless you are trying to demonstrate how air craft are identified by different insignia). Which model is "best?" A paper model of an airplane may be useful to demonstrate the idea of flight to a third grade class. A clay model might be best in a wind tunnel to test aerodynamics of a 750 mph wind. In economics, models built using individuals may not be useful in describing the economic behavior of multinational corporations.

Models using land, labor and capital may not ask and answer the same questions as models that are built with energy, matter, time and technology.

Models may take many forms: narrative, visual/graphic, tabular, mathematical, Cartesian graphs are some of the forms that may be used to present models.

3.3 Foundations of "Science"

Jacob Bronowski contends there are three creative ideas central to science. These are the ideas of:

1) order,

2) causes and

3) chance. (Bronowski 1978)

ORDER

Bronowski states that, "*Science is not an impersonal construction*." (Bronowski. p 13) This human construction of knowledge begins ordering of things and events or phenomena. Aristotle saw order in the "nature of things." Things fall to the earth because it is in their nature to do so. Bronowski mentions that one of the contributions made by the philosophers of the Middle Ages is that there is a hierarchy to the system of order. (Ibid. p 23)

The notion of order is implicit in the classification of phenomena. Taxonomy (the art and/or science of identification, naming and categorization of phenomena) is fundamental to the process of science and the acquisition of knowledge. To classify events or things requires the recognition of the way in which things are alike or different. Taxonomy implies observation of the phenomena and some recognition of specific characteristics.

Science looks for order or regularities among sets of facts. Order or regularities are patterns that are repeated in data or facts. Facts or data are usually collected by empirical methods. Observation is a typical method of collection. If we watch a "magician" or a group of witnesses to a crime testify, we understand that what we observe is not always what is. It is important to be very careful about what we see as facts. Different sets of "facts" can lead to very different questions and conclusions. Different "facts" or data can be collected about the same set of events. The taxonomy or the categorization of facts may lead to the recognition or belief that these facts are related in particular ways. A different taxonomy may result in the perception of different patterns When inputs are categorized as land, labor, capital and entrepreneurial ability, the order recognized may be different to a set of inputs categorized as energy, matter, time and technology. Depending on the patterns (order) perceived within the data, different questions may be asked.

CAUSES

Bronowski argues that both DA Vinci and Newton were great inventors and mechanics. They both recognized patterns of order in the universe and were able to describe these patterns. The difference, according to Bronowski, is that while DA Vinci was interested in variety and infinite adaptability, Newton was focused on unity and the singleness of nature. (Bronowski, p 24) Bronowski comments:

"*We could say that the Middle Ages saw nature as striving towards its own inner order: and that the Scientific Revolution overthrew this order and put in its place the mechanism of causes. … On the one hand, all science, and indeed all thinking starts from and rests upon the notions of order: what marks the Middle Ages is that their order was always a hierarchy. And on the other hand what marks the scientific view is not that it turned to the mechanism of causes, but that it saw the world as a mechanism at all – a machine of events."* (Bronowski, p 25)

Understanding how one fact is related to another fact is the recognition of causes. The recognition of order, regularities or patterns in a set of fact, raises the question as to the nature of the patterns. There are at least five possibilities:

1) event A may be caused by event B: $\mathbf{A = \mathit{f}_a(B)}$

2) event B may be caused by event A: $\mathbf{B = \mathit{f}_b(A)}$

3) events A and B may be caused by some (unobserved event C):

$\mathbf{B = \mathit{f}_{bc}}$© and $\mathbf{A = f_{ac}}$©

4) event A may be caused by some interaction between events B and C:

$\mathbf{A = \mathit{f}_h(B, C)}$

5) events A and B may be the result of coincidence

Statistical analysis is the typical method used to manipulate and analyze data. Many technical tools can be used to describe and relate the facts in data sets. Averages, median, mode, range, domain, variance, standard deviation and other measures are descriptive statistics. Correlation, analysis of variance and regression can be used to relate different aspects (variables) in the data set. The strength of the relationships that are recognized in the data set can the tested using t-scores, F-ratios, Chi Square and other methods. At the end of the day, none of these methods can prove causation: they can only show correlation. The concept of causation depends on a theory (or hypothesis) about the relationship between the variables. Statistical methods allow a test of the hypothesis or theory. The hypothesis cannot be proven it can only be disproven and the hypothesis rejected. Statistics can be used as evidence to support or reject a perception of causation.

CHANCE

If the world of events were truly a machine subject to the law of causes, events would be deterministic. Bronowski argues that the recognition of the law of chance is central to the method of science. It adds “*statistical law”* to the concept of “*causal law*.” (Bronowski,. p 82) Causal law states that event B is caused by event A and therefore, event B will follow event A 100 time out of 100 occurrences of event A. Statistical law is based on the notion that event B will “*probably*” follow event A. The process is described as one where:

> *“We look for a trend or systematic difference. But the line of this trend will itself be blurred by the unsteady hand of chance or random fluctuation. We cannot get rid of this random scrawl. But we can from it determine a measure of random variation, and use that to draw round the trend an area of uncertainty. If the area is small enough by standards which are agreed between us, then the trend is established, and we know the limits within which it is likely to lie.* (Bronowski, p 92)

The concept of probability provides the method by which observations of an extraordinarily complex world can be interpreted. It gives us information and knowledge that may not be “true” but is useful.

In a complex world, there may be many reasons for a lack of certainty in causes. There may be other hidden or unrecognized forces that influence the relationship between event A and event B. If event A results in event B 90% of the time we may believe that A “causes” B. If the occurrence of A results in event B 30% of the time, other “causes” of B may be more important. Probability is a key idea in the understanding of causes. Statistics provides the means to state that with 95% confidence (or some other percentage) event A is correlated with event B.

USEFULNESS AND “TRUTH”

Knowledge held at any time may be “true” or “not true.” Knowledge that is true may or may not be useful. Knowledge may be useful whether it is “true” or not. Before the Copernican Revolution, a common belief was that the Earth was a stationary center of the universe. This was the Ptolemaic system attributed to Claudius Ptolemy [127-151 AD], a Greek mathematician and astronomer who lived in Egypt. In this system, the sun, stars, planets and moon circled the Earth in repeated patterns. Complex models were constructed to explain and predict the paths of the objects. These models worked with reasonable accuracy and were useful to plan for seasons, planting of crops, and to prepare for floods. The models were useful, but "wrong." New information obtained through observation and measurement showed there were simpler explanations for the paths of the celestial bodies. The Copernican or heliocentric view gained dominance. Galileo [1564-1642] verified the Copernican system with a new technology (the telescope). Johann Kepler [1571-1630] improved on Galileo's findings and calculated equations to explain the elliptical orbits of the planets about the sun. As we accept "new knowledge" about the cosmos and subatomic matter, we replace old truths with new truths.

3.4 Explanation, Prediction and Storytelling

Explanation and prediction are two of major objectives of science. These two goals are not symmetrical: it is possible to explain an event or phenomenon without being able to predict the probability of its occurrence: at the same time, it is possible to predict an event without being able to explain its nature or causes. Mark Blaug identifies two problems that arise from the "Symmetry Thesis." First is the problem: "*the history of science contains a number of theories which appear to explain natural phenomena, without however predicting them even in a statistical sense.*" (Blaug, 1986, p 274) Darwin's theory of evolution is cited as an example.

Second is the problem: "*…science, and particularly social science, abound in rules-of-thumb that yield highly accurate predictions about both natural and social events despite the fact that we may have absolutely no idea why these rules-of-thumb work as well as they do.* (Ibid.)

Whether explaining or predicting, science places value on precision and rigor of the process. However, one should avoid using the same criteria to evaluate scientific models with different objectives. It is also necessary to avoid attempts at precision and rigor that are not possible. Thomas Mayer cautions economists (the warning applies to all disciplines):

> *"...we should draw a much sharper distinction that is usually done between two types of economic theory. One, formalist theory is abstract theory that is concerned with high-level generalization and looks towards axiomization. The other, empirical science theory focuses on explaining past observations and predicting future ones. While both are perfectly legitimate, applying the criteria appropriate to one to evaluate the other generates confusion and misunderstanding. (Mayer's book)...is a plea for a more modest economics that recognizes the inherent difficulty of making precise and indubitable statements about the actual world, accepts that there is a trade-off between rigor and relevance. I certainly agree that one should be as rigorous as one can be: I just oppose trying to be as rigorous as one can not be."* (Mayer, p

7)

An emphasis on rigor and precision may result in attempts to develop theories or models that are esoteric and of little interest to anyone other than the scientist-author.

In addition to explanation and prediction, science and the stories of science also create, shape and transmit individual and social values. Often this is an unintended effect rather than a conscious objective. The study of the evolution of methods in a discipline, such as economics, will hopefully create a greater awareness of this role and a greater understanding of one of the important effects.

3.5 Logic

Several processes can be used in the discovery, creation and justification of knowledge. Instinct, intuition, abduction, deduction, induction and authority are examples of sources of knowledge. Appeals to authority as a justification for acceptance of knowledge is common but is not a reliable source. Instinct, intuition and introspection were once of great importance, but are not often seen as credible as “science” when seeking justifications for “knowledge” in Western, industrial societies. Research in the cognitive sciences and behavioral economics has recently been investigating intuition as a means of decision-making. Daniel Kahneman (a psychologist) received the Nobel in economics for work in cognitive processes and intuition in economic decisions. However, most discussions of methods in science place primary emphasis on inductive and deductive processes.

3.5.1 Deductive Reasoning

Aristotle (384-322BCE) is usually credited with formalizing syllogistic or deductive reasoning. Deductive reasoning is a process that starts with a set of premises (or *a priori* truths) or general principles and through rules of logic, "deduces" a conclusion about a specific case. There are usually two premises: a major premise and a minor premise. If the general principle or major premise were that all the water in the lake was safe to drink, then deductive reasoning would conclude that a specific glass of water from the lake (the minor premise is the water is from the lake) is safe to drink. The internal logic could be correct but if either of the premises were false, correct deductive logic would not yield true conclusions.

3.5.2 Inductive Reasoning

Francis Bacon (1561-1626) is credited with formalizing inductive reasoning. J.E. Creighton argues that Bacon's *Novum Organum* was to replace Aristotle as the preeminent guide to the process of acquiring knowledge.

> *"Bacon did for inductive logic what Aristotle did for the theory of the syllogism. It is of course, incorrect to say, as has sometimes been said, that Bacon invented the inductive method of reasoning. … What Bacon endeavored to do was to analyze the inductive procedure, and to show what conditions must be fulfilled in order that truth may be reached in this way."* (Bacon, pps vii-viii)

Inductive reasoning is the process of inferring information from empirical observations. If several glasses of water were taken from a lake and each glass of water was shown to be safe to drink, it might be "inferred" that the water in the lake is safe to drink. Because all the water in the lake was not (and possibly could not) be tested there is some probability that all the water in the lake is not safe to drink. Empiricism is rooted in the inductive process and is based on empirical observations. Statistical inference is an application of the inductive method.

While inductive methods are useful, there are pitfalls to avoid. Observations might be incomplete or the interpretation of the observation(s) could be incorrect. The selection of which phenomena to observe and the sequencing of the "facts" can alter the conclusions reached. The application of inference and inductive methods requires judgment and caution in the interpretation of data.

3.5.3 Abductive Reasoning

Abduction is a creative process from which hypotheses arise. Abduction is similar to induction. The differences are that abduction is less formal process that consists of a combination of intuition, experience, observation, deductive reasoning and generates hypotheses which could be wrong. Abduction is the insight that occurs with less conscious formal reasoning than either induction or deduction.

It is the purpose of inductive and deductive reasoning to test the hypotheses that emerge from the process of abduction.

3.6 Epistemology and Economic Methodology

Epistemology is the study of the nature and limits of knowing. Economists are confronted with an ocean of facts and data that are reputed to support a plethora of theories and laws that purport to be the "truth" about economic behavior. Any discipline, whether it is economics, physics, biology or …, advances because someone questions the received wisdom: both extensions of ideas and new ideas that are created as reactions against result from questions about the received wisdom. If a scientist, economist or practitioner of any discipline has the "truth," their only task is to make sure others accept that "truth." A bit of humility about what one thinks they know is not a bad thing. A quick survey of some of the basic ideas in epistemology provides an enlightened humility.

3.6.1 A Taxonomy of Knowledge

Joel Mokyr classifies knowledge as propositional and prescriptive knowledge. Mokyr, an economic historian, relates the problem of human knowledge to economic growth and the economic problem. Propositional knowledge is "..*knowledge (that is to say beliefs) about natural phenomena and regularities*." (Mokyr, p 4) Prescriptive knowledge is instructional or knowledge about techniques about how to do something. (ibid)

3.6.1.1 Propositional Knowledge

In Mokyr's taxonomy, propositional knowledge (Ω) can take two forms. He describes these as (1) "*the observation, classification, measurement, and cataloging of natural phenomena*." And (2) "*the establishment of regularities, principles and 'natural laws' that govern these phenomena and allow us to make sense of them.*" Mokyr's characterization of propositional knowledge is:

> *"Science, as John Ziman has emphasized, is the quintessential form of public knowledge, but propositional knowledge is much more: the practical informal knowledge about nature such as the properties of materials, heat, motion, plants and animals: and intuitive grasp of basic mechanics (including the six 'basic machines of classical antiquity: the lever, pulley, screw, balance, wedge and wheel): regularities of the ocean currents and the weather: and folk wisdom in the 'apple-a-day-keeps-the-doctor-away' tradition. Geography is very much a part of it: knowing were things are is logically prior to the instructions of how to go from here to there."* (Mokyr, p 5)

He argues that for the economic historian what matters is the collective knowledge of what society, as a whole, knows (the union of all statements of such knowledge). Confidence and consensus about knowledge as well as access to and transmittal of that knowledge is of great importance to how propositional knowledge is used. Mokyr characterizes the development of new propositional knowledge as "*discovery, the unearthing of a fact of natural law that existed all along but was unknown to anyone in society.*" (Mokyr,, p 10)

3.6.1.2 Prescriptive knowledge

Prescriptive knowledge (λ) is the knowledge about how to do something: it is technique or instructional knowledge. This prescriptive knowledge is defined as "*sets of executable instructions or recipes for how to manipulate nature.*" (Mokyr,, p 10) The addition to this prescriptive knowledge is called an "*invention*." Prescriptive knowledge is not right or wrong it is successful or unsuccessful. Mokyr argues that the industrial revolution and the associated economic growth began when prescriptive knowledge came to be based on proportional knowledge. Individuals can learn to do things without knowing why they work. Once you know why techniques (prescriptive knowledge) work, (propositional knowledge), it is easier to invent improvements to old techniques and develop of new ones.

3.6.1.3 An example

Knowledge about baking includes an understanding of the effects of altitude, leavening, moisture, temperature, gluten and a host of other phenomena on cakes. This knowledge is propositional knowledge. A cake can be baked by someone in San Francisco with a recipe (prescriptive knowledge) and no knowledge about the effects of altitude on cakes. The recipe will work as long as person doesn't try to bake a cake in Santa Fe, NM (elevation 7200 feet). To modify the recipe so it will work at the new elevation requires propositional knowledge. The development of new recipes (λ) requires some proportional knowledge (Ω).

3.6.2 Brief Survey of Epistemology

Karl Popper [1902-1994] is the primary architect of falsification as a method of science. In his *The Logic of Scientific Discovery*, 1934, he outlines the basic approach taken in what is called the scientific method. He proposes that scientific knowledge grows through a process of making hypotheses abut the nature of problems and the falsification or testing of those hypotheses. Popper argues that it is the duty of every scientist to try to disprove or reject his or her hypotheses. If a hypothesis cannot be rejected by empirical evidence, it may be retained as "probably true." All knowledge then is probabilistic: it has not yet been falsified. The process is subject to what statisticians call Type I and II (or alpha and beta) errors. Type II errors occur when a false hypothesis is accepted as "true." When a "true" hypothesis is rejected as false a Type I error has occurred.

Thomas Kuhn [*The Structure of Scientific Revolutions*, 2cd ed, 1962,1970] offers another explanation for the evolution and change of scientific thought in the "hard sciences." His explanation is often applied to economics and social sciences. Kuhn used the concept of "paradigms" and paradigm shifts to explain the process. The term, paradigm, is often used and abused in discussions.

Kuhn's approach is essentially a "truth by consensus" which is contained in the paradigm. This paradigm (and its associated "truth by consensus") is practiced until there are "anomalies" or problems that the existing paradigm cannot explain. Then an alternative paradigm with greater explanatory powers replaces it. He argues that a science operates within a paradigm. This paradigm is characterized by,

- the "community structure of science'
- or the "disciplinary matrix" which consists of symbolic generalizations (deployed without question),
- shared commitments to a set of beliefs and a set of values.

The members of the science use this paradigm to resolve anomalies. When an anomaly of major significance or a large number of anomalies cannot be explained, the paradigm must be questioned and a new paradigm for that science developed. In this manner "science progresses."

Imre Lakatos' method is expressed in his book, *Proofs and Refutations*, [Cambridge University Press: Cambridge, 1976]. Lakatos' approach, while in the tradition of one of his teachers, Karl Popper, is critical of both Popper and Kuhn. He advocated a more sophisticated form of falsification of "groups of theories" and combined it with "scientific research programmes (SRP's)" which were more specific than paradigms. Lakatos' SRP consists of two elements, the "hard core, protective belt" and the "positive heuristic." (Pheby, John, *Methodology and Economics: a Critical Introduction*, M.E.Sharpe, 1988,, p 56) The hard core is constructed of "basic axioms and hypotheses" that are accepted without question and is used as a defense mechanism. The positive heuristic is the body of theories and problems that drive the research programmes. (Pheby, p 56)

Kuhn's approach can be contrasted with that of Karl Popper and Imre Lakatos. Popper saw the advancement of knowledge as the result of the falsification of testable hypotheses. Those hypotheses that were not disproved were accepted as "probably true." Lakatos took the middle ground. Rather than falsifying a hypothesis or the whole paradigm, he felt that the process was based on "scientific research programs." A school of economic thought may represent a paradigm (in a Kuhnian sense) or a scientific research program (in a Lakatian sense).

A more extreme view is expressed in Paul Feyerabend's book, *Against Method* (Verso: London, 1988, originally published by New Left Books, 1975). He advocates an approach to science that has been called "theoretical anarchism." Feyerabend argues that the "success of science cannot be used as an argument for treating yet unsolved problems in a standardized way" and scientific achievements can "be judged only after the event." (Feyerabend, p 2) Feyerabend's approach to the methodology of science is radically different because of his objectives. He claims his purpose is "humanitarian not intellectual" in that he wants "to support people not advance knowledge." He is "against ideologies that use the name of science for cultural murder." (Feyerabend, p 4]) While he does not disavow the title of "theoretical anarchist," he does provide insights into the evolution of science and knowledge. Feyerabend summarizes some of his insights:

> *"Neither science nor rationality are universal measures of excellence. They are particular traditions, unaware of their historical grounding."* (Feyerabend, p 231)
>
> *"Yet it is possible to evaluate standards of rationality and to improve them. The principles of improvement are neither above tradition nor beyond change and it is impossible to nail them down."* (Feyerabend, p 248)
>
> *"Science is a tradition among many and a provider of truth only for those who have made the appropriate cultural choice."* (Feyerabend, p 256)
>
> *"The entities postulated by science are not found, and they do not constitute an 'objective' stage for all cultures and all of history. They are shaped by special groups, cultures, civilizations: and they are shaped from a material which depending on its treatment, provides us with gods, spirits, a nature that is a partner of humans rather than a laboratory for their experiments, or with quarks, fields, molecules, tectonic plate. Social monotony thus implies cosmic monotony - or 'objectivity,' as the latter is called today."* (Feyerabend, p 260)

Science (and economics) is not free from ideology. It is necessary to understand the prevailing ideology in a culture, society, group or corporation in order to interpret one's own perspective. Imagine a luxury train, the Orient Express. You find your way to the club car and find a billiard table. You shoot the cue ball down the table (parallel to the tracks) in the direction the train is coming from at the same speed the train is traveling. You perceive that the ball is rolling toward the other end of the table. To some one observing the train pass by, as they peer into the window they perceive that the cue ball is stationary and that the table, you and the train are moving away from the point where the ball is fixed. Your perspective determines your interpretation of the event.

3.6.3 Milton Friedman

Milton Friedman [1912-2006] is one of the best-known economists of the 20th century. His article, "The Methodology of Positive Economics" in *Essays in Positive Economics* [1953] was one of the most important influences on economic thought. In this important piece, Friedman sets the standards for *normative* and *positive* economics as well as influencing several generations of economists. He argues that positive economics is "*independent of any ethical position"* and its task is to provide "a *system of generalizations that can be used to make predictions about the consequences of any change in circumstances:"* it deals with "*what is."* (Friedman, p. 4) Normative economics is dependent on positive economics and deals with "*what ought to be*."

Friedman argues that economics can be a positive science. The structure of this positive science, like all positive sciences, consists of two parts: first, is a language and second, is a "*body of substantive hypothesis designed to abstract essential features of complex reality.*" (Ibid. p. 7) According to Friedman, language is a set of tautologies whose primary function is to organize and classify empirical material to facilitate our understanding. This language has no substantive content. This component or element in positive science may be evaluated by formal logic to determine if it is consistent and complete. Empirical or factual evidence and presumably the use of the language will reveal how well the analytical filing system functions. (Ibid.)

The body of "substantive hypotheses" or theory is primarily to yield "*valid and meaningful (i.e. not truistic) predictions about phenomena not yet observed*." (Ibid.) The only test of the validity of the hypotheses or theory is its "*predictive power for the class of phenomena it is intended to 'explain*.'" If there are alternative hypotheses that may be chosen, Friedman suggests two criteria: simplicity and fruitfulness. Simplicity is an echo of the work of William Ockham [1285-1347 (49?)] or Ockham's razor. Fruitfulness reflects the precision of predictions as well as their relevance for wider or more generalized applications. A more "fruitful" set of hypotheses would also suggest additional lines of research. The validity of a theory cannot be evaluated on the basis of the reality of the assumptions, rather a

> *"…hypothesis can be tested only by the conformity of its implications or predictions with observable phenomena: but it does render the task of testing hypotheses more difficult and gives greater scope for confusion about the methodological principles involved. More than other scientists, social scientists need to be conscious about their methodology."* (Friedman, p 40)

3.6.4 Deirdre McCloskey

Of all the individuals whose views on methodology have been discussed, Friedman and McCloskey are the only writers who can be identified as "economists." McCloskey's book, *The Rhetoric of Economics*, (University of Wisconsin Press: Madison, 1985) has gained widespread attention among economists. McCloskey argues that the method economists claim to follow is not the method that they follow in practice. Most economists, as well as individuals in most other disciplines, claim to follow the "scientific method" of falsification (i.e. hypothesis testing), usually in the format expressed by some integration of Popper/Lakatos/Kuhn. McCloskey charges that as a result of attempts to create and follow a modern science, "modernism" has become a dominant theme. According to McCloskey, *modernism* is a "word that can be fully defined only in use." (McCloskey, 1985, p 5) She points out that modernism is not limited to economics but is also present in philosophy, architecture, music, and politics. This list can be expanded to include management, accounting and a multitude of other fields. While it may not be possible to give a precise definition of modernism, it is possible to characterize its nature. Some of its characteristics are identified in the following quotes about modernism:

> *"knowledge is to be modeled on the early twentieth century's understanding of certain pieces of nineteenth-century and especially seventeenth-century physics."* (McCloskey, 1985, p 5) (Presumably, Comte, Descartes and Newton are the seventeenth century physicists in the reference.)
>
> It is the *"notion that we can know only what we cannot doubt and cannot really know what we can merely assent to."* (McCloskey, 1985, p 5)
>
> *It includes the belief that "only falsifiable hypotheses are meaningful: the evidence is consistent with the hypothesis: of tastes one ought not, of course, to quarrel."* (McCloskey, 1985, p 6)
>
> *"Modernism views science as axiomatic and mathematical and takes the realm of science to be separate from the realm of form, value, beauty, goodness, and all unmeasurable quantity."* (McCloskey, 1985, p 6)
>
> It is *"functionalist and given to social engineering and utilitarianism, the modernist is antihistorical, uninterested in cultural or intellectual traditions."* (McCloskey, 1985, p 6)

McCloskey advocates the use of classical rhetoric to advance economic theory through the same methods used in literary criticism. Rhetoric, which includes the use of fact, logic, metaphor and story, provides the criterion and framework that guides the development of science.

Deirdre McCloskey argues that,

> *"(E)conomists do not follow the laws of inquiry their methodologies lay down."* (McCloskey, 1983, p 482)

Rather,

> *"Economists in fact argue on wider grounds and should. Their genuine workaday rhetoric, the way they argue inside their heads or their seminar rooms diverges from the official rhetoric."* (McCloskey, 1983, p 482)

McCloskey proposes that the development of "knowledge" about economic relationships and behavior is pushed forward by "rhetoric." The many dimensions of rhetoric emerge from quotes McCloskey chooses from Wayne Booth. Rhetoric is:

> *"the art of probing what men believe, rather than proving what is true according to abstract methods."*
>
> *"the art of discovering good reasons, finding what really warrant assent, because any reasonable person ought to be persuaded."*
>
> *"careful weighing of more-or-less good reasons to arrive at more-or less probable or plausible conclusions - none too secure but better than would be arrived at by chance or unthinking impulse."*
>
> *the "art of discovering warrantable beliefs and improving those beliefs in shared discourse."*
>
> *not to "talk someone else into a preconceived view: rather it must be to engage in mutual inquiry."* (McCloskey, 1983, pp. 482-483)

McCloskey argues that,

> *"Each step in economic reasoning, even the reasoning of the official rhetoric, is metaphor. The world is said to be 'like' a complex model, and its measurements are said to be like the easily measured proxy variable to hand."* (McCloskey, 1983 p 502)

Even "...mathematical theorizing is metaphorical and literary." (McCloskey, 1983, p 505) In *If You're So Smart*, published in 1990, McCloskey argues that,

> *"Like other arts and sciences, that is, economics uses the whole rhetorical tetrad: fact, logic, metaphor, and story. Pieces of it are not enough. The allegedly scientific half of the tetrad, the fact and logic, falls short of an adequate economic science, or even a science of rocks or stars. The allegedly humanistic half falls short of an adequate art of*

economics, or even a criticism of form and color." (McCloskey, 1990, p 1)

To consider the rhetoric and storytelling of economics does not mean that economics is or should be without method. Rhetoric provides a framework and criterion that guides the development of economic theory. It is rhetoric that makes theory more relevant, identifies the ethical content and increases flexibility in the evolution of economic knowledge.

3.7 WHICH METHODOLOGY IS "CORRECT?"

Which of the methodological arguments is "correct" and should be followed? There is not a universally accepted answer in any academic discipline nor among those who study the philosophy of science. To understand and contribute to any field of knowledge, it is necessary to be aware of the methodology(ies) that have guided the development of accepted ideas, hypotheses, theories, concepts, tools, values and ideologies that are used within that discipline. Ignorance of methodology dooms an individual to perpetual training and re-training rather than opening the door to education.

Methodological problems apply to all knowledge including Newtonian mechanics, the theory of relativity and quantum mechanics as well as economics. In economics, the methods used and ideological preconceptions of individual economists and schools of thought help to explain many of the differences in explanations of problems and policies advocated.

Modern economic theory has a long tradition of following a "modernist" methodology characterized by a strong faith in empiricism and rationalism. Within modern economics, knowledge is believed to be advanced by inductive or empirical investigations that can verify (or fail to falsify) "positive" concepts, hypothesis, theories or models developed by deductive or rationalist logic.

Normative economics (or the study of what "ought to be") is seen as distinctly separate from positive economics.

When economics is studied as a process of provisioning, normative and positive issues become interrelated.

3.8 The Standard View of the Scientific Method

The process by which knowledge is acquired is often called the "scientific method." There are several variations of the way in which the scientific method are characterized, but the steps usually are:

1) recognition of a problem
2) creation of a hypothesis about the nature of the problem
3) collect relevant data to test the hypothesis
4) propose a solution to the problem
5) act on the proposed solution or policy to solve the problem
6) monitor the results of the policy: collect and analyze data on the application of the policy
7) make adjustments in the hypothesis and solutions as needed.

The first step in the so-called scientific method requires an integration of positive and normative issues (normative and positive aspects of economics was discussed under the section on Milton Friedman). The recognition of a problem is a recognition of a deviation between what should be and what is. If my shoes do not hurt my feet (a positive statement), I probably don't think about my shoes. If my shoes hurt my feet (a positive statement) and I think they shouldn't hurt my feet (a normative statement), I recognize a problem. If there is unemployment (positive statement) and believe there should be unemployment (normative statement), a problem is not recognized. If there is unemployment and think that there should not be unemployment, a problem is recognized.

4 Individuals and Community

A community is made up of a group of individuals. One of the characteristics of a community is that there is an intersection of a set of shared values and objectives held by the individuals. Social institutions (embedded patterns of behavior within a society) represent these shared values. Only under rare circumstances would a group of individuals have the same set of shared objectives. Because they are individuals, it is probable that some of their objectives will be different and conflict or compete. It is necessary for the community to have a set of social institutions to coordinate competing values and ends.

Social institutions both arise from human behavior and influence their behavior. Traditions, mores, customs and more formal institutions (such as laws), define the range of choices. Markets are also a social institution. A voluntary contract between two individuals is a social mechanism to coordinate activities. Markets require a social infrastructure. Trust, expectations about buyers and sellers providing information (no fraud, deceit or duress), obligation to fulfill contracts and expectations that individuals will do no harm to others, facilitates the operation of markets. Adam Smith (1723-1790) points out that markets are subject to abuse:

> *People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices. It is impossible indeed to prevent such meetings, by any law which either could be executed, or would be consistent with liberty and justice. But though the law cannot hinder people of the same trade from sometimes assembling together, it ought to do nothing to facilitate such assemblies, much less to render them necessary.*(Smith *WN*, p 128)

Participants in markets may also use formal institutions (law, regulations) to benefit themselves:

> *The interest of the dealers, however, in any particular branch of trade or manufactures, is always in some respects different from, and even opposite to, that of the public. To widen the market and to narrow the competition, is always the interest of the dealers. To widen the market may frequently be agreeable enough to the interest of the public: but to narrow the competition must always be against it, and can serve only to enable the dealers, by raising their profits above what they naturally would be, to levy, for their own benefit, an absurd tax upon the rest of their fellow-citizens. The proposal of any new law or regulation of commerce which comes from this order ought always to be listened to with great precaution, and ought never to be adopted till after having been long and carefully examined, not only with the most scrupulous, but with the most suspicious attention. It comes from an order of men whose interest is never exactly the same with that of the public, who have generally an interest to deceive and even to oppress the public, and who accordingly have, upon many occasions, both deceived and oppressed it.* (Smith WN, p 250)

4.1 Institutions

Douglass North argues that

> *Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic. Institutional change shapes the way societies evolve through time and hence is the key to understanding historical change.* (North, 1990, p 3)

North expands "human exchange" to include human interactions that include "political, social or economic" phenomenon. Human exchange is interpreted as "human interaction on social, political and economic levels." North's broader definition will be used in this chapter even though the term "exchange" is quite specific:

> *Exchange involves a* quid pro quo*, i.e. an exchange of private property rights between individual agents. The terms of the exchange are clearly specified: "I will give you this if you will give me that." The goods to be exchanged are clearly specified, as are the terms of the exchange. (Chapter 2, p 15)*

North identifies the roles of these institutions:

- "Institutions reduce uncertainty by providing structure to everyday life." (North, p 3)
- "Institutions include any form of constraint that human beings devise to shape human interaction. Are institutions formal or informal? The can be either, and I am interested both in formal constraints – such as rules that humans beings devise – and informal constraints – such as conventions and codes of behavior." (North, p 4)
- "Institutional constraints include both what individuals are prohibited from doing and, sometimes, under what conditions some individuals are permitted to undertake certain activities."(North p 4)
- "A crucial distinction in this study is made between institutions and organizations. Like institutions, organizations provide a structure to human interaction. (North, pp 4-5: North points out that organizations are considered as one of the players or actors while institutions are the underlying rules of the game.)

"Institutions are a creation of human beings. They evolve and are altered by human beings: . . . Integrating individual choices with the constraints institutions impose on choice sets is a major step toward unifying social science research." (North, p 5)

North refers to some institutions as "conventions and codes of conduct." Traditions, customs, mores, rules of thumb are other examples of implicit institutions that are part of the rules of the game. These habitual patterns of behavior or embedded rules may arise spontaneously. Individuals seek solutions to problems. When they find something that works (or provides a reasonable solution), they learn to try the same approach when the same or new problems arise. These institutions become short cuts to analyzing and devising new solutions for every new problem.

These implicit institutions may be transmitted to others in a variety of ways. Custom and traditions are the most obvious. It is possible to create codes of conduct that may be communicated through religious beliefs. Religious law and jurisprudence are common to almost all societies. In societies that depend on interpersonal relationships, these implicit institutions may be dominant in influencing behavior patterns.

In cases where the community becomes complex, the effects of social values on individual choices may be weakened. If implicit social institutions are weakened, force of law (formal explicit institutions) may be used to encourage some behavioral patterns and discourage others. Adam Smith had a manuscript on jurisprudence destroyed at the time of his death (1790). Copies of students' notes on Smith's lectures on jurisprudence (1762-63, 1766) were found and published as *Lectures on Jurisprudence (LJ)*. In these notes, Smith describes the role of law within a society.

The two traditions of common law and the Napoleonic code provide the framework for the legal systems in most Western industrial countries. Common law is based on *stare decisis*: i.e. laws emerge over time on the basis of precedence. As society, technology, relationships, environment and other features of society change, laws are modified. The Napoleonic code (dates from 1804) is based on Roman Law. It establishes a clear legal framework on issues of property, inheritance, the family and individual freedom. Both approaches provide formal rules of the game and may be considered as an explicit, formal institution.

The relationship between the legal and economic system is well established. John R. Commons (*Legal Foundations of Capitalism*, 1924) and Richard Posner (*The Economic Analysis of the Law*, 1973, sixth edition 2003) are foundations for two traditional approaches to law and economics.

4.2 Institutions and Costs

The provisioning process and the allocation process both involve the ownership of resources and goods as well as the mechanisms by which the rights of ownership are transferred. With in a society, the transfer of ownership of goods is not with out costs. In the case of eminent domain, there are costs (opportunity costs) to the authority that defines and enforces the transfer of ownership of goods (property rights). Individuals who are affected by eminent domain incur costs as well. There are also costs of using exchange. These costs are the effort (sacrifice) of individuals to obtain information about goods, other individuals who are willing to enter a contract and the effort to negotiate the contract or terms of exchange.

Social institutions and organizations are a social response to reduce the costs of exchange and eminent domain. Social institutions also facilitate and enforce reciprocity. The costs of using exchange are referred to as "transaction costs." (see Coase, "Nature of the Firm". 1937)

The institutions define the rules of the game: provide individuals with information and some degree of certainty in their social interactions. This reduces the time and effort (transaction costs) that individuals devote to the allocation problem.

Institutions and organizations are human creations that are intended to solve problems. It should be noted that these human creations might be intentional and explicit or unintentional and implicit. As in all human endeavors, some attempts are more successful than others: i.e. some institutions are more successful at achieving objectives than others.

Institutions arise as solutions to a given set of problems. Should the elements of the problem change (the actors, agents, technology, information, other institutions), the institutions may need to adapt. However, any set of institutions is correlated with the interests of particular individuals. Some of these individuals benefit from the particular structure while others are not. Those who benefit from a particular institutional structure have a vested interest in preventing changes in the institutions. These vested interests may use their positions and power to prevent institutional change and to work to alter institutions (particularly explicit institutions such as law) in their interests. Consequently, the institutions that are prevalent at any point in time may lag behind environmental, technological and social changes.

Patents, copyrights, regulations of communication industries (radio, television, newspapers, internet and the like) determine the behavior of the agents and firms in those industries. George Stigler (1911-1991) described a "capture theory of regulation." (Stigler, 1971, Published first in 1962 with Claire Friedland) He argues that when an industry is regulated, it is in the interests of that industry to capture the regulatory agency and influence its policies. The communication industries have a greater incentive to influence the policies of the Federal Communications Commission (FCC) than the average person. Recent actions by the FCC have allowed greater concentration of news media. Companies that publish music have more interest in the laws regarding the ownership (copyrights) and royalties to music than the public: the "Napster" incident on downloading music files from the Internet is an example.

The insurance, pharmaceutical, hospital and medical industries have more interest in the social institutions that influence the delivery of health care than individuals. Health insurance emerged in the mid 1930's as a solution to the problems of random, catastrophic health care costs and how hospitals and doctors would receive financial payment. The insurance and health care providers (doctors, pharmaceutical, hospitals and insurance industries and firms) have a vested interest in maintaining the system that maintains their sources of revenue.

The vested interests have an incentive to shape the formal and informal institutions that relate to their activities.

4.3 Morality, Justice and a Stable Society

Institutions reduce the costs of the allocation process. Additionally, justice, an orderly society, tranquility, security, peace are objectives that are commonly held in many societies. Adam Smith (1723-1790) is used to express these ideas here since he is generally regarded as one of the first writers to advocate a system based on morality, markets and law. He wrote the *Theory of Moral Sentiments* in 1759 to describe his view of the role of sympathy and empathy in human behavior. He argues that justice is essential for an orderly society. On the first page of *Theory of Moral Sentiments* , Smith writes:

> *How selfish man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it, except the pleasure of seeing it. Of this kind is pity or compassion, the emotion which we feel for the misery of others, when we see it, or are made to conceive it in a very lively manner. That we often derive sorrow from the sorrow of others, is a matter of fact too obvious to require any instances to prove it: for this sentiment, like all the other original passions of human nature, is by no means confined to the virtuous and humane, though they perhaps may feel it with the most exquisite sensibility. The greatest ruffian, the most hardened violator of the laws of society is not altogether without it.* (Smith, *TMS*, p 47)

Smith continues on the role of society in the formation of individual values:

> *Were it possible that a human creature could grow up to manhood (sic) in some solitary place, without communication with his (sic) own species, he could no more think of his own character, of the propriety or demerit of his own sentiments and conduct, of the beauty or deformity of his (sic) own mind, than of the beauty or deformity of his (sic) own face. All these are objects which he cannot easily see, which naturally he does not look at, and with regard to which he is provided with no mirror which can present them to his view. Bring him into society, and he is immediately provided with the mirror which he wanted before. It is placed in the countenance and behavior of those he lives with, which always mark when they entered into, and when they disapprove of his*

> *sentiments: and it is here that he first views the propriety and impropriety of his own passions, the beauty and deformity of his own mind.* (Smith, TMS, p 204)

Smith continues:

> *It is thus that man, who can subsist only in society, was fitted by nature to that situation for which he was made. All the members of human society stand in need of each other's assistance, and are likewise exposed to mutual injuries, Where the necessary assistance is reciprocally afforded from love, from gratitude, from friendship, and esteem, the society flourishes and is happy. All the different members of it are bound together by the agreeable bands of love and affection, and are, as it were, drawn to one common centre of mutual good offices.*
>
> *But though the necessary assistance should not be afforded from such generous and disinterested motives, though among the different members of society there should be no mutual love and affection, the society, though less happy and agreeable, will not necessarily be dissolved. Society may subsist among different men, as among different merchants, from a sense of its utility, without any mutual love or affection: and though no man in it should owe any obligation, or be bound in gratitude to any other, it may still be upheld by a mercenary exchange of good offices according to an agreed valuation.*
>
> *Society, however, cannot subsist among those who are at all times ready to hurt and injure one another.* (Smith TMS, p 166)
>
> *. . . Society may subsist, though not in the most comfortable state, without beneficence: but the prevalence of injustice must utterly destroy it. . . . Justice, on the contrary, is the main pillar that upholds the whole edifice. If it is removed, the great, the immense fabric of human society, that fabric, if I may say so, to have been the peculiar and darling care of nature, must in a moment crumble into atoms.* (Smith TMS, p 167)
>
> *As society cannot subsist unless the laws of justice are tolerably observed, as no social intercourse can take place among men (sic) who do not generally abstain from injuring one another:* the consideration of this necessity, it has been thought, was the ground upon which we approved the enforcement of the laws of justice, by

Smith recognizes that beneficence and morality cannot be the only mechanism that creates order in society. He argues that:

> *This disposition to admire, almost to worship, the rich and the powerful, and to despise, or, at least, to neglect persons of poor and mean condition, though necessary both to establish and maintain the*

> *distinction of ranks and the order of society, is, at the same time, the great and most universal cause of the corruption of our moral sentiments. That wealth and greatness are often regarded with the respect and admiration which are due only to wisdom and virtue: and that the contempt, of which vice and folly are the only proper objects, is often mostly unjustly bestowed upon poverty and weakness, has been the complaint of moralists of all ages.* (Smith TMS, p 126)

Smith is not the only writer to argue the importance of justice and morality in the proper functioning of society. Plato, Aristotle, St Thomas, and a host of writers argue the role of justice. At the same time, most recognize that beneficence and cannot be the only motivating force in society.

The need for morality is based on biology and ecology: Joan Robinson argues:

> *A society cannot exist unless its members have common feelings about what is the proper way of conducting its affairs, and these common feelings are expressed in ideology.* (Robinson, p 3)
>
> *The biological necessity for morality arises because, for the species to survive, any animal must have, on the one hand some egoism-a strong urge to get food for himself (sic) and to defend his means of livelihood: also-extending egoism from the individual to the family- to fight for the interests of his mate and young. On the other hand, social life is impossible unless the pursuit of self-interest is mitigated by respect and compassion for others. A society of unmitigated egoists would knock itself to pieces: a perfectly altruistic individual would soon starve. There is a conflict between contrary tendencies, each of which is necessary to existence, and there must be a set of rules to reconcile them. Moreover, there must be some mechanism to make an individual keep the rules when they conflict with his immediate advantage.* (Robinson, p 4) . . .
>
> *Since the egotistic impulses are stronger than the altruistic, the claims of other have to be imposed upon us. The mechanism by which they are imposed is the moral sense or conscience of the individual.* (Robinson, p 5) . . .
>
> *But observe, it is the honesty of other people that is necessary for my comfort.* (Robinson, p 6)

Justice and concern for others is an important objective that is often reflected in the golden rule: "Do unto others as you would have them do unto you." Or to quote Ivan Hill,

> *Men of many ages have considered the Golden Rule to be the fundamental moral imperative. Confucius once was asked, 'Is there one word which may serve as a rule of practice for all of one's life?' He answered, 'Is not reciprocity such a word? What you do not want done to yourself, do not do to others."* (Hill, p 4)

A just and moral society where humans can live in a peaceful environment is an objective held by many philosophers through the ages. Perhaps for some, the history of conflict and war casts doubt on a human objective of justice. Alternatively, perhaps conflicts and wars occur because of feelings or injustice.

Tradition, customs, mores, and other social institutions are mechanisms through which individuals acquire common values. The size of one's family, forms of marriage, responsibility for children or parents, expectations about disposal of wastes, use of resources, obligations to care for less fortunate people, trust, theft, voting, creativity, duty to family (country, etc) attitudes about stewardship, are examples of values that may be generally held by the members of a community. These values influence the choices that individuals make.

4.4 Agents

A decision also implies the existence of an agent. An agent is an individual who has the authority to evaluate, select, and act on alternatives to achieve an end. The agent may act for themselves or on the behalf of a principal. Agents choices may be based on intuition, habits (rules of thumb, institutions), explicit rules or reason.

Any decision implies that there is an end, objective, or goal that an agent wishes to achieve. Humans seek means to achieve ends. As suggested above, decisions based on reason must have an objective. Intuition as a method for making decisions also implies that a result is desired. Rules and habits (or social institutions) arise because there is some desired end to be accomplished. The question is what is the origin and nature of the objectives.

Both the ends and means may be influenced or constrained by resource endowment, technology, or social institutions (such as customs, traditions, markets and law).

In the case of an agent or agents representing a principal, there may be a conflict or incompatibility among their objectives. This is referred to as the principal/agent problem. The agent has a conflict of interest. A stockbroker acts as an agent for an investor: a doctor may act as the agent for a patient. The lawyer acts as an agent for her client, the principal. The goal or end of the investor may be to maximize earnings on their assets. The end or objective of the stockbroker may be to maximize their commission. In the short run, the broker may sacrifice the earnings of the investor to maximize commissions. Hopefully, in the long run the broker will recognize that the short term strategy will result in the loss of the investor as a client. The principal must have some knowledge and information regarding the agent's behavior. In a complex world, this does not always happen. Enron is an example of the principal/agent problem. The interests (ends) of the CEO and management (the agents) were inconsistent and had priority over the goals of the stockholders (principals).

In a complex world where it is difficult for principals to have information to evaluate all the action of the agents, a code of conduct or code of ethics may be important as a means to get the agent to act for the principal. The Hippocratic oath is a social institution to insure the physician acts in the principals interests. Accountants and lawyers are other examples of professions that rely heavily on codes of ethics to resolve conflicts between the principal and agent.

4.5 Organizations and Agents

Organizations are another way that the cost of economic activities. North distinguishes between institutions and organizations. Both provide structure to human interactions. Ronald Coase (1910-) sees both as mechanisms to reduce the costs of transferring ownership. (Coase, 1937)

The crucial difference is that institutions are part of the rules of the game and organizations are participants in the game. The firm (or any organization) arises because there are costs to using the "pricing mechanism."

> *What the prices are have to be discovered. There are negotiations to be undertaken, contracts to be drawn up, inspections to be made, arrangements to settle disputes, and so on. These costs have come to be known as transaction costs. Their existence implies that methods of co-ordination alternative to the market, which are themselves costly and in various ways imperfect, may nonetheless be preferable to relying on the pricing mechanism* (market? Author's question)*, the only method of co-ordination normally analyzed by economists. It was the avoidance of the costs of carrying transactions out through the market that could explain the existence of the firm, in which the allocation of factors came about as the result of administrative decisions.*
>
> *In the "Nature of the Firm" I argued that in a competitive system there would be an optimum of planning since a firm, that little planned society, could only continue to exist if it performed its co-ordination function at a lower cost than would be incurred if co-ordination were achieved by means of market transations and at a lower cost than this same function could be performed by another firm. . . .*
>
> *I argued in "The Nature of the Firm" that the existence of transaction cost leads to the emergence of the firm. (Coase 1995, p 8-9)*

The firm (or any organization) comes into existence to create a small "planned society" and to use administrative decisions to allocate resources because it would be more costly to use market exchange. Firms (or organizations) may be for profit, not-for-profit, cooperatives, sole proprietorships, partnerships or corporations. There are many ways of categorizing organizations.

Within a firm the CEO, Board of Directors, shareholders, Vice-President of Marketing, Vice-President of Production and the assembly line workers may have competing objectives that will be resolved by authority, contract, or some other social institution. There are managerial techniques that might be used to coordinate the activities of the diverse groups in a firm.

In a family, the parents may have different ends than the children. There are parental "instincts," love and social expectations as well as laws that insure the parents act in the child's interests.

Within an organization, the principal/agent problem becomes important. Usually a manager (CEO) makes administrative decisions that affect many other groups. Their administrative decisions may be guided by general policies and guidelines established by a Board of Directors who in turn is constrained by the shareholders (or owners). The objectives of the shareholders may or may not be reflected by the decisions of the manager. The manager may have a different set of objective and the shareholders may or may not have information (or control) over the decisions of the manager. Kenneth Lay and the management of Enron is an example of the principal/agent problem.

4.6 Objectives

An objective, goal or end is something that an individual or group of individuals hopes to achieve. There may be many alternatives that will potentially achieve the end or goal. Some alternatives have a higher probability of success. The alternative that is selected, through reason, rules, habits or intuition, is the means.

It is not always clear how humans create their objectives or ends. One hypothesis is that they are capable of thought and can imagine alternative states or conditions. If the alternative state is perceived as preferable to the existing state, the alternative state becomes an end. This process necessarily requires a subjective valuation or ranking of alternative states or conditions. I am hungry. I can perceive or imagine myself not being hungry. Not being hungry is preferable to being hungry so the objective or end is to reach the preferred state. The mind is capable of recognizing an incongruity between what is and what I imagine can be. I may seek the means to satisfy my hunger through reason. Intuition, rules or habitual patterns of behavior may also suggest means of satisfying my hunger.

Many substances will satisfy hunger. Geographic differences and resource endowment may alter what people choose to eat. Inuit people eat whale and sea lion. In the southwestern United States pinto beans, corn and chili peppers are favorites. In France, escargot is a delicacy. Individuals often develop a "taste" or preference for a food they ate as a child. As a result, we often think of foods as representing different social of ethnic groups. Italian, Chinese, Mexican, Indian are examples of ethnic foods that represent different social groups from different locations.

Hunger is a physiological stimulus so it is easy to recognize the incongruity between being hungry and not being hungry. Other events are more complex. I have shelter that is adequate (a 700 square foot shelter that has plumbing and heat) but can imagine a larger house (3000 square foot with a den and multiple bathrooms) that I would prefer. If the 700 square foot house is adequate, why is the larger house preferred? Is it because I perceive that my neighbors (the community) associate the bigger house with status? Do the values of the community influence my preferences? If my objective or end was to acquire status, the large house was the means to achieve that end. If my objective was to have enough room for a large family, the large house may be the means to achieve that end. To the casual observer the acquisition of a large house may incorrectly be seen as the desired end.

Economics is a study that is based on scarcity of the means to achieve objectives. As a result, choices must be made on the relative values that are placed on the competing objectives. To repeat from above, Warren Samuels argues that the "*economy is a process of valuation*…. *That to behave and to choose is to engage in valuation and thereby to participate in the social, or socioeconomic, valuation process.*" [Samuels p ix] He goes on to point out that, "*the economy encompasses more than the market*…" and "*that other nonmarket valuational processes exist*." These valuational processes are used to choose among competing ends, or objectives.

4.7 Economic objectives

Justice, respect from others and creativity are not easily measured. Income, quantities of goods and prices are more easily measured. There are many complexities in measuring incomes, quantities of goods and prices. In spite of measurement problems, individuals tend to focus on phenomena that can be ranked or associated with a magnitude (or number). This is particularly a problem when quantifiable objectives are to be traded off for non-quantifiable objectives. Examples include an individual who sacrifices a larger salary for a job with more activities that are creative or to remain near a personal relationship. The appreciation of environment or wildlife may be sacrificed for jobs or timber production.

Economic objectives are complex linkages. Utilitarianism is the philosophical foundation of modern economics. The perceived objective is to maximize the utility or welfare of the members of society. In a simplistic world, the welfare or utility of the community is the sum of the utilities or each member of that society. Therefore, if each individual maximizes their utility it will maximize the utility of the group. The maximization of each individual's utility is consistent with the maximization of the utility of society. This view requires a social mechanism or institution to coordinate or constrain the behavior of individuals. The constraints may be social institutions such as moral rules, mores, customs, laws, or the market.

Since it is not possible to measure utility, welfare or happiness, utility is connected to variables that can be measured. In orthodox economics, a person's utility is a function of (or determined by) the quantity of goods and services they consume. Since utility can't be measured and is a function of the quantity of goods, an increase in the quantity of goods consumed is assumed to increase utility or welfare: *more goods are preferred to fewer goods*. As a result, economic growth, producing more goods (as measured by gross domestic product) becomes a perceived objective.

The inability to measure utility also leads to the use of price as a proxy. The price of a good is perceived as an indicator of its value. Relative prices are seen as information that can be used to rank the worth or value of goods.

The inability to measure utility directly leads to a focus on quantities of goods and their relative prices as a substitute. This process often leads to ignoring or minimizing the importance of non-market objectives. If prices are distorted by lack of information or imperfections in the social institutions, the rankings based on relative prices may be misleading.

In the modern world our objectives and behavior may be altered by advertising. Fashion and fads popularized in the media also shape our objective and the means we choose to achieve them.

5 Criteria for Evaluation

Individuals must make choices about their objectives (or ends) and the alternatives (means) they choose to achieve those objectives. To make these choices, it is necessary to value or prioritize ends and means. The process of ranking and the ultimate selection of priorities require criteria to value the alternatives.

Both ends and means can be ranked on the basis of tradition. Communities often develop traditional solutions to economic problems. In some societies, the solution to the problem of food acquisition may be hunting. Hunting a given specie or species of animals provides a workable solution given technology, natural and built environments. Religion and other social institutions may develop to support these solutions. Use of tradition and institutions (and rules of thumb) to choose ends and means is a way of minimizing the use of analysis and reasoning to make choices: there are a set of ready-made choices. These traditional ends and means are created and evolve as workable solutions to problems. In many cases, traditional solutions may be very effective. However, traditions by their nature persist over time (tend to maintain the status quo) and may become less effective as circumstances change. When natural or built environments change society may still cling to the traditional solutions in the face of declining success. Religion, the vested interests, desire for the old ways and human resistance to change are examples of forces that inhibit the search for new solutions. The ranking of ends and means by tradition may lag behind the changes in knowledge, technology and environmental circumstance. If traditions and existing institutions result in increasingly less successful results, new solutions that are more consistent with individual values and expectations may emerge.

5.1 Criteria to Evaluate Ends and Means

The evaluation and ranking of both ends and means requires the application of ethical principles. At another level, the choices of means to achieve a given end may appear to be based on efficiency.

Ethics is the study of the process by which an objective (and/or the means used) is judged "right or wrong." Efficiency is a measure of the extent to which an objective is achieved. Efficiency can only be used to evaluate the means used to achieve a goal or end. Ultimately, efficiency rests on a foundation of ethics. An immoral objective can be achieved "efficiently." Nazi Germany sought "efficient" means to achieve the annihilation of an ethnic group.

Modern, neoclassical economics is often perceived as a study of efficiency with in the context of a very specific ethical system: "utilitarianism."

5.2 Ethics

Ethics is the branch of philosophy that studies the nature of "right and wrong" and the criteria used to evaluate the moral questions about ends, choices, means and behavior. Albert Schweitzer is quoted,

> *"In a general sense, ethics is the name we give to our concern for good behavior. We feel an obligation to consider not only our own personal well-being, but also that of others and of human society as a whole."* *(quoted in Hill, p 4)*

Humans tend to rationalize and justify their values, beliefs and behavior: they like to think that what they believe and do is "the right thing to do." For our purposes, there are two broad approaches to judging right and wrong. One approach is to judge the moral quality of an end or action based on duty. This is called deontological ethics. The second approach is to judge the rightness or wrongness with regard to the consequences or outcomes of actions. This approach is referred to as axiological ethics. A third approach is teleological ethics that presumes that each person or community has some unique purpose and that the moral objective should be the attainment of that purpose.

DEONTOLOGICAL ETHICS

In deontological ethics, right and wrong are judged on "duty." Individuals often engage in activities and make choices that are based on a sense of duty. These duties may be based on tradition, expectations or more formal rules. The rightness of behavior is can be seen as compliance with these rules. It should be noted that these rules may be implicit or explicit. The belief that individuals have an obligation to tell the truth, not to kill, to vote or to serve their country are examples of rules that specify duties. In an exchange relationship the seller (or buyer) may have a duty to provide information to the buyer (or seller).

AXIOLOGICAL OR CONSEQUENTIALIST ETHICS

Right and wrong (or goodness and badness) of an act (or choice) is based on the value of the outcome of that act (or choice) in axiological ethics. One subset of axiological ethics is consequentialist ethics. In consequentialist ethics, the consequences of actions determines what an individual ought to do and will do. Utilitarianism is a consequentialist ethic that provides the ethical foundation of orthodox microeconomics.

Neoclassical economics is based on Utilitarianism, a system of ethics that was formalized by Jeremy Bentham [1748-1832]. Bentham believed that seeking pleasure (happiness, satisfaction, welfare or utility) and avoiding pain determined what individuals do and should do. It is based on the goal of maximizing the welfare or utility of the people "whose interests are of concern." The rightness or wrongness of a choice is based on the outcome or the utility that results from that choice. If the total utility of the group is increased, the choice was "right." If utility is decreased, the choice was unjustified by this ethical standard. In the *Introduction to the Principles of Morals and Legislation* (1789), Bentham makes the following observations.

- "Nature has placed mankind under the governance of two sovereign masters, pain and pleasure. It is for them alone to point out what we ought to do, as well as what we shall do." (Bentham, Principles, Chapter I)
- "By utility is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness or to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered: if that party be the community in general, then the happiness of the community: if a particular individual, then the happiness of that individual." (Ibid.)
- "The interests of the community then is, what? --the sum of the interests of the several members who compose it." (Ibid.)

The consequentialist ethic of Utilitarianism and neoclassical economics is based on the maximization of each individual's utility. It provides the criteria that are used to judge what we should do and it is the stimulus that directs what we do. The interest or welfare of the community is the sum of the interests of individuals therefore the sum of individuals' utilities is the community or social welfare. Anything that increases the utility or welfare of an individual or society is perceived as ethically correct.

Bentham tried to create a method to calculate the utility or welfare of a community: a "felicific calculus." His approach required that each individual's utilities be independent other individuals utility functions so that they could be added. This process is a form of "reductionism," the overall system is simply the sum of its parts. Bentham considered seven characteristics of each act to calculate the consequences. These included: intensity (of pleasure or pain), the duration, the certainty, propinquity (nearness in place or time), fecundity (capacity to produce similar results), purity and the extent or number of persons affected. Bentham argues the process is to

"Sum up all the values of all the pleasures on the one side, and those of

> *all the pains on the other. The balance if it be on the side of pleasure, will give the good tendency of the act upon the whole, with respect to the interests of that individual person: if on the side of pain, the bad tendency of it upon the whole."* (Bentham, p 39)

Bentham's utilitarianism is a benefit-cost analysis of pleasure and pain. If the pleasure associated with an act exceeds the pains associated with that act, the act is justified by consequentialist ethics. In economics, finance, accounting and policy analysis, benefit/cost analysis is often used in decision making: if the benefit/cost ratio exceeds one, the project is justified. The difference between Bentham and modern benefit/cost analysis is that Bentham's approach is much broader. In modern benefit/cost analysis, prices of goods are substituted for pleasure and pain. Only market pleasures (utiltity) and pain (cost) are used in the analysis. Pleasure and pain encompass emotional and non-market values held by individuals.

5.3 Efficiency

Efficiency is a measure of the extent to which an objective has been achieved. If an objective is immoral or unethical, efficiency can still be used to evaluate the extent to which the objective is met. Consider the construction of ovens. If an oven is "too small", there is inefficiency in the loss of energy because the door is opened and closed more frequently. If an oven is "too large" it is inefficient in heating too much space. The choice of using a toaster oven or a full size oven is a judgment about their efficiency at different tasks. If the task were to dispose of human bodies during genocide, efficiency would be important in determining the size of the ovens even though the objective is clearly immoral.

It is possible to have objectives that are unethical or wrong and still achieve those objectives with different degrees of efficiency. If an objective were good, moral or ethically correct, then greater efficiency would be desirable. If the objective is immoral or bad, then greater efficiency is not necessarily desirable.

If there are alternative means to achieve an ethical objective, the means may have different levels of efficiency. It is also possible that the different means will be more or less ethical than others. In this case, it may be necessary to judge between an efficient less ethical means and a less efficient more ethical one.

The idea of efficiency was borrowed from physics.

Energy efficiency is often measured as:

$$\% \text{ efficiency} = \frac{\text{useful energy produced}}{\text{total energy used}} \times 100$$

Mechanical efficiency is defined as:

$$\% \text{ efficiency} = \frac{\text{output power}}{\text{input power}} X\,100$$

In economics, efficiency can be thought of as a ratio of outputs to inputs. The resources used in production are the inputs and the goods (and services) that are produced are the output. Efficiency is not in and of itself an objective. It is possible to efficiently pursue immoral objectives. It is also possible to pursue ethical ends with unethical means.

Several variations of efficiency are relevant in economics: technical efficiency, allocative or economic efficiency and Pareto efficiency. These concepts of efficiency are straightforward: the difficulty lies in measurement of output, value of outputs, inputs and the value of inputs. In neoclassical microeconomics, utilitarian ethics is the foundation of the concepts of efficiency. Relative prices of inputs and outputs are used as proxies or surrogates for relative values. Again, remember the warning of Oscar Wilde:

"A cynic is someone who knows the price of everything and the value of nothing." Price and value are not the same thing, but prices may be used as an approximation of value. Prices may not reflect all the benefits or costs associated with a choice. They may be distorted in a variety of ways: exchange may not be voluntary: agents may engage in deception, institutions may be inconsistent with technical and environmental circumstances, regulations and other problems.

5.3.1 Technical Efficiency

One of the functions of an economic system is to coordinate the production of goods (and services). The technical efficiency of a productive process is the ratio of the outputs (or resources used) to the input (of goods and services). If an economic system produced two goods: Xebecs (Q_X) and Yawls (Q_Y), the output could be measured as $Q_X + Q_Y$. The inputs would be the sum of the resources used (Land ®, labor (L) and capital (K)). Efficiency can be expressed as:

$$\text{Technical efficiency} = \frac{Q_X + Q_Y}{R + L + K} = \frac{\text{output}}{\text{input}}$$

5.3.2 Production Possibilities Function

Efficiency as a market phenomenon can be illustrated using a production possibilities model. (Sometimes called a Production possibilities function, production possibilities curve, production possibility frontier, PPF or transformation function). The PPF is a model that identifies all the production alternatives that are possible for two goods given a set of inputs and a state of technical knowledge. Using the equation from above:

- Output is $Q_X + Q_Y$ or the quantity of good X (xebecs) plus the quantity of good Y (Yawls), there are alternative quantities of Q_X and Q_Y that can be produced. By limiting the outputs to two goods, the model can be constructed in two-dimensional space (on a graph). If three goods are considered, the model requires a thee-dimensional space.
- Inputs are: R (natural resources) + L (labor) + K (capital), these resources are finite and given at any point in time.
- The state of technology is the information the agents have about the various ways of producing different quantities of goods X (xebecs, or Q_X) and Y (yawls, or Q_Y).

If all inputs and the best technology available were allocated to the production of xebecs (Q_X), a finite quantity could be produced. In Figure 5.1 this is shown at point G on the X axis when 32 units are produced. Since no inputs are allocated to the production of yawls (Q_Y), none are produced. If the agents decided that some yawls were desired, they would have to take some of the inputs from the production of xebecs to use in the production of yawls. Since all the inputs (and best technology) were used to produce 32 xebecs in our example, any reallocation of inputs from the production of xebecs to yawls would require a sacrifice, or the production and availability of fewer units of xebecs. This can be shown as a move from point G (Q_X = 32: Q_Y = 0) to point F (Q_X = 31: Q_Y = 10). The production of 10 units of yawls requires the sacrifice of 1 units of xebecs (32-31=1). The inputs that are least effective in producing xebecs would be reallocated to the production of yawls. The sacrifice of xebecs would be minimized. (You would not shift the best resources to produce xebecs into the production of yawl: that would maximize the sacrifice.)

At point A (Q_X = 0: Q_Y = 53), all inputs are allocated to the production of yawls so no xebecs are produced. Resources can be reallocated from the production of yawls to produce xebecs: the first five units of xebecs can be produced by sacrificing the output of 3 yawls. Again, the least effective inputs in the production of yawls would be shifted to the production of xebecs. This can be shown as a movement from point A to point B. Sacrifice of one good to produce more of the other is called "opportunity cost." We can locate other output alternatives along the PPF: points A, B, C, D, E, F, G all represents alternative outputs of xebecs and yawls. Any point that lies on the PPF is an output alternative that represents a combination of Q_X and Q_Y that can be produced given inputs and technology. Any output combination inside the PPF is possible but, would not be the maximum amounts of X and Y that could be produced. Output combinations that lie outside the PPF are not attainable or feasible given the inputs and technology available.

The output combination at point H (Q_X=16: Q_Y=20) is clearly not efficient: more X or Y or both can be produced given the inputs and technology. (Remember, R, L, K and technology, inputs are fixed.) Resources can be reallocated to produce more xebecs (a move to point E), to produce more yawls (point C) or more of both (any point in the triangle HEC.

Any output combination that can be shown as a point on the PPF can be considered as "technically efficient." Any output combination that falls inside the PPF is technically inefficient: there are unused inputs or inputs are not being used for the most appropriate purpose. Clearly there is a problem: there are an infinite number of output combinations (any point on the PPF) which are technically efficient. There are also an infinite number of output combinations that lie inside the PPF that are technically inefficient.

If we expand the model to include the ratio of output to inputs, an increase in technical efficiency could be the result of:

- an increase in the output of either good while the other good and inputs are held constant
- an increase in both goods while inputs are held constant
- a decrease in the inputs while the output is held constant
- an increase in output and a decrease in inputs.

A movement from a point inside the PPF to a point on the curve is can be regarded as an "increase in efficiency." An improvement in technical knowledge can also be regarded as an "increase in efficiency" since the same output combination could be produced with fewer inputs. The technological improvement can also be envisioned as a shift of the PPF, more output can be produced if the same quantities of inputs are used. This is shown in Figure 5.2.

There are an infinite number of technically efficient solutions to the allocation problem. However, there is only one allocation that achieves economic or allocative efficiency.

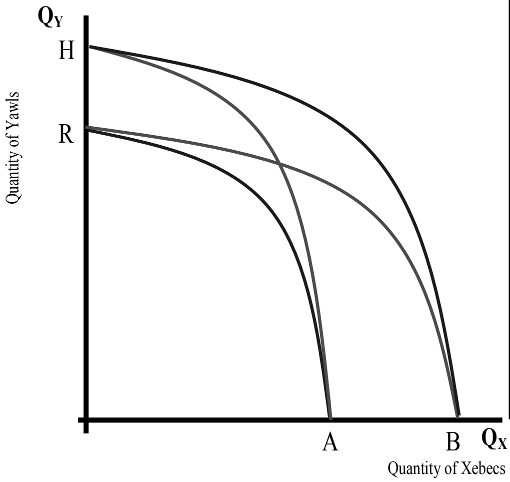
ALLOCATIVE OR ECONOMIC EFFICIENCY

Since Xebecs (good Q_X) and Yawls (good Q_Y) are not the same things, it does not make sense to add them together (case of adding apples and oranges, $Q_X + Q_Y$). If the values of the two (or more) goods were known or there were an acceptable proxy for the value, it would be possible to add their values. Remember that one of the tasks of the economic process is to allocate resources to their highest valued use. Technical efficiency is a prerequisite for allocative efficiency.

Economic or allocative efficiency takes into account the value of both the inputs and outputs. Economic efficiency is measured by a ratio of the value of the output to the value of the inputs. Value is a complex notion and market prices are often used as an indicator of exchange value. (Remember the warning of Oscar Wilde: "*A cynic is some one who knows the price of everything and the value of nothing*.") Lacking a better proxy for value, price

is often used. If the price of good X (P_X) and good Y (P_Y) are proxies for their value and the wage or price of labor (W_L or P_L) and capital (P_K or %) were proxies for their values then allocative or economic efficiency might be represented as:

$$\text{Allocative efficiency} = \frac{\text{value of output}}{\text{value of input}} = \frac{P_X Q_X + P_Y Q_Y}{P_L L + P_K K}$$



Given the original PPF as line RA. An improvement in technology that impacts only the production of xebecs can be seen as a shift from RA to RB. An improvement in technology that influences only the production of Yawls would be a shift from RA to HA. Technology that impacts the production of both goods would be a shift from RA to HB. These outward shifts are sometimes called "economic growth."

A change in inputs could also be shown as shifts in the PPF, a decrease in inputs would shift the PPF inward toward the origin. An increase in inputs would shift the PPF outward.

Figure 5.2

Allocative efficiency is not only influenced by the quantities of the goods produced and quantities of the inputs used, but the relative values of the inputs and outputs are also important. The benefits or value of an alternative can be expressed as $P_XQ_X + P_YQ_Y$. The costs of the alternative could be expresses as $P_LL + PK_K$. Given a set of inputs and technology the solution that achieves allocative efficiency is the highest valued output possible given the inputs and prices.

Given inputs and a state of technology, the alternative sets of outputs are shown by the production possibilities function. If all inputs are used to produce Yawls (good Y, or Q_Y), a maximum of 53 units can be produced. If the inputs are reallocated to produce 5 Xebecs (good X, or Q_X), it will be possible to only produce 50 yawls. At the output shown by point C, 16 units of xebecs and 40 units of yawls are produced. If all inputs are used to produce Xebecs (Q_X= 32 at point G), a maximum of 32 units of X can be produced.

Given technology and inputs, all possible output combinations are shown by all points that lie along and inside the line ABCDEFG. A change in inputs or technology will shift the production possibilities frontier.

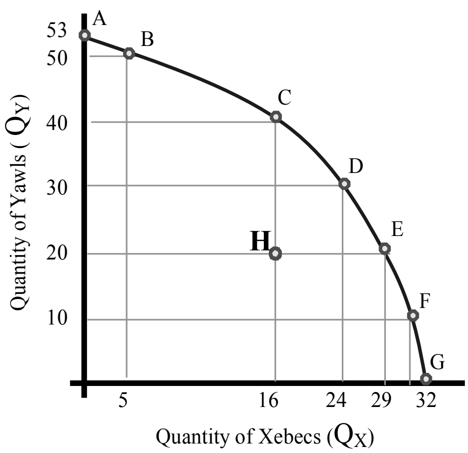


Figure 5.1

Using the same production possibilities function as in Figure 5.1, allocative efficiency can be described in Figure 5.3**.** In this example, the optimal output alternative is that with the highest value. Since value cannot be measured directly, neoclassical economists use market price as an approximation of value. In order for market price to be a reasonable approximation, exchanges must be voluntary exchanges of goods with exclusive property rights. If the price of xebecs were $4 and the price of yawls were $2 the "value" of each alternative identified in Figure 5.2 can be calculated. Alternative A is worth $106, alternative B is worth $120, C is worth $144, D is worth $156, E is also "valued" at $156. The output at alternative F is worth $144 and at G is worth $128. These calculations can be seen in Table 5.3. The highest valued output, based on market prices will lie on the PPF between alternatives C (valued at $156) and D (also $156).

If the prices of the goods are accepted as the value of the goods, the calculation of each alternative are shown in Table 5.1

If the price of good Y should rise to $3.50 (and the price of X stay at $4) the alternative with the "highest value" is at point C as shown in Table 5.2.

The alternative that is allocatively or economically efficient is dependent on a set of prices that measures value. We will explore the ability of the market to accurately reflect values of outputs. It is also important to note that there are many things that humans value that cannot be expressed as a market price.

The PPF is determined by the finite quantity of inputs and technology. If the price of xebecs is \$4 (P_X=\$4) and the price of yawls is \$2 (P_Y=\$2), at point A the "value" of good X is 0 and the "value" of good Y is \$106, the "value" of the output (given prices) is \$106.

At point B the value of the output of good X is \$20 (\$4x5 units X), the value of good Y is \$100 (\$2x50 units Y). The value of output of good X and Y is \$120.

At D and E the value of the output is \$156. Some where between alternatives D and E on the PPF the value of the output will reach a maximum. It is where the slope of the PPF is equal to P_X/P_Y.

Any alternative inside the PPF will be valued at less than the maximum value.

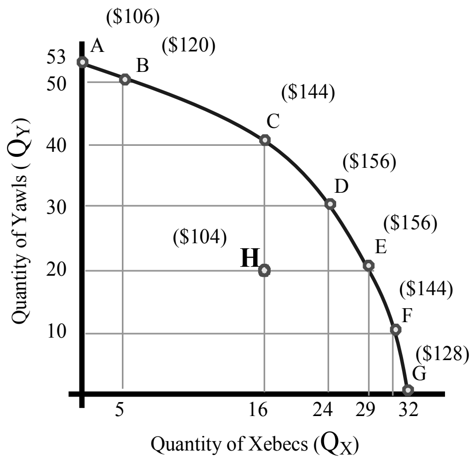


Figure 5.3

Table 5.1 Allocative Efficiency and Value of Output

Alternative	Q_X	P_X	Value of output of X ($P_X Q_X$)	Q_Y	P_Y	Value of output of Y ($P_Y Q_Y$)	Value of output ($P_X Q_X + P_Y Q_Y$)
A	0	$4.00	$0.00	53	$2.00	$106.00	$106.00
B	5	$4.00	$20.00	50	$2.00	$100.00	$120.00
C	16	$4.00	$64.00	40	$2.00	$80.00	$144.00
D	24	$4.00	$96.00	30	$2.00	$60.00	$156.00
E	29	$4.00	$116.00	20	$2.00	$40.00	$156.00
F	31	$4.00	$124.00	10	$2.00	$20.00	$144.00
G	32	$4.00	$128.00	0	$2.00	$0.00	$128.00
H	16	$4.00	$64.00	20	$2.00	$40.00	$104.00

Table 5.2 Allocative Efficiency and Value of Output							
Alternative	Q_X	P_X	Value of output of X (P_XQ_X)	Q_Y	P_Y	Value of output of Y (P_YQ_Y)	Value of output ($P_XQ_X + P_YQ_Y$)
A	0	$4.00	$0.00	53	$3.50	$185.50	$185.50
B	5	$4.00	$20.00	50	$3.50	$175.00	$195.00
C	16	$4.00	$64.00	40	$3.50	$140.00	$204.00
D	24	$4.00	$96.00	30	$3.50	$105.00	$201.00
E	29	$4.00	$116.00	20	$3.50	$70.00	$186.00
F	31	$4.00	$124.00	10	$3.50	$35.00	$159.00
G	32	$4.00	$128.00	0	$3.50	$0.00	$128.00
H	16	$4.00	$64.00	20	$3.50	$70.00	$134.00

5.3.3 Pareto Efficiency

At a technical level, economics provides a set of tools to aid in choosing among competing alternatives. In 1906 an Italian, French, Swiss, engineer, sociologist, economist Vilfredo Pareto (1848-1923) introduced the concept of Pareto optimality as a means to undermine the role of utilitarianism in economics. Instead, it became the foundation for what is now called benefit cost analysis and its derivative measures of allocative performance such as rate of return on investment and cost effectiveness.

Consider a community of individuals. Your task is to choose an alternative to maximize the welfare or utility of the group. If there were an alternative that would improve the welfare (or increase the utility) of at least one person in the group without making any one worse off (decrease their welfare or utility), you should choose to that alternative. However, if all the alternatives that would make at least one person better off would also make at least one other person worse off, you cannot know if that alternative would improve the wellbeing (utility) of the group.

Pareto efficiency is the condition where all alternatives that would increase the welfare of at least one person without decreasing the welfare of others have been exhausted. There is nothing that can be done to improve the welfare of anyone without making someone else worse off. In the PPF model (Figure 5.4), Pareto efficiency exists at any point on the PPF once you have attained that point.

Given the PPF, point H is not Pareto efficient: more X (Y) can be produced with no sacrifice of good Y (X). A move to any output combination identified in the triangle HEC is a Pareto improvement; some one (or everyone) is better off and no one is any worse off; this area is Pareto Safe. A move to any point in the Pareto Safe area is a Pareto improvement or is Pareto superior.

Once on the PPF (point D for example) any change to improve the welfare of an individual (or group) who prefers good Y, would make those who prefer good X "worse off." To increase the quantity of Y, from point D to point C, would require that less X would be produced.

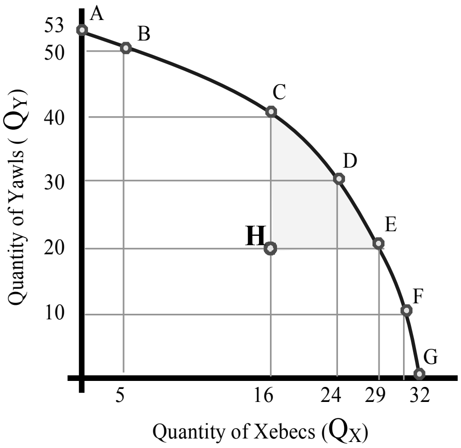


Figure 5.4

Pareto efficiency can be used as a criterion to decide whether to chose an alternative. If a choice makes some one better off and no one any worse off, it is a choice that will increase the achievement of the goal or end of maximizing the utility or welfare of the group. This can be

"**Pareto Safe**," i.e. the output can be altered so someone is "better off" and no one is worse off. Any change that increases the welfare of one person or persons that does not reduce the welfare of another is a "**Pareto improvement**" or Pareto Safe and will clearly increase the welfare or utility of the community. Any alternative that results in a greater utility of at least one person and no decrease in the utility of anyone can be referred to as "**Pareto superior**."

The problem is that this criterion tends to support the status quo. Almost all choices that increase the utility of an individual or group will make others worse off. Since a Pareto efficiency criterion is very restrictive, **Pareto Potential** is may be used. This is the same as the benefit/cost criterion. Pareto potential holds that if a choice or alternative makes one person or group better off but others are worse off, if the "winners" or those who gain can hypothetically reimburse those who are "losers" (or are worse off) and still be better off, the alternative will increase the utility of the group. In a more simplistic way, the benefits associated with the choice exceed the costs.

PARETO POTENTIAL, BENEFIT/COST AND MARGINAL ANALYSIS

The Pareto potential criterion for decision making is the foundation of analysis that use benefit/cost, cost effectiveness and rate of return for decision making.

Marginal Analysis

The process of making decisions is like the proverb "The longest journey begins with the first step." Or like the question posed by Albert Camus (1913-1960) about the individual deciding each day about suicide or continuing life. The individual taking a journey must make the decision about taking the first step before they decide on the second. In Camus' case, one must decide not to committee suicide before you tackle the rest of the day.

Decisions in economics are always made at the "margin." A decision to change one variable will cause a change in some other related variable. An act or choice will have benefits and costs <u>associated with that act</u>. An increase in the production of xebecs may require a reduction in the production of Yawls: the benefit is more xebecs, the cost is fewer yawls.

A change in the price of a good will change the quantity sold, a change in the quantity sold will change the total revenue collected. The change in total revenue caused by a change in units sold is called marginal revenue. The marginal concept is applied to a wide variety of relationships. In principles of economics, these are usually described as a "one unit" change in the variables. The Greek letter delta, Δ is used to identify a change calculated by subtraction. In other cases, a derivative (d) or partial derivative (∂) will be used to denote a change that approaches 0.

The use of marginal is applied to many economic relationships. In fact, the early period of the development of microeconomics (mid to late 19th century) was called the "*marginalist revolution*." Below are some definitions of several useful marginal relationships.

Marginal Cost (MC)

MC is defined as the change in Total Cost (TC) or variable cost (VC) caused by a one unit change in the quantity produced, output (Q). MC represents opportunity cost.

$$MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta VC}{\Delta Q}$$ ***Equation 5.3***

Marginal Benefit (MB)

MB is defined as the change in total benefit (TB) caused by a one unit change in quantity consumed (Q).

$$MB = \frac{\Delta TB}{\Delta Q}$$ ***Equation 5.4***

Marginal Utility (MU)

$$MU = \frac{\Delta TU}{\Delta Q}$$ ***Equation 5.5***

MU is the change in utility caused by a change in quantity consumed (Q)

If Pareto Potential or the Benefit/Cost criteria are to be used for decision-making, the rule is quite simple: if the benefits associated with a choice (or alternative) exceed the costs associated with that choice, then the choice will increase net benefits. If the costs of an alternative exceed the benefits of that alternative, then that alternative is not a good choice.

EXAMPLE BENEFIT/COST USING MARGINAL ANALYSIS

Using the example PPF presented in Figure 5.5 (Same PPF as in 5.1, 5.3, 5.4)

Consider the PPF in Figure 5.5: Xebecs are priced at $4 (PX= $4) and yawls are $3.50 (PY = $3.50). If the initial output were where QX= 16 and QY = 20, which is represented at point H. At these prices, the output of xebecs is "worth" $64 and yawls are worth $70. The "value" of the output alternative identified at point H is $134.

Original allocation is at H (Q_X=16, Q_Y=20);
P_X = $4 and P_Y = $3.50

Alternative E (C, D or any choice in triangle HEC) has no MC, the output of X or Y or both X and Y increases so the MB is positive. The B/C ratio of any alternative is grater than one, the MB>MC.

If production were at point D (Q_X=24, Q_Y=30), a choice of alternative C would result in Q_X=16, Q_Y=40, 8 units of X are traded for 10 units of Y. Six fewer units of X at $4 each is a MC of $24. The MB is 10 additional units of Y at $3.50 each or $$35. The MB>MC, The B/C ratio >1, the net benefits will increase by $11 by selecting alternative C over D. Alternative C is worth

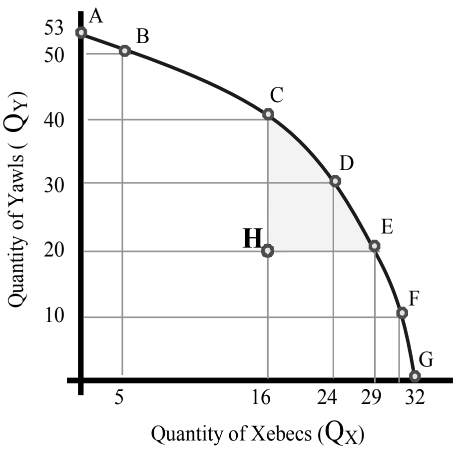


Figure 5.5

Ranking of Alternative H with Alternative E

If alternative E were chosen over alternative H, 13 additional units of xebecs would be produced (29-16=13). This is the marginal benefit (MB) of the choice of reallocating resources from alternative H to E. If xebecs were valued at $4 each, that would be a MB of $52 in monetary terms. This can be viewed as a move from row H to row E in Table 5.3

Table 5.3
Allocative Efficiency and Value of Output

Alternative	Q_X	P_X	Value of output of X (P_XQ_X)	Q_Y	P_Y	Value of output of Y (P_YQ_Y)	Value of output ($P_XQ_X + P_YQ_Y$)
A	0	$4.00	$0.00	53	$3.50	$185.50	$185.50
B	5	$4.00	$20.00	50	$3.50	$175.00	$195.00
C	16	$4.00	$64.00	40	$3.50	$140.00	$204.00
D	24	$4.00	$96.00	30	$3.50	$105.00	$201.00
E	29	$4.00	$116.00	20	$3.50	$70.00	$186.00
F	31	$4.00	$124.00	10	$3.50	$35.00	$159.00

This reallocation of resources would not reduce the output of yawls, so the marginal cost of the reallocation is 0. Since the MB > MC, the reallocation or inputs to move the output alternative from H to E would be an improvement in the achievement of the objective (producing the highest valued output). The output of xebecs and yawls at point E is $186 (134 + 52: the value of the output at H added to the MB of reallocation of inputs)

The relative prices of xebecs and yawls are irrelevant since the marginal cost (MC) is zero. Any increased production of xebecs at any positive price would be a Pareto improvement. A reallocation to point D, C or any output combination that lies in the triangle HEC would be a Pareto improvement (or Pareto superior to the allocation at point H).

Ranking of Alternative E with Alternative F

If the current output were at point E (Q_X= 29 and Q_Y = 20), and alternative F (Q_X= 31 and Q_Y = 10) is considered. The marginal benefit (the benefit associated with reallocating resources to point F) would be an additional 3 units of xebecs (31-29=3). At $4 each this is a MB of $12 in monetary terms. However, the reallocation of resources from H to F requires a sacrifice or MC of 10 units of yawls (20-10=10). At a price of $3.50 the MC is $35 in monetary value. The MC = 35: MB = 12. A reallocation of inputs to move from point E to point F would be trading $12 for $35: not a good idea.

Ranking of Alternative E and Alternative D

A reallocation of resources from alternative E to alternative D would result in an increased output of 10 yawls. At a price of $3.50, the MB is $35. This reallocation reduces the output of xebecs from 29 to 24, a marginal cost of 5 units of xebecs. At $4 each this is a MC of $20. Since the MB > MC (35 > 20), the reallocation of inputs from the production of the output at point E to point B is justified by our benefit/cost criterion. Notice that the net gain to society is $15, so point D is "worth" $15 more than the output at point E. D is "valued" at $201 and E is "valued" at $186 (186 +15 = 201).

Can a reallocation of inputs from the production of the output at point D to point C be justified using the Pareto potential criterion?

Complications

This analysis is simplified. There are a number of questions.

When the "winners" gain more than the losers, the reallocation is justified. The winners can hypothetically reimburse the losers but the reimbursement may never occur. The alternative at point C is preferable to that at point D. The net marginal benefit of a reallocation form D to C is $3. The individuals who have a preference for xebecs are “worse off” (losers) Those who prefer yawls are “better off” (winners).

Can the redistribution of benefits from one group to another be justified on ethical grounds? Consider a reallocation of water from storage behind a dam to a free flowing river. Irrigators and power users may incur significant costs while the fishermen and white water rafters gain. A tax cut clearly benefits some individuals but may impose costs on others. There may be no mechanism by which the losers can be compensated by the winners.

Another issue is that if the move from D to C involves fewer xebecs and more yawls. The increase in yawls might cause the price for yawls to fall while the decrease in xebecs could feasibly result in a price increase for xebecs.

If the winners of an action can hypothetically compensate the losers and still be better off, the benefits exceed the cost of the action. The benefit/cost ratio is greater than one and is justified by the Pareto Potential criterion. There are still ethical questions involved.

5.3.4 Some practical ethics

The ideas of justice and ethics are often considered a matters of individual preference and therefore impossible to evaluate. What I consider just, someone else may perceive as unjust. It has been a perplexing problem that has been addressed by philosophers over the ages. Plato and Aristotle both were concerned with justice. Adam Smith saw justice as a necessary requirement for a civil society. Ethics is important. One of the approaches that is applicable in economics is the “veil of ignorance” as described by John Rawls.

> *“It is assumed, then, that the parties do not know certain kinds of particular facts. First of all, no one knows his place in society, his class position or social status: nor does he know his fortune in the distribution*

of natural assets and abilities, his intelligence and strength, and the like. Nor, again, does anyone know his conception of the good, the particulars of his rational plan o life, or even the special features of his psychology such as his aversion to risk or liability to optimism or pessimism. More than this, I assume that the parties do not know the particular circumstances of their own society. That is, the do not know its economic or political situation, or the level of civilization and culture it has been able to achieve, the persons in the original position have no information as to which generation they belong. These broader restrictions on knowledge are appropriate in part because questions o social justice arise between generations as well as within them, for example, the question of the appropriate rate of capital saving and of the conservation of natural resources and the environment of nature. There is also, theoretically anyway, the question of a reasonable genetic policy, In these cases too, in order to carry through the idea of the original position, the parties must not know the contingencies that set them in opposition, They must choose principles the consequences of which they are prepared to live with whatever generation they turn out to belong to." (Rawls, P 137)

Individuals must be prepared to be placed in a society and no matter the circumstances, say "That's fair."

5.3.5 Efficiency and ethics (again!)

If the objective is to maximize the welfare or utility of a group, an alternative with a benefit/cost ratio that exceeds 1 will increase the utility of that group. The winners can hypothetically reimburse the losers and still be better off. If the hypothetical reimbursement is not actually made, the distribution of wealth, income and the level of goods that each person can potentially consume will be altered. Some people are better off and other people are worse off. This change in relative welfare of individuals is an ethical question, not one of efficiency, although it often masquerades as a question of efficiency.

Consider a case of a society. Under the present conditions, there is a distribution of income and wealth that results in different individuals consuming differed quantities of goods. These individuals probably have different preferences and derive different levels of utilities from the given good. A tax cut will make some people better off: they pay fewer taxes. Since the government has less revenue, they must cut some programs: grants for low income students to attend college, road construction, etc. Students, employees at universities, movie theaters near the university, trucking companies, and consumers who must pay higher prices because it costs more to transport goods may be worse off. Taxpayers with lower taxes, firms where these taxpayers spend their increased incomes and workers who are hired by the firms are better off than before. If the benefits exceed the costs, the winners could hypothetically reimburse the losers. If the reimbursement is not actually made (which it probably will not), there is an ethical question about taking from one group to benefit another.

6 Introduction to the Rules of the Game and Economics Systems

Whether a society emphasizes the use of exchange, reciprocity or eminent domain to allocate resources, "*Any economic system requires a set of rules, an ideology to justify them, and a conscience in the individual which makes him strive to carry them out*." (Robinson, p 13) This set of rules includes informal institutions and values held by individuals as well as formal law. The structure of the rules of the games shapes the society's economic system. Neoclassical microeconomics does not often explicitly consider the nature of these rules and their relation to economic behavior.

6.1 Economic Systems

Societies that fail to meet minimum subsistence requirements for its members become relics of the past. Ideally, an economy will produce more than necessary for subsistence and apply the additional output to improving the lives of the members of society through development and/or economic growth. The ideas of "progress," economic development and economic growth came with the development of the commercial world that replaced the feudal society of the medieval world.

An economic system consists of a matrix of social institutions (law, political institutions, religion, etc), agents (individuals or actors), organizations (corporations, unions, charitable org, not-for-profit firms, etc) and society. The principles, beliefs and values held by individuals are included in the structure of society. The function of an economic system is to coordinate the activities of agents in the processes of provisioning and allocation. Nonmaterial characteristics of life (social stability, low crime rates, a sense of community, etc) are related to the economic processes and should be included.

Robert Heilbroner identifies thee basic types of economic systems. These are classified as markets, command, and tradition. In practice, most economies are a mixture that includes elements of all three. However, the economic system is usually classified by the dominant approach. Markets and command exist in traditional economies. Tradition and markets exist in command economies. Western industrial societies categorized as "market-oriented" economies rely primarily on exchange, but contain elements of tradition and command. In market economies tradition is important to such decisions regarding values, expectations about behavior (trust, loyalty, etc.), fashion, preferences about housing, choices about occupations and geographic preferences. Command is also found in market economies as regulations and laws regarding the allocation or resources and goods.

6.1.1 Traditional Economies

Traditional economic systems are based the repeated use of solutions that have worked in the past. Solutions to problems in the processes of production, distribution and consumption are embedded in the customs, mores and cultural patterns of social life. These solutions have been established through trial and error: those activities that result in adequate production and an acceptable distribution are retained and used often without question. Agents in traditional societies may engage in exchange transaction but these are peripheral to the provisioning and allocation problems.

The traditional economic system tends to be found in non-industrial societies that are engaged in hunting, gathering, pastoral, or basic agriculture. Often these are subsistence economies: there is little or no growth or progress. The aboriginal culture in Australia is an example of an economy that has flourished for thousands of years (40,000 years by some estimates) as a traditional economy.

Traditional economies tend to depend upon a deontological ethic. Duties to other members of the family, tribe or clan and "reciprocity" are the primary allocative mechanisms. The forms of production that individuals engage in are based on the processes that have worked in the past. Social institutions, such as religion, may evolve to reinforce the traditional ways.

These societies must communicate behavioral expectations to each new generation. The most important form of knowledge may be contained in stories and myths. Mythology and story telling are important aspects of the creation and communication of cultural values. *Webster's Encyclopedic Unabridged Dictionary of the English Language* gives one of the definitions of myth as:

> *"an unproved collective belief that is accepted uncritically and is used to justify a social institution."*

Keen and Valley-Fox describe myths as:

> *"… an intricate set of interlocking stories, rituals, rites and customs that inform and give the pivotal sense of meaning and direction to a person, family, community or culture."* (Keen, p xii)

Mythology is one of the processes by which cultural values and expectations about behavior are transmitted from generation to generation. Even in modern societies, stories are fundamental to the process of creating, and perpetuating culture in societies.

Reciprocity is often a key element in traditional economies. Remember that reciprocity is based on duty and involves obligatory gift giving: I do you a favor and both you and I (and other members of society) expect that you will return some unspecified favor at some unspecified time in the future. It requires a sense of duty, social values and a community to enforce reciprocation. Social institutions give structure to the values, duties and expectations about economic behavior.

In many societies, reciprocity becomes an important element of the social process. In a ranching community Rancher Smith goes to the other ranchers and says: “I need some help branding my calves next Tuesday, I’d appreciate some help.” On Tuesday, the ranchers show up at Rancher Smith’s place and help with the task. If Rancher Jones does not come to help, it may be for a good reason. However, if he or she is perceived as shirking his or her duty, it may be difficult for Jones to get neighbors to help with future tasks. Similarly, if everyone helps Rancher Smith but then at some point in the future Rancher Smith does not reciprocate by helping someone else fix his or her fence, then Rancher Smith may find it difficult to get anyone to help in the future. There is a community that expects that the other members will help when needed and will reciprocate in the future. The community must communicate the willingness of its members to participate in mutual aid and to sanction members who do not fulfill their obligatory duties.

Notice that the substance of the event is different if Rancher A says: “I’ll pay you $10 per hour to help me brand my calves.” Shifting the process from reciprocity to a market exchange significantly alters the relationships and the nature of the event. In the case of reciprocity, there is a sense of community. The relationship between the members of the community may be of value in and of itself. Blood and organ donations are examples. Moving a good or activity into a market transaction may significantly alter its meaning or value. A market exchange can take place between anonymous individuals.

As communities become larger, more complex and social relationships are altered: tradition may be less useful as an allocative mechanism. It is more difficult for the members of the community to communicate the extent to which the members fulfill their duties. Social pressure to enforce obligations of reciprocity and duty may become less effective since each person has more relationships that may be more valued.

Another weakness of a traditional economy is that it does not adapt quickly to changes in technology or the environment. So long as there are no (or few) changes in the environment, technology or external forces, the traditional economy is stable or static. However, if there are sudden changes in the environment, the traditional solutions may no longer suffice. Droughts, desertification, over hunting specific animals are examples of events that traditional societies may not be able to deal with. Native Americans in the plains developed societies that were dependent upon the bison. Their economies, social structure, politics and religions were based on bison. With the advent of Europeans, firearms, railroads and a demand for hides, the bison were hunted almost to extinction. Many of the native societies found it difficult to adapt to a system without bison. Whaling, fishing, hunting, agriculture based on single (or limited) crops are other examples of the difficulty that traditionally based economies have in adapting to change.

6.1.2 Command Economies

Eminent domain is the primary allocative mechanism used in a command economy. An economic system based on command requires an agent or organization with the authority to make allocation decisions. This authority may be based on religion, military strength, political position, birth or wealth.

Command economies often rely on traditions as part of the allocative process. This traditional process is subordinated to eminent domain. The Roman society is an example of a command economy. Fascist Germany, the former Soviet Union and Maoist China are other examples of attempts to use command. These economies are often thought of as "planned economies." During World War II many allied countries relied on command systems to coordinate the war effort.

In both traditional and market economies command may play a significant role. In modern, market economies there are regulations and laws that mandate particular actions, behavior, production techniques and/or characteristics of products.

A command economy requires an overall objective or goal for the governing body: individuals' goals become subordinate. Since command economies are often represented by nation states, these can be thought of as national goals. Some organizations act as small communities with organizational goals and use command and eminent domain as the primary allocative mechanism. During the medieval era, the Church and the secular state both operated as command economies that were interrelated. In the modern industrial world, the multinational corporation uses a command system internally: its decisions are made administratively. Goals may include:

- economic growth,
- full employment,
- industrialization,
- military strength,
- conquest,
- acquisition of specie (gold/ silver),
- land,
- political control
- religious conversions
- control over markets where they sell,
- control of resources,

- or any thing else that the governing authority chooses.

One of the important questions in a command economy how the overall objective is selected. It may be an administrative choice. The authority may simply select the objective. If this is the case, the intentions of the authority become crucial: are they benevolent or not? In some cases, it may be possible to have the objectives of the members of the community reflected in the overall objective. Market socialism in the former Yugoslavia is an example.

The task of the command system is to coordinate individual behavior with the national or organizational goal. A command system relies on administrative decisions that flow from the authority down. This requires that the decisions be communicated to the individuals and enforced. This may require a complex system of rules and institutions to communicate and create the appropriate incentives to act on that information.

The authority that is responsible for the administrative decisions that are imposed on the members of the organization or state, must have information about the goals, the members of the community, the availability of inputs, all potential technologies, all alternative outputs and potential distribution patterns. This is an enormous information requirement that was debated in the "socialist calculation debate."

One of the strengths of a command system is that it can alter its objectives quickly. In a wartime economy, it may be useful to be able to command the allocation of resources into the development and production of munitions and military hardware.

The weakness of a command system is that the authority would need an enormous amount of information about individuals' preferences and the production requirements of all goods and services. Command systems may also be flawed by the nature of the authority that may or may not be benevolent. Another major problem of a command system is the loss of individual autonomy.

6.1.3 Market

Market based economies depend on individual exchange contracts that occur in the context of a social contract. An exchange contract is based on *quid pro quo*, "*I will give you this if you give me that!*" The nature of the goods (include money) to be exchanged as well as the conditions and time is clearly specified. It is necessary that both parties engage in the contract or exchange voluntarily.

If the exchange is voluntary, the presumption is that a person would engage in the exchange if and only if they are better off or no worse off after the exchange. Therefore, a voluntary exchange results in Pareto improvements and ultimately a Pareto superior solution to the allocation problem.

Neoclassical microeconomics uses "supply and demand" as a representation of a market. The demand function represents the behavioral patterns of the buyers (both actual and potential) of a specific good. The supply function represents the behavior of actual and potential sellers (producers) of a good.

The strength of market system is that is capable of quickly adapting to changes in preferences and technology. The information required by any one agent is minimal. The weakness is that when exchanges are not voluntary or property rights are attenuated (weakened), outcomes may be less than optimal.

Neoclassical microeconomics tends to be a study of contracting and voluntary exchanges between individuals. The context in which these contracts occur is usually "the market." The structure of the markets is perceived to influence the behavior or the individuals who participate in voluntary exchanges or contracts.

In its most ideal form, the market is characterized as "pure competition." In pure competition, there are a large number of buyers and sellers, none of which can influence the price or the behavior of others: they can only contract to exchange goods (and money). The purely competitive market is characterized by goods that are homogeneous: i.e. buyers perceive these goods as identical or perfect substitutes. Buyers have no preference for one seller's good over another's. The exchange or contract is made on the basis of price. In this way, sellers compete for buyers by lowering the price to the minimum they will accept. Buyers compete to purchase by offering the highest price they are willing to pay. In a market such as this the equilibrium price: the price at which the last (or marginal) unit is exchanged will optimize the welfare of the buyers and sellers. In the least desirable market form, a seller has a monopoly where there is only one seller of a good. The effects of market structure on the behavior of buyers and sellers are an important topic in neoclassical microeconomics that is covered in Part II of this text.

The social context of economic behavior is often not made explicit. People perceive that individual exchange in competitive markets is the only consideration. This leads to the perception that the government and community have little or no role in economic activity. Many *laissez faire* advocates fail to recognize that economic behavior is a part of social behavior. Friedrich A. Hayek (1899-1992) is a well-known advocate of the market system. He identifies the social infrastructure that must exist to support individual market exchange. The following quotes are long because they are important and must be considered in the context of Hayek's ideas:

> *While it would be an exaggeration, it would not be altogether untrue to say that the interpretation of the fundamental principle of liberalism as absence of state activity rather than as a policy which deliberately adopts competition, the market, and prices as its ordering principle and uses the legal framework enforced by the state in order to make competition as effective and beneficial as possible-and to supplement it where, and only where, it cannot be made effective-is as much responsible for the decline of competition as the active support which governments have given directly and indirectly to the growth of monopoly. It is the first general thesis which we shall have to consider that competition can be made more effective and more beneficient by certain activities of government than it would be without them. With regard to some of these activities this has never been denied, although people speak sometimes as if they had forgotten about them. That a functioning market presupposes not only prevention of violence and fraud but the protection of certain rights, such as property, and the enforcement of contracts, is always taken for granted. Where the traditional discussion becomes so unsatisfactory is where it is suggested that, with the recognition of the principles of private property and freedom of contract, which indeed every liberal must recognize, all the issues were settled, as if the law of property and contract were given once and for all in its final and most appropriate form, i.e., in the form which will make the market economy work at its best. It is only after we have agreed on these principles that the real problems begin.* (Hayek, pp 110-111)

Hayek continues:

> *If I am not mistaken, the main headings under which the measures required to insure an effective competitive order ought to be considered are the law of property and contract, of corporations and associations, including, in particular, trade-unions, the problems of how to deal with those monopolies or quasi-monopolistic positions which would remain in a otherwise sensibly drawn-up framework, the problems of taxation, and th problems of international trade, particularly, in our time, of the relations between free and planned economies.*
>
> *As far as the great field of the law of property and contract are concerned, we must, as I have already emphasized, above all be aware of the error that the formulas of "private property" and "freedom of contract" solve our problems. They are not adequate answers because their meaning is ambiguous. Our problems begin when we ask what ought to be the contents of property rights, what contracts should be enforceable, and how contracts should be interpreted or, rather, what standard forms of contract should be read into the informal agreements of everyday transactions.* (Hayek, pp 112-113)

Adam Smith also saw a positive role for government. As implied in the quotes from Hayek, it is the content of the laws of property and contract that is crucial. It is important to identify the role of the state in structuring the allocative process that society depends upon.

6.1.4 Role of Government

One of the major controversies is the proper role of government (and the use of command) within a market based economic system. Many of the issues in this controversy are ideological in nature and result in the existence of different "schools of economic thought." The Chicago School and the Austrian School of economic thought argue that the role of government in the economy should be minimized. (Hayek taught at the University of Chicago and was an Austrian economist.) The American or "Old" Institutionalists and much of Neoclassical microeconomics (in the Cambridge tradition) sees a more positive or active role for government in many areas.

The French Physiocrats [led by Francios Quesnay, 1694-1774] advocated a minimal role for government. Jacques Claude Vincent de Gournay [1712-1759] is usually credited with the phrase *laissez faire, laissez-passer!* Some advocates of an extreme *laissez faire* doctrine argue that there is no or almost no role for government. Most argue for limited government action in the economy. Others, such as Adam Smith and F. A Hayek (above) see a positive role for social institutions and government participation. Adam Smith [1723-1790], who was familiar with the work of the Physiocrats, advocated a social system based on ethics, markets and jurisprudence with a minimal role for government.

There are many arguments about the proper role of government. Some of the arguments are based on ideology while other disagreements arise on pragmatic grounds. Here are several possible roles for government:

6.1.5 Property Rights

One of the functions of government is to define and protect property rights. John Locke [1632-1704] argues the social contract is for the purpose of protecting property rights. Such diverse writers as Adam Smith [1723-1790] and Karl Marx [1818-1883] argue that this is one of the primary functions of governments.

Property rights may also be defined and enforces by informal rules such as social institutions, civility, tradition, custom, mores and systems of ethics.

6.1.6 Domestic Justice

Adam Smith included the enforcement of property rights under the establishment of domestic justice when he defined the role government. Domestic justice is broader and includes "*protecting, as far as possible, every member of society from the injustice or oppression of every member of it*. . . " (Smith, *Wealth of Nations*, p 669)

6.1.7 National Defense

While leaders and policy makers may argue about the level and nature of national defense, there are few who would argue that there is no reason for the state to provide protection from attack by other nations. The debate takes the form of the nature and extent of that national defense. National defense is one of the best examples of a public or collective good. In the case of a public good, it is impossible to exclude a person from the consumption of the good and the marginal cost of an additional user is zero. In these conditions, the state often provides the good.

6.1.8 Provision of collective or public goods

Public goods are those goods whose property rights are not exclusive: it is not possible to exclude anyone from their use and the additional cost (marginal cost) of an additional user is zero. National defense is a case of a public good. If a baby is born in the country, it is not necessary to increase national defense. Clean air is another example of a public good.

Adam Smith included other public goods in this category. He referred to them as public institutions and public works. In the terminology of modern economics, these goods are often called quasi-public goods: the marginal cost of additional uses may be zero, but it is possible to exclude users. Roads, bridges, canals, navigational devices and the like could be paid for by tolls or financed by government.

Smith includes education in this category of activities. He discusses specifically education of youth. He also says:

> *"In the progress of the division of labor, the employment of the far greater part of those who live by labor, that is, of the great body of the people, comes to be confined to a few very simple operations, frequently one or two/ But the understandings of the greater part of men [sic] are necessarily formed by their ordinary employments. The man whose whole life is spent in performing a few simple operations, of which, the effects too are, perhaps, always the same, or very nearly the same, has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to*

become." (Smith, Wealth of Nations, p 734)

Smith continues on the next page:

> *"But in every improved and civilized society this is the state into which the labouring poor, that is the great body of the people, must necessarily fall, unless the government takes some pains to prevent it."*

The role of government in the provision of education and arts for individuals in society is controversial. Currently, there are a variety of debates ranging from voucher systems to the appropriate level of funding for English as a second language and special education.

6.1.9 Promote Competition

The models of purely competitive markets show that the behavior of the individual sellers (and buyers) will be consistent with social welfare in the long run. When there are impediments to competition, the prices are distorted and incorrect signals encourage behavior that is less than socially optimal. As a result, governments often try to regulate the behavior or to promote competition. Most industrial nations have laws that make monopolization of markets, price fixing, collusion, tying contracts and other anti-competitive practices illegal. The Sherman Antitrust Act of 1890, the Clayton Act of 1914 and the Robinson-Patman Act of 1936 are examples.

Information is important to any allocative system. It is necessary for agents in a market exchange to have information to value goods and negotiate contracts. Most societies see that one of the roles of government (if not a moral system) is to prevent fraud, deceit, and other methods of distorting information provided by buyers and sellers. The Securities Exchange Commission attempts to regulate financial information provided to the financial markets, insider trading is illegal, there are truth in advertising laws and agencies that regulate the content and quality of goods (food, drugs, etc.).

The development of policy and law in these areas is often controversial and vested interests attempt to manipulate the regulations in their favor. (Remember George Stigler's capture theory of regulation.)

6.1.10 Safety Net

Most civilized societies try to provide a safety net for individuals who are unable to care for themselves. There are many disagreements about the criteria to be used to decide which people should be included in this group.

6.2 Property Rights

The concept of property rights is essential to any economic system. The analysis of property rights is complicated by several factors.

First is the fact that when the term "property rights" is used, the listener usually subconsciously inserts the word "private." In addition to private property, rights there are also public property rights and common property rights. Private property rights, in theory should apply to individuals but often private property rights is applied to publicly chartered organizations.

Second, property rights can be justified by "natural rights" or by logic and pragmatism. John Locke [1632-1704], a natural law philosopher argues that humans have a natural right to the ownership of private property. This natural right to property stems from the fact that the individual has a right to their own labor and therefore a property right to the fruits of that labor when mixed with un-owned resources. Labor is the justification for property. Locke places two limitations on this right. He argues that the individual has a right to acquire property so long as nothing is wasted and there are sufficient resources left for others. (Locke, pp 115-126) The emotional context of property rights associated with the natural rights approach that also complicates the discussion and analysis of the structure of property rights in a social system.

A pragmatic justification of property rights is based on defining property rights to achieve an objective. That objective could be an optimal allocation or to maximize the monetary value of assets. Property rights justified on natural rights tends to be static while pragmatism tends to justify property rights that evolve to meet the needs of changing circumstances (population, technology, environment, etc.). Hayek, a market oriented economist, seems to focus on a pragmatic approach to property rights:

> *Where the law of property is concerned, it is not difficult to see that the simple rules which are adequate to ordinary mobile "things" or "chattel" are not suitable for indefinite extension. We need only turn to the problems which arise in connection with land, particularly with regard to urban land in modern large towns, in order to realize that a conception of property which is based on the assumption that the use of a particular item of property affects only the interests of its owner breaks down. . . . .*
>
> *The problem of the prevention of monopoly and the preservation of competition is raised much more acutely in certain other fields to which the concept of property has been extended only in recent times. I am thinking here of the extension of property to such rights and privileges as patents for inventions, copyright, trademarks, and the like. It seems to me beyond doubt that in these fields a slavish application of the concept of property as it has been developed of material thins has done a great deal to foster the growth of monopoly and that here drastic reforms may be required if competition is to be made to work.* (Hayek, pp113-114) . . .
>
> *It seems to me that, in general, the freedom of the individual by no means need to be extended to give all these freedoms to organized groups of individuals, and even that it may on occasion be the duty of governments to protect the individual against organized groups. It appears to me also as if historically in the field of the law of corporations we had a situation rather analogous to that in the field of the law of property to which I have already referred As in the law of property the rules developed for ordinary mobile property were extended uncritically and without appropriate modifications to all sorts of new rights: and thus the recognition of corporations as fictitious or legal person has had the effect that all the rights of a natural person were automatically extended to corporations.* (Hayek, p 116)

Hayek is quoted at length because he is a market-oriented economist who recognized that property rights must evolve with changes in the economy and technology. He also recognizes that the form the property rights laws take is crucial to the operation of a market system.

6.2.1 Property Rights And Markets

The operation markets and market exchange is facilitated by strong or "nonattenuated" property rights. The benefits and costs of exchange and use of resources and goods affect only the parties to the exchange. The welfare of individuals who are not engaged in the transaction or use of economic goods is not altered.

Furubotn and Pejovich define property rights as:

> *Property rights are understood as sanctioned behavioral relations among men [sic] that arise from the existence of goods and pertain to their use. These relations specify the norms of behavior with respect to goods that each and every person must observe in his daily interactions with other persons, or bear the cost of non-observance. The term "good" is used here for anything that yields utility or satisfaction to a person. Thus, and this point is important, the concept of property rights in the context of the new approach applies to all scarce goods. The concept encompasses both the rights over material things (to sell my typewriter) as well as 'human' rights (the right to vote, publish etcetera). The prevailing system of property rights in the community is, then, the sum of economic and social relations with respect to scarce resources in which individuals stand to each other.* (Furubotn, p 3)

These "sanctioned behavioral relations" include both the formal sanction of legal systems and informal sanctions of social institutions. A sense of community, social values, religion, politeness and respect for others are probably more efficient ways to enforce property rights than the enforcement of laws by the state. Property rights may be "private" property rights or "public" property rights.

Strong or non-attenuated property rights that facilitate the effective use of market exchange have three basic characteristics:

- Exclusivity
- Enforceability
- Transferability

EXCLUSIVITY

It is impossible for the property rights to any good or resource to be completely exclusive. However, the greater the exclusivity the more likely market exchanges will produce improvements to the welfare of society. An exclusive property right is one where all the benefits and cost associated with a choice fall on the person(s) making the choice. If Nigel drinks a cup of tea, the costs and benefits of that act fall (for the most part) on Nigel. A case of nonexclusive property rights occurs when Harold smokes a cigar in church. The smoke may impose significant costs on other members of the congregation. It might be possible that Aunt Mabel and others in the congregation could contract (or pay) with Harold not to smoke. If a voluntary contract is made, Harold is better off because he prefers the payment to smoking. Aunt Mabel and the congregation are better off because they were willing to pay Harold not to smoke. This assumes that Harold had a property right to smoke. An alternative view is to ban smoking in the church by assigning the property rights to smoke free air to Aunt Mabel and the others. If Harold wanted to smoke, he would have to contract with the congregation for the right to do so.

EXTERNALITY

The failure of exclusive property rights results in three problems in the market. First is the problem of "externalities." The example of second hand smoke in the previous paragraph is an example. Pollution from a steel mill or odor from a pig farm are other examples. A negative externality results in "too much" or over use of a resource or good since the marginal costs to society exceed the marginal cost to the economic agent who makes the decision. The Environmental Protection Agency was created to deal with many of the problems of negative externalities.

Externalities may also be positive. The marginal benefits to society are greater than the marginal benefits to the decision maker or economic agents engaged in an exchange. If I landscape my front lawn, it may increase the property values of my neighbor. The benefits to my neighbor are not taken into account by my decision. In general, the market signals an under utilization of goods and resources that have positive externalities

PUBLIC GOODS

A second problem is that of "public goods." A public good is one in which the marginal cost of an additional user is zero and it is impossible to exclude anyone from its use. National defense is often used as an example of a public good. There are other goods like roads, bridges, etc. that may be treated as public goods even though it is possible to exclude users. These are sometimes referred to as "quasi-public goods.

COMMON PROPERTY RESOURCES

The third property rights problem is "common property resources." A common property resource is one where users are not excluded but the marginal cost of users is positive. Garret Hardin's 1968 article, "Tragedy of the Commons" argues that common property tends to be overuse and can be driven to extinction. Passenger pigeons, whales, American bison, and fisheries are often cited as common property resources. The property rights for these common property resources are not clearly defined and are "fugitive" resources: whoever captures the resource has ownership rights. It is in the interests of the economic agents to capture as much as possible as quickly as possible. The result is the market signals an overuse of the resource. Treaties and government regulation may be used to establish property rights that will result in a more economic use of the resource. International treaty protects whales. State fish and game departments may sell license and regulate the capture of game.

Externalities, public goods and common property resources are fodder for debates between pro and anti market advocates. The economics of non-exclusive property rights will be covered in more detail in later chapters.

ENFORCEABILITY

The establishment of property rights is fundamental to society. Social institutions and a sense of community (with a respect for others) establish the nature of property rights. John Locke, Adam Smith Karl Marx and many other writers have argued that one of the functions of government (or the "state") is to define and enforce property rights. In a world of chattel and real property, property rights can be defined and enforced. In a world of intellectual property rights, computers, copy machines and all manner of devices to copy and transmit intellectual property with 0's and 1's, the enforcement of property rights is more problematic. As the society has shifted to greater emphasis of an "information" economy, intellectual property has become more important. Music, computer software, books, and knowledge of how to do things has made the enforcement of property rights and market exchanges difficult in many cases. The development of technology to electronically copy and transmit information has increased the problems of enforcing property rights to that information.

Copyright and patent laws are examples of attempts to define and enforce property rights. Pharmaceuticals, DNA and knowledge are often the source of legal action. As the technology to develop, copy and transmit information improves, the enforcement of intellectual property rights will become more difficult and expensive to enforce. Many interesting economics questions will accompany these changes.

TRANSFERABILITY

In many cases, it is technically impossible to transfer property rights. The property rights to a person's height or athletic skill cannot be transferred. I cannot become a professional basketball player by purchasing a player's height or skill. I might hire some one to coach me but there is no way to transfer property rights to height and skill. However, with the "advances" in science it may be possible to genetically modify a fetus with DNA from a person who has some physical characteristic that is desired.

Often society will choose to prevent the transfer of property rights by making an exchange illegal. Buying and selling children is technically possible but societies usually choose to make it illegal. The Organ Transplantation Act of 1984 is another example. While it is technically feasible to transplant organs (heart, kidney, lung, pancreas, liver, etc.), the law makes it illegal to sell an organ for transplantation. However, it is now possible to travel to other countries to "buy" a kidney. There is some evidence that a black market (or illegal market) has been developing. There are also advocates of creating a market for transplantable organs.

6.2.2 Issues In Property Rights

Technological change and structural changes in the modern economy pose great challenges for society and the evolution of property rights. Conventional thought holds that the industrial economies are undergoing a structural change. There is a shift from manufacturing to information and services. This shift has implications for the way in which property rights are assigned. As Hayek has pointed out, property rights cannot be static: the property rights that apply to chattel property of individuals may not apply equally well to intellectual property. Property rights that work for individuals may not work for organizations such as corporations. The nature of property rights is a major concern for modern society.

Private property rights have long been seen as an important incentive for good stewardship. If chattel or land is "mine" I am more likely to use it wisely. This perspective is based on property rights that are exclusive and enforceable. A version of this view has been extended to intellectual property rights. If the property rights to ideas, inventions, patents, trademarks, copyrights are held privately, the owners will use them to the greatest advantage. These property rights also insure that individuals with have a strong incentive to create new ideas and inventions.

At the same time, all new ideas and inventions are founded on prior knowledge. The material in this text is a conglomeration of ideas that have been debated for as long as humans have communicated. There is little new material presented here. It consists of old ideas that have been restructured and combined with other ideas in new ways. Academic tradition and law provides for the use of these ideas. If authors do o appropriately cite sources of ideas, they are guilty of plagiarism. However, it is impossible to know the origins of all ideas that authors use.

The evolution and creation of knowledge and technology depends on the availability knowledge from the past. If intellectual property rights are not flexible enough that the existing ideas and knowledge cannot be used to create new knowledge, progress and economic growth are impeded. Lawrence Lessig argues that property rights must be balanced between provision of incentives and to allow others to use intellectual property to extend knowledge. Culture and knowledge progresses by building on the past:

> *Creators here and everywhere are always and at all times building upon the creativity that went before and that surrounds them now. That building is always and everywhere at least partially done without permission and without compensating the original creator. No society, free or controlled, has ever demanded that every use be paid for or that permission for Walt Disney creativity must always be sought. Instead, every society has left a certain bit of its culture free for the taking—free societies more fully than unfree, perhaps, but all societies to some degree.* (Lessig, *Free Culture*, p 29)

The questions become:

- What form should intellectual property rights take if creativity is to be promoted?
- How can property rights be structured to provide incentives for creators to continue to develop new ideas?

> *A free culture is not a culture without property: it is not a culture in which artists don't get paid. A culture without property, or in which creators can't get paid, is anarchy, not freedom. Anarchy is not what I advance here. Instead, the free culture that I defend in this book is a balance between anarchy and control. A free culture, like a free market, is filled with property. It is filled with rules of property and contract that get enforced by the state. But just as a free market is perverted if its property becomes feudal, so too can a free culture be queered by extremism in the property rights that define it.* (Lessig, *Free Culture*, p xvi)

> *There is a history of just such a property system that is well known in the Anglo-American tradition. It is called "feudalism." Under feudalism, not only was property held by a relatively small number of individuals and entities. And not only were the rights that ran with that property powerful and extensive. But the feudal system had a strong interest in assuring that property holders within that system not weaken feudalism by liberating people or property within their control to the free market. Feudalism depended upon maximum control and concentration. It fought any freedom that might interfere with that control. As Peter Drahos and John Braithwaite relate, this is precisely the choice we are now making about intellectual property. We will have an information society. That much is certain. Our only choice now is whether that information society will be* free *or* feudal. *The trend is toward the feudal.* (Lessig, *Free Culture*, p 267)

As changes in technology pushes us into the age of information, the question of property rights will become more difficult.

7 Economic Way of Thinking

7.1 Market Exchange as an Allocative Mechanism

Exchange is a voluntary transaction between two or more persons. The conditions of the transfer are clearly specified. It is a ***quid pro quo*** arrangement. Market exchange is a contract or agreement between the parties to the transaction. These agreements or contracts may be implied or explicit, formal or informal. There is no need for one party of the exchange to know the other. Each party only needs to know the terms of the exchange and that the other party will fulfill the agreement. There is no need for any relationship between the parties other than the exchange. In many ways anonymity of the parties to the exchange may make the exchange less complicated. Often it is more difficulty to sell your used car to a relative or friend than to a stranger. In other cases some of the features of reciprocity and redistribution may facilitate or improve the process of market exchange. In the diamond trade in New York City or on the farm in Iowa, participants may know and trust each other to meet the conditions of the market exchange. This reduces the effort or transaction cost of negotiating the agreement. In other cases redistribution by an authority may facilitate market exchange. An individual who fails to comply with the terms of the contract or exchange may by sued in a system of courts that has the authority to enforce the exchange.

A major advantage of market exchange as an allocative mechanism is that once you have found others to contract or exchange with, each actor only needs information about their own preferences and what they are willing and able to do. It is not necessary that all information be available in a central location or to a planner. It may be useful to think of a market as a communication system. The preferences and feasible alternatives available to each agent or individual are communicated through the market. Relative prices and quantities are pieces of information that may be used by the actors. The buyer of a good demonstrates that they prefer the good they purchase to the money or the other things that an equal amount of money would buy. Similarly, the seller demonstrates a preference for the money (or what it will buy) to the good they sold. A good sold for a price of €5 is valued at or is "worth" at least €5 to the buyer or the buyer would not have purchased the good. Risk and uncertainty are a part of virtually all human choices. While an individual may think they will receive some level of benefit or utility from a purchase, they may fail to do so.

A second advantage attributed to the market is that it is flexible and provides information and incentive to encourage agents to adapt quickly to changes in technology, supplies of inputs and environmental conditions. In order for individuals and society to benefit from market exchange, there are two fundamental conditions that must hold. One is that exchanges must be voluntary. The other is that property rights must be "nonattenuated."

7.1.1 Voluntary Exchange

In neoclassical economics, the objective of an economy is to increase the welfare or utility of the individuals who make up the society. One of the basic concepts described in Chapter I Introduction was "Pareto Efficiency or Pareto Optimality." To review, remember that a Pareto efficient or optimal solution to the allocation problem exists when all the alternatives that will improve the welfare (utility) of a least one person, without making anyone else "worse off" have be exhausted. Any alternative that will improve the welfare or utility of at least one person without decreasing the welfare or utility of another person would increase the welfare of society. This improvement is called a Pareto improvement and the result is said to be Pareto superior to the initial alternative.

Generally, a person would enter into a voluntary exchange if they can improve their welfare or increase their utility. It is assumed that an individual who voluntarily enters into an exchange would not make himself or herself "worse off." Therefore, any voluntary exchange will increase the welfare of one or both parties and neither will be any worse off.

Jeremy Bentham [1748-1832] attempted to make "utilitarianism" the operative mechanism to improve the welfare of society. He and many of his followers attempted to find a way to quantify utility and use it for decision-making. Bentham proposed a felicific calculus to make be used. However, it is not possible to make interpersonal comparisons of utility, i.e. if each of 100 persons is given one Euro (€) each there is no reason to believe that they would all get the same utility. Nor is it possible to assume that the utility or welfare of the group would be maximized by that distribution.

Consider a distribution where every member of society is given 1 case of cola and 1 box of tea bags. Since individuals do not have the same preference for cola and tea, there is no guarantee this equal distribution of cola and tea would maximize the utility or welfare of the group. Information on the preferences of all individuals is not held in one central place, utility cannot be measured and summed, so it is impossible to redistribute cola and tea by eminent domain and insure an increase in total utility. Voluntary exchange is believed to increase the utility of the members of society. Individuals who prefer cola to tea should trade (or exchange) cola for tea with those individuals who prefer tea to cola. The utility of all individuals, whether they prefer tea or cola would increase (or at least not go down). The parties to the exchanges must have information about their own preferences and who the others are that are willing to trade. It would be helpful to have information about the preferences of others before one offers to trade. If I knew you liked tea did not like cola, I would offer to trade a small amount of tea for a large amount of cola. It would be to your advantage that I not know your true preferences. Information is valuable. You might try to convince me that you liked cola to get a "better deal." This is called "haggling or bargaining." The negotiations for a contract often include the process of discovering the preferences and the maximum amount the other person will trade for a good, i.e. "the best deal." As trades are negotiated among the members of a society, information about these transactions becomes valuable. If you wish to buy or sell a used car you may consult the Kelly Blue Book or Edmunds to find out the average prices that other exchanges. Providing false information may be regarded as fraud or deceit. In communities where others often know one another, one's reputation is often based on "honest" dealings. In more complex societies, law and legal suits may be used to prosecute fraud and deception.

The maximum price the buyer is willing and able to pay for a good is called the "reservation price of the buyer (RPB)" and the minimum price the seller will accept for the good is the "reservation price of the seller (RPS)." So long as the RPB is greater than the RPS, a trade can take place. If the RPS is greater than the RSB, no trade will occur. Neither the buyer nor seller wants the other party to know their reservation price. Haggling is the process by which a mutually agreeable price can be determined. The price at which the exchange will occur will be greater than the RPS and lower than the RPB (RPS>P>RPB). In the case of a single transaction, the price will be closer to the reservation price of the seller or buyer with the most information and the greatest skills in negotiation. The degree to which individuals adhere to a pure quid pro quo and consequentialist ethic may give individuals an advantage over individuals who are constrained by a deontological ethic.

Over time an expected pattern of trade emerges. A given amount of cola is expected to trade for a specific number of tea bags. The ratio at which cola and tea trade can be called the exchange ratio. The exchange ratio is the price of one good in terms of another. This exchange ratio is determined by the preferences of the individuals, the relative amount and distribution of cola and tea. If it is established that on average, 1 cola trades for 5 tea bags, individuals who do not like cola will be willing to accept cola on trade because they know its will trade for tea. If 1 cola (1c) trades for 5 tea bags (5t), money can be used to facilitate the exchanges. The use of money results in monetary prices rather than prices in terms of other goods. The monetary price of cola will be labeled, P_C, the price of tea P_t. The relative prices of cola and tea are established by the exchange ratio. If one cola will trade for 5 tea bags,

$$1c = 5t,$$
$$\text{if } P_c = \$1 \text{ implies } P_t = \$.20$$
$$\text{if } P_t = \$1 \text{ implies } P_c = \$5$$

In microeconomics it is the relative prices that are important. If the exchange ratio is 1c = 5t, the "correct" set of prices can be either

P_c = \$1 and P_t = \$.20
or
P_c = \$5 and P_t = \$1

Any voluntary exchange reflects the preferences of the parties to the exchange. If Joan buys a cola for €1, she must prefer the cola to €1 or she would have kept her money. If John sells Joan a cola for €1, he must prefer the €1 to the cola or he would have kept the cola. Therefore if Joan voluntarily buys a cola from John (who voluntarily sells it) they are both "better off" or have increased their utility.

The problem arises as to what is meant by "voluntary." Some actions, such as "duress" clearly violate the concept of voluntary. Any contract concluded under duress is unenforceable in most countries. Contracts or exchanges with minors are also unenforceable. If Joan holds a gun to John's head to force him to sell the cola, that would clearly be duress or coercion and violate the conditions of voluntary exchange. If the instructor of a class suggests you buy his or her book, is that coercion? If your mother says, "You go ahead and do what you want to do but it will break my heart!" Is that coercion? "Voluntary" exchange is often a matter of degree. Often the only "voluntary" choice open to an individual in a pure market is to "exit." The person may choose to participate or not.

7.1.2 Economic Way of Thinking

Economic theory provides a "map" or structure to aid in the interpretation of economic data or information. The nature of the map (economic theory) determines the nature of the questions asked. Joan Robinson's [1903-1983] comment was, "If you don't ask the right question, you won't get the right answer."

*N*eoclassical microeconomics is based on the belief that individuals are rational and that they attempt to optimize.

7.1.2.1 Individuals are rational

1. objectives are known
2. all feasible alternatives are known
3. each alternative is evaluated with respect to the objective

7.1.2.2 Benefit - cost format [Pareto efficiency/potential]

Most of economic theory is based on individuals making "optimal choices." Objectives or goals are usually based on the maximization or minimization of some variable, i.e. the maximization of utility, output or profit or the minimization of cost per unit.

Benefit/cost analysis is a basic approach that is used. If the benefits associated with a choice (alternative) exceed the costs incurred with the choice, there is an increase in net benefits. If the costs exceed the benefits of a choice, it will not increase net benefits. Notice that it is the cost and benefit associated with a choice. This requires "marginal analysis." B/C analysis is a variation of the Pareto Potential criterion.

7.1.2.3 Marginal Analysis

Decisions in economics are always made at the "margin." A decision to change one variable will cause a change in some other related variable. A change in the price of a good will change the quantity sold, a change in the quantity sold will change the total revenue collected. The change in total revenue caused by a change in units sold is called marginal revenue. The marginal concept is applied to a wide variety of relationships. In principles of economics these are usually described as a "one unit" change in the variables. The Greek letter delta, Δ is used to identify a change calculated by subtraction. In other cases a derivative (d) or partial derivative (∂) will be used to denote a change that approaches 0.

The use of marginal is applied to many economic relationships. In fact, the early period of the development of microeconomics (mid to late 19th century) was called the "*marginalist revolution*." Below are some definitions of several useful marginal relationships.

1. Marginal Cost (MC)

   MC is defined as the change in Total Cost (TC) or variable cost (VC) caused by a one unit change in the quantity produced, output (Q). MC represents opportunity cost.

$$MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta VC}{\Delta Q}$$

2. Marginal Benefit (MB)

   MB is defined as the change in total benefit (TB) caused by a one unit change in quantity consumed (Q).

$$MB = \frac{\Delta TB}{\Delta Q}$$

3. Marginal Utility (MU)

   MU is the change in utility caused by a change in quantity consumed (Q)

$$MU = \frac{\Delta TU}{\Delta Q}$$

4. Marginal Revenue (MR)

   MR is the change in Total Revenue (TR) caused by a one unit change in the quantity sold (Q).

$$MR = \frac{\Delta TR}{\Delta Q}$$

5. Marginal Product (MP)

The marginal product is the change in output (Q) caused by a change in a variable input (L or K).

$$MP_L = \frac{\Delta Q}{\Delta L}, \quad MP_K = \frac{\Delta Q}{\Delta K}$$

7.1.2.4 Marginal Analysis and Objectives

1. To maximize utility

So long as the MU > MC, consume the next unit. If MU<MC reduce the level of consumption. Where MU=MC maximum utility is attained.

If there are two or more goods that have a price (or cost), the process of utility maximization requires that each additional expenditure be made on the good that has the highest marginal utility. To maximize utility with several goods that have economic prices, the "equimarginal principle," is used.

$$\frac{\mathrm{MU}_X}{P_X} = \frac{\mathrm{MU}_Y}{P_Y} = \ldots = \frac{\mathrm{MU}_N}{P_N}$$

$$\text{Subject to } B \geq P_X Q_X + P_Y Q_Y + \ldots + P_N Q_N$$

$$\text{When } P_i = \text{price of good } i \text{ , } B = \text{budget, } Q_i = \text{Quantity of good } i$$

2. To maximize profit (Π)

So long as the next unit of output can be produced at a cost that is less than it can be sold for, do it!

When MR >MC, produce

When MR <MC reduce output,

Maximum profits when MR = MC

3. Maximum welfare of buyers and sellers

The market is a social institution that provides information to guide the allocation process in a society. Buyers should purchase additional units of a good so long as the MB > P.

The producers (sellers) of a good should continue to produced and sell more of a good so long as the P > MC.

The welfare of buyers and sellers will be maximized when

MB = P = MC

7.1.2.5 Appendix I: Schools of Economic Thought

Human behavior can be viewed from many different perspectives. Sociology, political science, psychology, anthropology, history, and economics are just a few of the basic approaches to the study of the individuals and society. Within each of these disciplines there are differences in perspectives. In economics, there are "schools of thought" that have alternative approaches to the analysis of economic processes. These schools of thought may ask different questions and use different methods in their attempts to answer them.

Within microeconomics the mainstream view is "Neoclassical economics" which is the topic of this outline. Other approaches include, Austrians, "Old" Institutionalists, "New" Institutionalists, Walrasians, Marxists, Public Choice theorists, law and economics, Chicago, Keynesian and social economics. Some of these schools focus on macroeconomics while others are primarily deal with microeconomic issues. While many of these schools have different approaches, there is often overlap. It is useful to know a little about some of these alternative approaches to understand how mainstream economics has developed and which aspects of Neoclassical economics might be subject to criticism and how it may be adapted.

George Stigler (1911-1991), described a school of economic thought,

> *A school within a science is a collection of affiliated scientists who display a considerably higher degree of agreement up on a particular set of views than the science as a whole displays. It is essential to a school that there be many scientists outside it, or the school would have no one with whom to argue. Schools have received little study, and the following remarks are only casual impressions.*
>
> *A school must have a leader, because of the consensus of its members will normally be achieved and maintained by major scientific entrepreneurs. …*
>
> *If the school is united on methodology rather than substantive doctrines, its life will be longer, but also less influential….*
>
> *A school may be based on policy views rather than upon economic analysis or scientific method….* [Stigler, *The Economist as Preacher*, Basil Blackwell, Oxford, 1982, p116]

7.1.2.6 Microeconomic Schools of Economic Thought

Economics, as an identifiable discipline, began with the Physiocrats. The Physiocrats, led by François Quesnay (1694-1774), emphasized a natural order and coined the phrase "*Laissez faire, laissez passer*." They were strong advocates of free trade. Quesnay recognized the idea of a flow or circular flow of goods and money in the *tableau*. The Physiocrats were concerned with the relationship of the individual to society. They believed that free trade with minimal intervention by the state would allow a state of harmony to exist. They were reacting against the nationalistic policies of an economic policy called "Colbertism." Colbertism was a set of mercantilist policies that emphasized national power that could be enhanced by strong regulation of economic activities.

7.1.2.6.1 (1) Classical Economics

Adam Smith [1723-1791] knew some of the Physiocrats and used many of their ideas in the development of what was to become Classical economics. Smith's ideas are to be found in *The Theory of Moral Sentiments* (1759), *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776), and

Lectures on Jurisprudence (Lectures 1762-63 and 1766). Smith believed that social harmony would be the result of a system of morality, free markets and a set of laws. His primary concern was economic growth that was the result of specialization and the division of labor. Much of Classical economics was macroeconomics in its concern about economic growth and the division of income among the various factors of production (land, labor, and capital. Entrepreneurial ability as a factor was identified by Richard Cantillon [1680-1734] and popularized by J.B. Say [1767-1832])

Self-interested behavior within free markets, constrained by morality and law were the basis of the Smithian system. The *Wealth of Nations* provided the foundations for the Classical school of economics. Some members (such as David Ricardo and J.B. Say) of the school argued for free trade based on comparative advantage. Others (such as Thomas Malthus) argued for trade restrictions in the form of the "corn laws." The corn laws had the effect of restricting the importation of grains. These restrictions reduced the supply and increased the price of grains used as food. From a microeconomic perspective, this changes the relative prices of goods. From a macroeconomic perspective, the functional distribution of income and economic growth are altered.

The Classical economists tended to focus on the functional distribution of income (The functional distribution refers to the distribution of income to the factors of production, land, labor and capital. These were aligned with social classes.), economic growth (or stagnation in a stationary state), and social harmony. Smith saw the division of labor, increase in population and the accumulation of capital as the forces that promoted economic growth. Ricardo, Malthus, Mill and other classical economists believed that decreasing returns in agriculture and population growth would result in a stationary state.

Smith (as well as Ricardo and most Classical Economists) noted that there was a "value in use" and a "value in exchange." Consistent with the Classical focus on the use of markets as the primary allocative mechanism, value in exchange was considered as the topic of economic analysis. Generally, their approach began with a labor theory of value. Smith argued that

> *"The real price of every thing, what every thing really costs to the man who wants to acquire it, is the toil and trouble of acquiring it."* [Smith, WN, page 30]

Smith and Ricardo were aware that utility was an necessary prerequisite for a good to be exchanged, but believed that the costs of production determined value. A cost of production theory of value is a broader approach that was ultimately accepted by Smith.

Jeremy Bentham [1748-1832] is credited with contributing the foundation of "utilitarianism" to economics. Bentham presumed that human behavior was rational and was directed by "felicific calculus," an evaluation of the pains and pleasures associated with each choice. In Bentham's words:

> *"Nature has placed mankind under the governance of two sovereign masters, pain and pleasure. It is for them alone to point out what we ought to do, as well as to determine what we shall do. On the one hand the standard of right and wrong, on the other the chain of causes and effects are fastened to their throne. They govern us in all we do, in all we say, in all we think: every effort we make to throw off our subjection, will serve but to demonstrate and confirm it. In words a man may pretend to abjure their empire: but in reality he will remain subject to it all the while. The principle of utility recognizes this subjection, and assumes it for the foundation of that system, the object of which is to rear the fabric of felicity by the hands of reason and law. . .*
>
> *By the principle of utility is meant that principle which approves or disapproves of every action whatsoever: and therefore, not only of every action of a private individual, but of every measurement of government.*
>
> *By utility is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness. . .or. . . to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered: if that party be the community in general, then the happiness of the community: if a particular individual, then the happiness of that individual.*

The community is a fictitious body, composed of the individual persons who are considered as constituting as it were its members. The interest of the community then is, what? -- the sum of the interests of the several members who compose it.

It is vain to talk of the interest of the community, without understanding what is the interest of the individual. A thing is said to promote the interest . . . of an individual, when it tends to add to the sum total of his pleasures: or, what comes to the same thing, to diminish the sum total of his pains.

Bentham offered utility as an alternative explanation for value.

John Stuart Mill [1806-1873] can be regarded as a transitionary writer: he connects the Classical economists and Utilitarianism to the development of market-oriented microeconomics. Mill was an admirer and proponent of both Bentham and David Ricardo. Much of Mill's work seems to be an effort to integrate Ricardian economics with Utilitarianism.

The classical school of economics tended to advocate markets as the primary allocative mechanism. They followed the concept of natural liberty and are associated with the concept of "classical liberalism."

7.1.2.6.2 (2) Marxist

Karl Marx [1818-1893] was a critic of the capitalist system and of most of the classical economists who justified the market system. Marx built on the labor theory of value as expressed by David Ricardo. Marx's critique of capitalism can be found in a variety of his books and articles but perhaps the *Economic and Philosophical Manuscripts* [1844] and *Das Kapital* [1867, 1885,1894] are the best sources. Marx used "dialectical materialism' to build a system to explain the historical process. His focus was on struggles between the workers (proletariat) and the capitalists (bourgeoisie). He believed that the surplus created by the workers would be appropriated by the capitalists because they owned the means of production. This is what is meant by "exploitation. In the attempts to capture the surplus the capitalists would increase the amount of capital per worker and the rate of exploitation. As more and more capital was added, capital became less productive and generated less profit. The problem was a falling rate of profit that increased the unemployed and reduced the number of "petty bourgeoisie." Ultimately the capitalist system would fail due to contradictions within the system.

Marx believed that the "modes of production" (the technical way that society produced the material requisites) determined the structure of society. However, there was a lag between changes in the modes of production and the social structure.

7.1.2.6.3 (3) Marginalist Revolution

A combination of forces encouraged the application of mathematics (particularly calculus) to the analysis of economic behavior. Bentham's utilitarianism and classical economics coupled with the ideology and politics that accompanied the development of the industrial revolution brought about new perspectives and new problems. In seeking to explain relative prices, a utility theory of value emerges. The rate of change in total utility associated with a change in consumption (marginal utility) becomes the basis of value.

Johann Heinrich von Thünen [1783-1850, German] was one of the early writers who began to apply mathematical methods in the economics of location theory and wages. Hermann Heinrich Gossen [1810-1858] clearly stated the principle of diminishing marginal utility and the equimarginal principle by 1854. Gossen's approach was utilitarian and argued that value was primarily linked to subjective judgments about utility rather than the costs of production.

A group of French engineers, developing criteria for making choices about roads, bridges and canals were influenced by both mathematics and the Physiocrats. Jules Dupuit [1804-1866, French], along with colleagues, had worked out the importance of marginal benefits and marginal costs in making decisions. Augustin Cournot [1801-1877, French], a French mathematician, independently developed the use of marginal analysis in determining the behavior of firms who were competing in a market. The French engineers were quite advanced in the development of their analysis. [Eklund and Hébert, *Secret Origins of Modern Microeconomics*, University of Chicago Press, 1999] While the French probably developed marginal analysis before others, their work was not translated until later.

William Stanley Jevons [1835-1882, English] and Carl Menger (1840-1921, Austrian) and Léon Walras [1834-1910, French] independently developed concepts of marginal utility to explain value and behavior.

The differences among the French, English and Austrian economists are subtle but important. The French were attempting to use economic theory to evaluate choices at a public or social level. The English and the Austrians focused on individual choice.

7.1.2.6.4 (4) Neoclassical Economics

Neoclassical economics grew out of Classical Economics and the Marginalist Revolution. Alfred Marshall (1842-1924, English Economist), Léon Walras (1834-1910, French/Swiss) and Vilfredo Pareto (1848-1923, Itallian/French/Swiss) were among the writers who were instrumental in the development of Neoclassical economics in the basic form that persists.

Alfred Marshall is best known for his use of partial equilibrium that requires the concept of *ceteris paribus*. His focus is on individual and firm behavior in markets. Léon Walras developed the concept of general equilibrium that includes the interdependence of all markets. Marshall synthesized the cost of production theory of value of the classical school with the marginal utility of the marginalists. The cost of production theory of value suggests that supply determines price. The marginal utility approach attributes value to subjective choices and holds that price is determined by utility. Marshall argued that supply and demand interact to determine price. He used the metaphor of a pair of scissors to emphasize his argument.

> *"We might as reasonably dispute whether it is the upper or the under blade of a pair of scissors that cuts a piece of paper, as whether value is governed by utility or costs of production."* [Marshall, Principles of Economics, 8th edition, page 290]

Vilfredo Pareto, Francis Ysidro Edgeworth [1845-1926] and Henry Sidgwick [1838-1900] were all instrumental in developing the idea of indifference functions that allows the use of ordinal concepts of utility.

Most of the materials in modern principles of microeconomics have evolved from the framework of Neo classical economics. And that is the focus of this outline.

7.1.2.6.5 (5) Austrian Economics

Carl Menger and a group of followers (such as Eugen von Böhm-Bawerk [1851-1914], Friedrich von Wieser [1851-1926], Ludwig von Mises [1881-1973] and Friedrich Hayek [1899-1992]) have developed an alternative view of microeconomic behavior. The Austrian approach views human behavior as "purposive," (as opposed to rational). Markets are viewed as dynamic processes rather than the comparative statics of equilibrium outcomes in neoclassical economics. Behavior in conditions of disequilibria and processes by which individuals and systems might move toward equilibrium has been the focus of many Austrians.

Uncertainty and lack of information play an important role in Austrian economics. As a consequence, the role of information and learning becomes an important aspect of economic behavior and participation in markets. For the Austrians, value is subjective and is determined by the individual. Many of the ideas of the Austrians have been incorporated into neoclassical or mainstream economics. Wieser is credited with coining the term "opportunity cost." Imputing a value for inputs from the valuation of outputs has been integrated into mainstream economics. Austrian economics supports the ideas of individual choice and a minimal role for government.

7.1.2.6.6 (6) Institutional Economics

Thorstein Veblen (1857-1929) is regarded as the founder of the Institutionalist school of economics. Veblen reacted against the sterile, individualism of neoclassical economics and coined the term "neoclassical." He argued that neoclassical economics is static (it primarily uses comparative statics) and is limited in its ability to deal with dynamic forces such as technology. The Institutionalists argue that human behavior is not "rational" but rather is social behavior and is guided by "habitual patterns of behavior" which are expressed as social institutions. Idle curiosity, desire to be a parent and respect for workmanship are three of the forces that influence human behavior.

Veblen "…*develops the idea that institutions are inhibitory and backward looking, while science and technology are themselves dynamic and oriented toward change*." [Tilman, A Veblen Treasury, page *xxiii*]

Tilman finds five ideas in Veblen that are representative of his contribution:

- the emancipatory potential of the machine process
- antithesis between business and industry
- legal and political institutions as representing the vested interests
- the compulsive force of idea patterns
- the bankruptcy of commercial values

The Institutionalists, like the Austrians are regarded as "heterodox" economists.

7.1.2.6.7 (7) Others

Modern microeconomics is characterized by a variety of perspectives. The Chicago School, the Public Choice/Property Rights view, and the New Institutionalists represent variations on Neoclassical economics. These approaches tend to use Neoclassical economics to explain human behavior and the nature and structure of social institutions and organizations.

Social economists offer alternative views and argue that modern microeconomics has become "imperialistic" in its attempts to explain all human and social behavior in terms of economics. In recent years, there has been a small group of economists who have been trying to place economic theory within a social context. Richard Swedberg and Amitai Etzioni are characteristic of some of the writers who hold a social perspective. The focus is on the role of society and its influence on the individual. Society is seen as more than the summation of individual utility functions and behavior.

8 Demand and Supply in a Market System

The market system is an interrelated set of markets for goods, services and inputs. A market is defined as the interaction of all potential buyers and sellers of a good or class of goods that are close substitutes. The economic analysis that is used to analyze the overall equilibrium that results from the interrelationships of all markets is called a "general equilibrium" approach. Partial equilibrium is the analysis of the equilibrium conditions in a single market (or a select subset of markets in a market system). In principles of economics, most models deal with partial equilibrium.

In a partial equilibrium model, usually the process of a single market is considered. The behavior of potential buyers is represented by a market demand function. Supply represents the behavioral pattern of the producers/sellers.

8.1 Demand Function

A demand function that represents the behavior of buyers, can be constructed for an individual or a group of buyers in a market. The market demand function is the horizontal summation of the individuals' demand functions. In models of firm behavior, the demand for a firm's product can be constructed.

The nature of the "demand function" depends on the nature of the good considered and the relationship being modeled. In most cases the demand relationship is based on an inverse or negative relationship between the price and quantity of a good purchased. The demand for purely competitive firm's output is usually depicted as horizontal (or perfectly elastic). In rare cases, under extreme conditions, a "Giffen good" may result in a positively sloped demand function. These Giffen goods rarely occur.

It is important to identify the nature of the "demand function" being considered.

8.1.1 Individual Demand Function

The behavior of a buyer is influenced by many factors: the price of the good, the prices of related goods (compliments and substitutes), incomes of the buyer, the tastes and preferences of the buyer, the period of time and a variety of other possible variables. The quantity that a buyer is willing and able to purchase is a function of these variables.

An individual's demand function for a good (Good X) might be written:

$$Q_X = f_X(P_X, P_{\text{related goods}}, \text{income } (M), \text{preferences}, \ldots)$$

- Q_X = the quantity of good X
- P_X = the price of good X
- $P_{\text{related goods}}$ = the prices of compliments or substitutes
- Income (M) = the income of the buyers
- Preferences = the preferences or tastes of the buyers

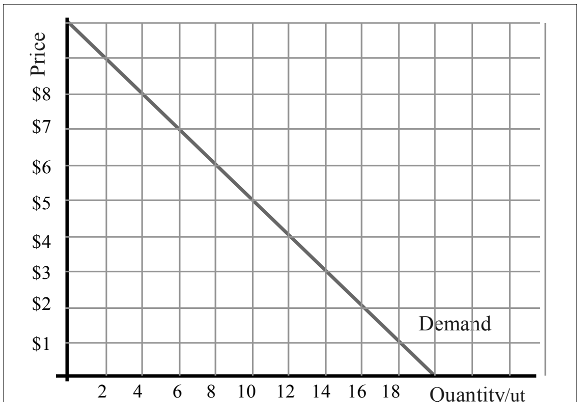


Figure III.A.1

The demand function is a model that "explains" the change in the dependent variable (quantity of the good X purchased by the buyer) "caused" by a change in each of the independent variables. Since all the independent variable may change at the same time it is useful to isolate the effects of a change in each of the independent variables. To represent the demand relationship graphically, the effects of a change in P_X on the Q_X are shown. The other variables, ($P_{related\ goods}$, M, preferences, . . .) are held constant. Figure III.A.1 shows the graphical representation of demand. Since ($P_{related\ goods}$, M, preferences, . . .) are held constant, the demand function in the graph shows a relationship between P_X and Q_X in a given unit of time (ut).

The demand function can be viewed from two perspectives.

The demand is usually defined as a schedule of quantities that buyers are willing and able to purchase at a schedule of prices in a given time interval (ut), *ceteris paribus*.

$Q_X = f(P_X)$, given incomes, price of related goods, preferences, etc.

Demand can also be perceived as the maximum prices buyers are willing and able to pay for each unit of output, *ceteris paribus*.

$P_X = f(Q_X)$, given incomes, price of related goods, preferences, etc.

It is important to remember that the demand function is usually thought of as Q = f(P) but the graph is drawn with quantity on the X-axis and price on the Y-axis. While demand is frequently stated Q = f(P), remember that the graph and calculation of total revenue (TR) and marginal revenue (MR) are calculated on the basis of a change in quantity (Q). TR = f(Q) The calculation of "elasticity" is based on a change in quantity (Q) caused by a change in the price (P). It is important to clarify which variable is independent and which is dependent in a particular concept.

8.1.2 Market Demand Function

When property rights are nonattenuated (exclusive, enforceable and transferable) the individual's demand functions can be summed horizontally to obtain the market demand function.

In Figure III.A.2 and Table III.A.2, a market demand function is constructed from the behavior of three people (the participants in a very small market. At a price of P_1, Ann will voluntarily buy 2 units of the good based on her preferences, income and the prices of related goods. Bob and Cathy buys 3 units each. Their demand functions are represented by D_A, D_B and D_C in Figure III.A.2.

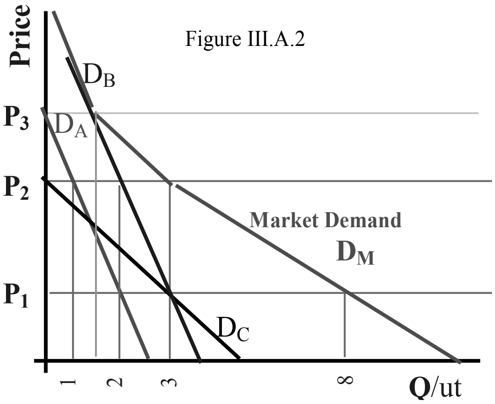


Table III.A.2

Computation of Market Demand by Horizontal Summation of Individual Demand Functions.

Price	Ann's Demand	Bob's Demand	Cathy's Demand	Market Demand
P_1	2	3	3	8
P_2	1	0	2	3
P_3	0	0	1.5	1.5

The total amount demanded by the three individuals at P_1 is 8 units (2+3+3). At a higher price each buys a smaller quantity. The demand functions can be summed horizontally if the property rights to the good are exclusive: Ann's consumption of a unit precludes Bob or Cathy from the consumption of that good. In the case of public (or collective) goods, the consumption of national defense by one person (they are protected) does not preclude others from the same good.

The behavior of a buyer was represented by the function:

$Q_X = f_X(P_X, P_{\text{related goods}},$ income (M), preferences, . . .). For the market the demand function can be represented by adding the number of buyers (#B, or population),

$Q_X = f_X(P_X, P_{\text{related goods}},$ income (M), preferences, . . . #B)

Where #B represents the number of buyers. Using ceteris paribus the market demand may be stated

$$Q_X = f(P_X), \text{ given incomes, price of related goods, preferences, \#B etc.}$$

8.1.3 Change in Quantity Demand

When demand is stated Q = f(P) *ceteris paribus*, a change in the price of the good causes a **"change in quantity demanded."** The buyers respond to a higher (lower) price by purchasing a smaller (larger) quantity. Demand is an inverse relationship between price and quantity demanded. Only in unusual circumstances (a highly inferior good, a Giffen good) may a demand function have a positive relationship.

A change in quantity demanded is a movement along a demand function caused by a change in price while other variables (incomes, prices of related goods, preferences, number of buyers, etc) are held constant. A change in quantity demanded is shown in Figure III.A.3.

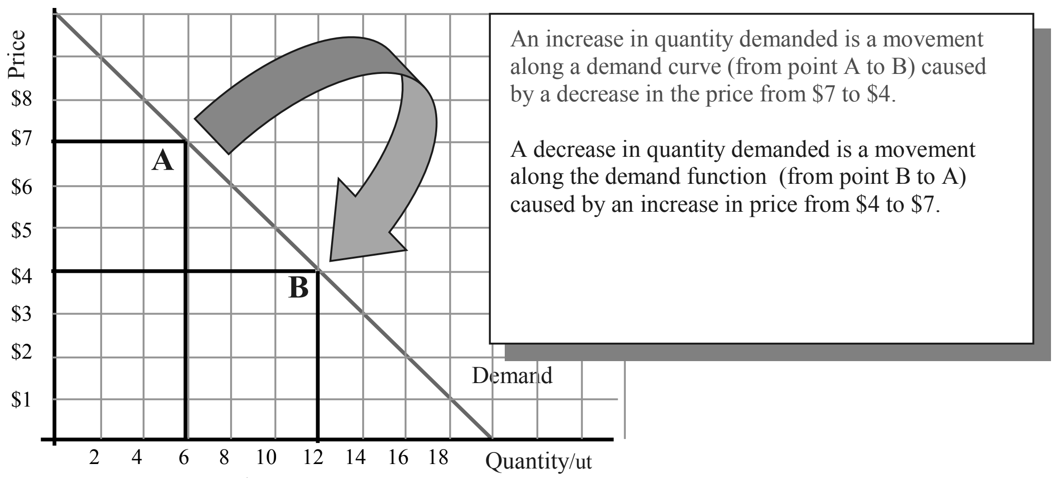


Figure III.A.3

8.1.4 Change in Demand

A change in demand is a "shift" or movement of the demand function. A shift of the demand function can be caused by a change in:

- incomes
- the prices of related goods
- preferences
- the number of buyers.
- Etc . . .

A"change in demand" is shown in Figure III.A.4. Given the original demand (Demand), 10 units will be purchased at a price of $5. An increase in demand ($D_{INCREASE}$) is to the right and at every price a larger quantity will be purchased. At $5, eighteen units are purchased. A decrease in demand is a shift to the left. At a price of $5 only 4 units are purchased. A smaller quantity will be bought at each price.

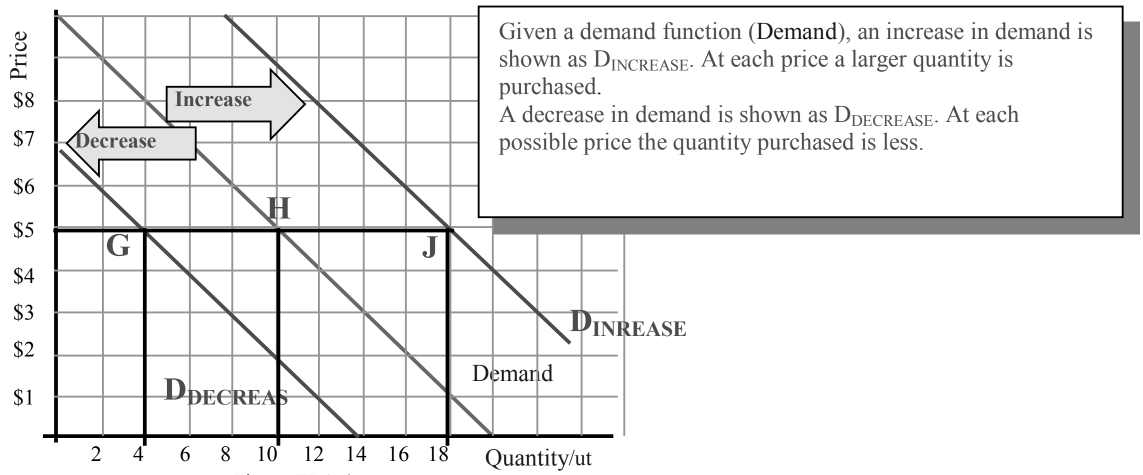


Figure III.A.4

8.1.5 Inferior, Normal and Superior Goods

A change in income will usually shift the demand function. When a good is a "normal" good, there is a positive relationship between the change in income and change in demand: an increase in income will increase (shift the demand to the right) demand. A decrease in income will decrease (shift the demand to the left) demand.

An inferior good is characterized by an inverse or negative relationship between the change in income and change in demand. An increase in the income will decrease demand while a decrease in income will increase demand.

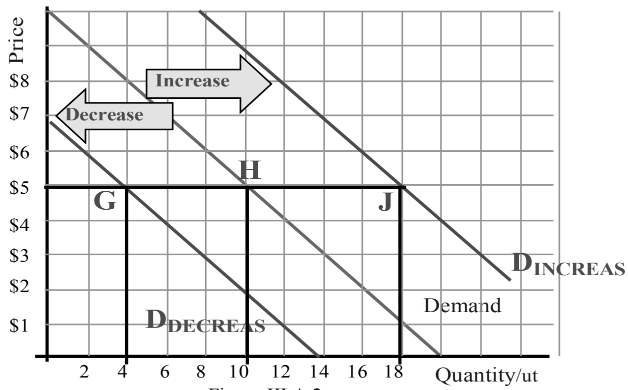
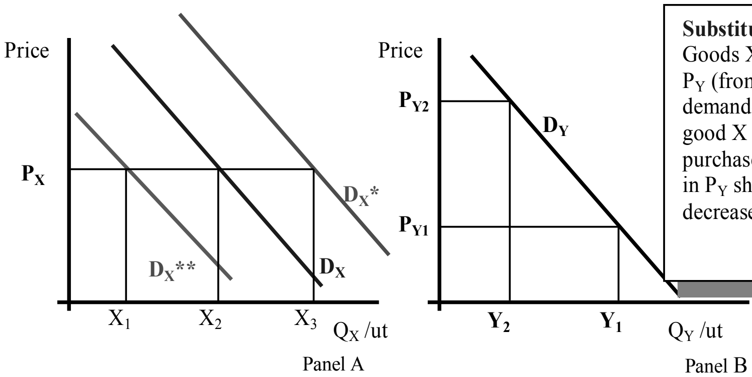


Figure III.A.2

A superior good is a special case of the normal good. There is a positive relationship between a change in income and the change in demand but, the percentage change in the demand is greater than the percentage change in income. In Figure III.A.2 an increase in income will shift the Demand function ("Demand") for a normal good to the right to $D_{INCREASE}$. For an inferior good, a decrease in income will shift the demand to the right. For a normal good a decrease in income will shift the demand to $D_{DECREASE}$.

8.1.6 Compliments and Substitutes

The demand for Xebecs (Q_X) is determined by the P_X, income and the prices of related goods (P_R). Goods may be related as substitutes (consumers perceive the goods as substitutes) or compliments (consumers use the goods together). If goods are substitutes, (shown in Figure III.A.3) a change in P_Y (in Panel B) will shift the demand for good X (in Panel A).



Substitutes
Goods X and Y are substitutes, An increase in P_Y (from P_{Y1} to P_{Y2}) decreases the quantity demanded for Y from Y_1 to Y_2. The demand for good X increases to D_X*. At P_X the amount purchased increases from X_2 to X_3. A decrease in P_Y shifts D_X to D_X** (Amount of X decreases to X_1).

Figure III.A.3

An increase in P_Y (from P_{Y1} to P_{Y2}) will reduce the quantity demanded for good Y (a move on D_Y). The reduced amount of Y will be replaced by purchasing more X. This is a shift of the demand for good X to the right (In Panel A, this is shown as a shift from D_X to D_X*, an increase in the demand for good X). At P_X a larger amount (X_3) is purchased

A decrease in P_Y will increase the quantity demanded for good Y. This will reduce the demand for good X, the demand for good X will shift to the left (from D_X to D_X**, a decrease). At P_X (and all prices of good X) a smaller amount of X (X_1) is purchased.

In the case of compliments, there is an inverse relationship between the price of the compliment (P_Z in Panel B, Figure III.A.4) and the demand for good X. An increase in the price of good Z will reduce the quantity demanded for good Z. Since less Z is purchased, less X is needed to compliment the reduced amount of Z (Z_2). The demand for X in Panel A decreases for D_X to D_X**. An decrease in P_Z will increase the quantity demanded of good Z and result in an increase in the demand for good X (from D_X to D_X* in Panel A).

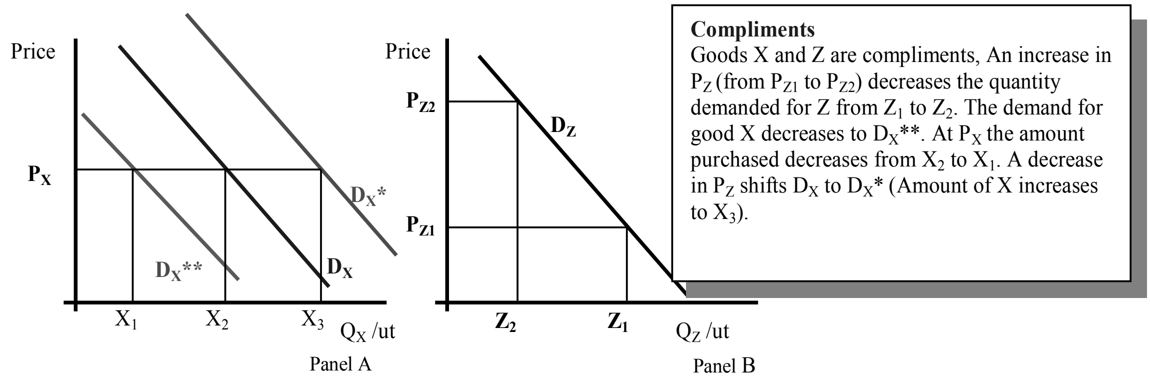


Figure III.A.4

8.1.7 Expectations

Expectations about the future prices of goods can cause the demand in any period to shift. If buyers expect relative prices of a good will rise in future periods, the demand may increase in the present period. An expectation that the relative price of a good will fall in a future period may reduce the demand in the current period.

8.2 Supply Function

A supply function is a model that represents the behavior of the producers and/or sellers in a market.

$$\mathbf{Q_{XS}} = f_S(\mathbf{P_X}, P_{INPUTS}, \text{technology, number of sellers, laws, taxes, expectations . . . \#S})$$

P_X = price of the good,

P_{INPUTS} = prices of the inputs (factors of production used)

Technology is the method of production (a production function),

laws and regulations may impose more costly methods of production

taxes and subsidies alter the costs of production

#S represents the number of sellers in the market.

Like the demand function, supply can be viewed from two perspectives:

Supply is a schedule of quantities that will be produced and offered for sale at a schedule of prices in a given time period, *ceteris paribus*.

A supply function can be viewed as the minimum prices sellers are willing to accept for given quantities of output, *ceteris paribus*.

8.2.1.1 (1) Graph of Supply

The relationship between the quantity produced and offered for sale and the price reflects opportunity cost. Generally, it is assumed that there is a positive relationship between the price of the good and the quantity offered for sale. Figure III.A.5 is a graphical representation of a supply function. The equation for this supply function is $Q_{supplied} = -10 + 2P$. Table III.A5 also represents this supply function.

TABLE III.A.5

SUPPLY FUNCTION

PRICE	QUANTITY
$5	0
$10	10
$15	20
$20	30

8.2.1.2 (2) Change in quantity supplied

Given the supply function, $Q_{xs} = f_s(P_x, P_{inputs}, Tech, \ldots)$, a change in the price of the good (P_X) will be reflected as a move along a supply function. In Figures III.A.5 and III.A.6 as the price increases from $10 to $15 the quantity supplied increases from 10 to 20. This can be visualized as a move from point A to point B on the supply function. A "**change in quantity supplied is a movement along a supply function**." This can also be visualized as a movement from one row to another in Table III.A.5.

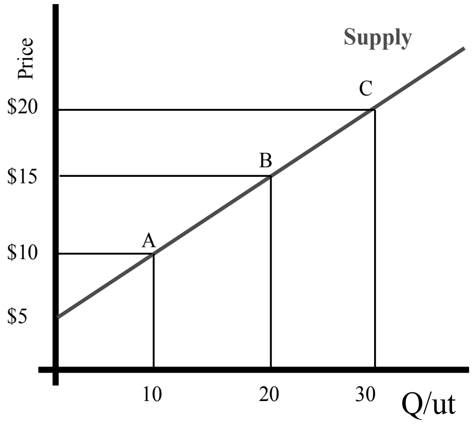


Figure III.A.5

8.2.1.3 (3) Change in Supply

Given the supply function, $Q_{xs} = f_s(P_x, P_{inputs}, Tech, \ldots, \#S)$, a change in the prices of inputs (P_{inputs}) or technology will **shift** the supply function. A shift of the supply function to the right will be called an increase in supply. This means that at each possible price, a greater quantity will be offered for sale. In an equation form, an increase in supply can be shown by an increase in the quantity intercept. A decrease in supply is a shift to the left: at each possible price a smaller quantity is offered for sale. In an equation this is shown as a decrease in the intercept.

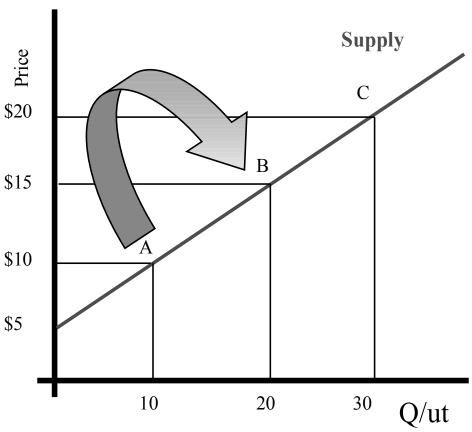


Figure III.A.6

> A **change in quantity supplied** is a movement along a supply function that is "caused" by a change in the price of the good. In the graph to the right, as price increases from $10 to $15 the quantity supplied increases from 10 to 20. This can be visualized as a move from point A to point B along the supply function. A decrease in supply would be a move from point B to point A as price fell from $15 to $10

> A **change in supply** is a "shift" of the supply function. A decrease in supply is shown as a shift from **Supply** to S_{decrease} in the graph. At a price of $15 a smaller amount is offered for sale. This decrease in supply might be "caused" by an increase in input prices, taxes, regulations or, . . .
> An increase in supply can be visualized as a movement of the supply function from **Supply** to **S**$_{increase}$.

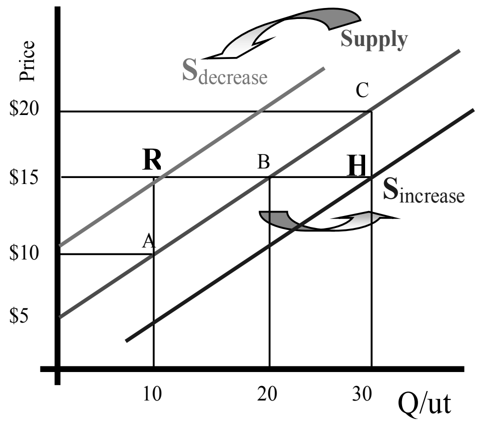


Figure III.A.7

8.3 EQUILIBRIUM

W*ebster's Encylopedic Unabridged Dictionary of the English Language* defines equilibrium as "*a state of rest or balance due to the equal action of opposing forces*," and " *equal balance between any powers, influences, etc.*" *The New Palgrave: A Dictionary or Economics* identifies 3 concepts of equilibrium:

- Equilibrium as a "balance of forces"
- Equilibrium as "a point from which there is no endogenous 'tendency to change'"
- Equilibrium as an " outcome which any given economic process might be said to be 'tending towards', as in the idea that competitive processes tend to produce determinant outcomes.""

In Neoclassical microeconomics, "equilibrium" is perceived as the condition where the quantity demanded is equal to the quantity supplied: the behavior of all potential buyers is coordinated with the behavior of all potential sellers. There is an equilibrium price that equates or balances the amount that agents want to buy with the amount that is produced and offered for sale (at that price). There are no forces (from buyers or sellers) that will alter the equilibrium price or equilibrium quantity. Graphically, economists represent a market equilibrium as the intersection of the demand and supply functions. This is shown in Figure III.A.8.

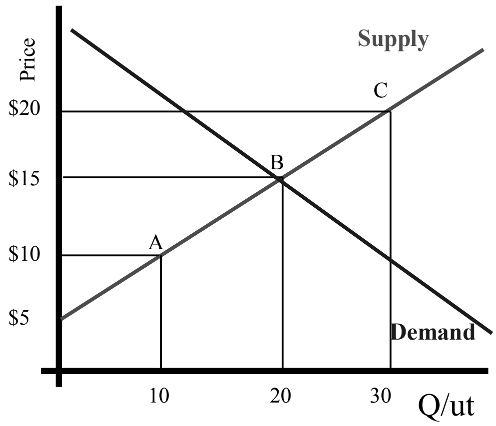


Figure III.A.8

In the graph to the left, equilibrium is at the intersection of the demand and supply functions. This occurs at point B. The equilibrium price is $15 and the equilibrium quantity is 20 units.

At the equilibrium price the quantity that buyers are willing and able to buy is exactly the same as sellers are willing to produce and offer for sale.

This notion of equilibrium is one of the fundamental organizing concepts of neoclassical economics

This is a mechanical, static conception of equilibrium. Neoclassical economics uses “comparative statics” as a method by which different states can be analyzed. In this approach to equilibrium in a market the explanation about how equilibrium is achieved does not consider the possibility that some variables change at different rates of time.

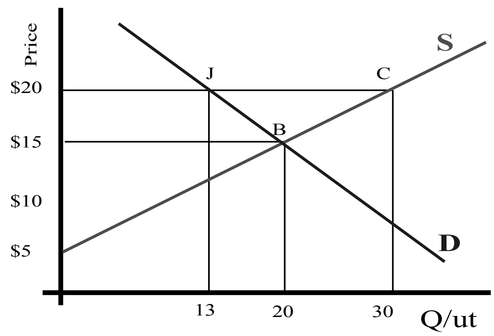


Figure III.A.9

The process of achieving a state of equilibrium is based on buyers and sellers adjusting their behavior in response to prices, shortages and surpluses. In Figure III.A.9.

If the price were at $20. the price is "too high" and the market is not in equilibrium. The amount of the good that agents are willing and able to buy at this price (quantity demanded) is less than sellers would like to sell (quantity supplied). At $20 buyers are willing and able to purchase 13 units while sellers produce and offer for sale 30 units. Sellers have 17 units that are not sold at this price. This is a surplus. In order to sell the surplus units, sellers lower their price. As the price falls from $20 the quantity supplied decreases and the quantity demanded increases. (Neither demand nor supply are changed.) As the price falls, the quantity supplied falls and the quantity demanded increases. At a price of $15 the amount that buyers are willing and able to purchase is equal to the amount sellers produce and offer for sale.

When the market price is below the equilibrium price the quantity demanded exceeds the quantity supplied. At the price below equilibrium, buyers are willing and able to purchase an amount that is greater than the suppliers produce and offer for sale. The buyers will "bid up" the price by offering a higher price to get the quantity they want. The quantity demanded will fall while the quantity supplied rises in response to the higher price.

An economic system has many agents who interact in many markets. General equilibrium is a condition where all agents acting in all markets are in equilibrium at the same time. Since the markets are all interconnected a change or disequilibrium in one market would cause changes in all markets. Leon Walras [1801-1866] was a major contributor to the concept of general equilibrium. Kenneth Arrow [1921-] and Gérard Debreu [1921-], show the conditions that must be met to achieve general equilibrium.

Antoine Augustin Cournot, [1801-1877] adopted the concept of partial equilibrium in 1838 out of mathematical expediency. (*The New Palgrave*) Alfred Marshall [1842-1924] approach was to introduce the concept of time and the process of analyzing one market at a time. Neoclassical microeconomics tends to focus on partial equilibrium. It was Marshall who introduced the concept of *ceteris paribus* as a means to isolate and analyze each market separately. Marshall understood that all markets were interconnected but chose to analyze each market individually. The concept of partial equilibrium is used in introductory economics courses and for some analysis.

8.3.1 Market Adjustment to Change

Market systems are favored by Neoclassical economists for three primary reasons. First, agents only need information about their own objectives and alternatives. The markets provide information to agents that may be used to identify and evaluate alternative choices that might be used to achieve objectives. Second, each agent acting in a market has incentives to react to the information provided. Third, given the information and incentives, agents within markets can adjust to changes. The process of market adjustment can be visualized as changes in demand and/or supply.

8.3.2 Shifts or Changes in Demand

The demand function was defined from two perspectives:

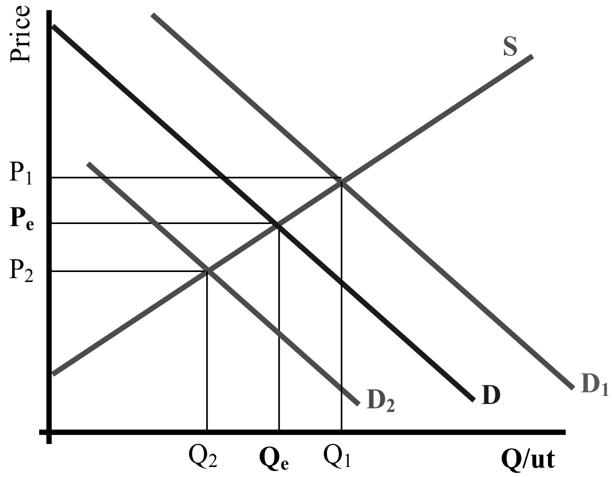
- A schedule of quantities that individuals were willing and able to buy at a schedule of prices during a given period, *ceteris paribus*.
- The maximum prices that individuals are willing and able to pay for a schedule of quantities or a good during a given time period, *ceteris paribus*.

In both cases the demand function is perceived as a negative or inverse relationship between price and the quantity of a good that will be bought. The relationship between price and quantity is shaped by other factors or variables. Income, prices of substitutes, prices of compliments, preferences, number of buyers and expectations are among the many possible variables that influence the demand relationship. The demand function was expressed:

$$\mathbf{Q_x = \boldsymbol{f}_x(P_x, P_c, P_s, M, Preferences, \#buyers, \ldots)}$$

P_c is the price of complimentary goods. P_s is the price of substitutes. M is income. Such proxies as gender, age, ethnicity, religion, etc represent preferences. Remember that a change in the price of the good (P_x) is a change in quantity demanded or a movement along a demand function. A change in any other related variable will result in a shift of the demand function or a change in demand.

In Figure III.A.10 the effects of a shift in demand are shown. If supply is constant, an increase in demand will result in an increase in both equilibrium price and quantity. A decrease in demand will cause both the equilibrium price and quantity to fall.



Given the supply (**S**) and the demand (**D**), the equilibrium price in the market is $\mathbf{P_e}$. The equilibrium quantity is $\mathbf{Q_e}$.

An increase in demand is represented by a shift of demand from **D** to $\mathbf{D_1}$. This will cause and increase in equilibrium price from P_e to P_1 and equilibrium quantity from Q_e to Q_1.

A decrease in demand to D_2 will cause equilibrium price to fall to P_2 and quantity to Q_2.

Figure III.A.10

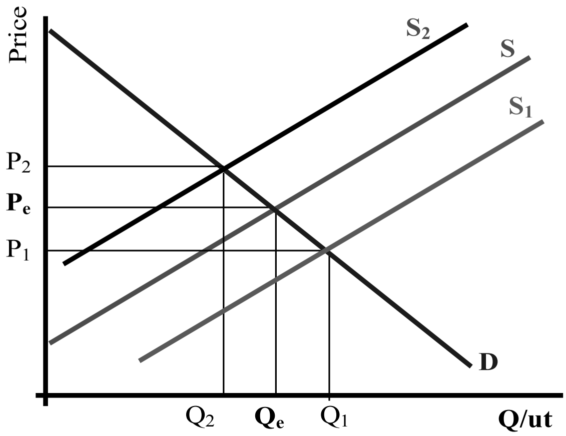
8.3.2.1 Shift of Supply

Remember that the supply function was expressed,

$$\mathbf{Q_{xs} = f_s\,(P_x,\ P_{inputs},\ Tech,\ regulations,\ \#\ sellers,\ .\ .\ .\ \#S)},$$

A change in the price of the good changes the quantity supplied. A change in any of the other variables will shift the supply function. An increase in supply can be visualized as a shift to the right, at each price a larger quantity is produced and offered for sale. A decrease in supply is a shift to the left: at each possible price a smaller quantity is offered for sale. If the supply shifts and demand remains constant, the equilibrium price and quantity will be altered.

An increase in supply (while demand is constant) will cause the equilibrium price to decrease and the equilibrium quantity to increase. A decrease in supply will result in an increase is the equilibrium price and a decrease in equilibrium quantity.



Given the demand (**D**) and the supply (**S**), the equilibrium price in the market is $\mathbf{P_e}$**.** The equilibrium quantity is $\mathbf{Q_e}$.

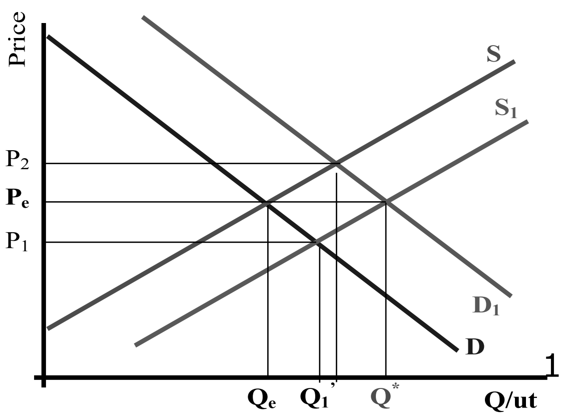
An increase in supply is represented by a shift of supply from S to S_1. This will cause and decrease in equilibrium price from P_e to P_1 and an increase in equilibrium quantity from Q_e to Q_1.

A decrease in supply to $\mathbf{S_2}$ will cause equilibrium price to increase to P_2 and equilibrium quantity to fall to Q_2.

Figure III.A.11

8.3.2.2 Changes in Both Supply and Demand

When supply and demand both change, the direction of the change of either equilibrium price or quantity can be known but the effect on the other is indeterminate. An increase in supply will push the market price down and quantity up while an increase in demand will push both market price and quantity up. The effect on quantity of an increase in both supply and demand will increase the equilibrium quantity while the effect on price is dependent on the magnitude of the shifts and relative structure (slopes) of supply and demand. The effect of an increase in both supply and demand is shown in Figure III.A.12.



Given supply (**S**) and demand (**D**), the equilibrium price is $\mathbf{P_e}$ and quantity is $\mathbf{Q_e}$.

An increase in supply to S_1 results in a drop in price from $\mathbf{P_e}$ to P_1 while quantity increases from $\mathbf{Q_e}$ to Q_1.

If demand then increased to D_1, the equilibrium quantity would increase to **Q***. The price however, is pushed up. In this case the price is returned to **Pe.** If the shift in demand were greater of less (or the slopes of S and **D**) were different, the equilibrium price might rise, fall or remain the same; the change is indeterminate

Figure III.A.12

When supply and demand both shift, the direction of change in either equilibrium price or quantity can be known but direction of change in the value of the other is indeterminate.

8.3.3 Equilibrium and the Market

Whether equilibrium is a stable condition from which there "is no endogenous tendency to change," or and outcome which the "economic process is tending toward," equilibrium represents a coordination of objectives among buyers and sellers. The demand function represents a set of equilibrium conditions of buyers given the incomes, relative prices and preferences. Each individual buyer acts to maximize his or her utility, *ceteris paribus*. The supply function represents a set of equilibrium conditions given the objectives of sellers, the prices of inputs, prices of outputs, technology, the production function and other factors.

The condition of equilibrium in a market, where supply and demand functions intersect ("quantity supplied is equal to the quantity demanded") implies equilibrium conditions for both buyers and sellers.

9 Demand and Consumer Behavior

Demand is a model of consumer behavior. It attempts to identify the factors that influence the choices that are made by consumer. In Neoclassical microeconomics, the objective of the consumer is to maximize the utility that can be derive given their preferences, income, the prices of related goods and the price of the good for which the demand function is derived. An individual's demand function can be thought of as a series of equilibrium or optimal conditions that result as the price of a good changes. There are two approaches that may be used to explain an individual's demand function: utility analysis and indifference analysis. The two approaches are compatible.

9.1 Consumer Choice and Utility

Utility is the capacity of a good (or service) to satisfy a want. It is one approach explain the phenomenon of value. Utilitarianism is the ethical foundation of Neoclassical microeconomics. Jeremy Bentham [1748-1832] formalized "utilitarianism." Utility is a subject evaluation of value. Bentham seemed to intuitively grasp the notions of total an marginal or incremental utility. However, it was not until 1844 that Dupuit [1804-1866] linked marginal utility to the concept of demand. Heinrich Gossen [1810-1858] developed the "law of satiable wants" which is considered to be a forerunner of the "law of diminishing marginal utility. In 1871 William Stanley Jevons [1835-1882] used the term "final degree of utility" and Carl Menger [1840-1921] recognized that individuals rank order their preferences. It was Friedrich von Wieser, [1851-1926] who first used the term "marginal utility."

9.1.1 Utility

Since utility is subjective and cannot be observed and measured directly, it use here is for purposes of illustration. The objective in microeconomics is to maximize the satisfaction or utility of individuals given their preferences, incomes and the prices of goods they buy.

A. TOTAL UTILITY (TU) AND MARGINAL UTILITY (MU)

Total utility (TU) is defined as the amount of satisfaction or utility that one derives from a given quantity of a good. **Marginal utility (MU)** is defined as the change in total utility that can be attributed to a change in the quantity consumed.

$$\text{Total Utility} = \text{TU} = f\left(\text{Q, preferences, } \ldots\right)$$
$$\text{Marginal Utility} = \text{MU} = \frac{\Delta \text{TU}}{\Delta \text{Q}}$$

As a larger quantity of a good is consumed in a given period we expect that the TU will increase at a decreasing rate. It may eventually reach a maximum and then decline. Remember the last time you went to an all you can eat pizza place and ate too much? This is shown in Figure IV.A.1. As the quantity of pizza/day consumed increases, the TU derived from the pizza increases at a decreasing rate until the maximum or 27 is reached at the 5th pizza.

TU is a function of the individual's preferences and the quantity consumed. In the illustration to the right, 10 units of utility are obtained by consuming 1pizza/day. The consumption of 2 pizzas/day results in a total of 18 units of satisfaction. The maximum satisfaction that can be derived from the consumption of pizza is 27. This occurs at 5 pizzas. If the individual eats more than 5 pizzas their total satisfaction declines.

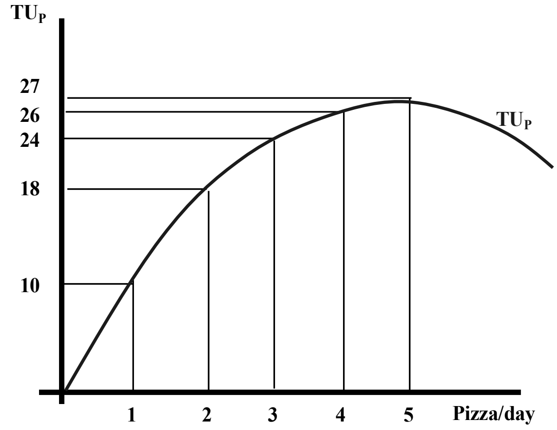


Figure IV.A.1

Total Utility can be displayed in table form. The information contained in Figure IV.A.1 is shown in Table IV.1

Marginal utility (MU) is the change in TU that is "caused" by a change in the quantity consumed in the particular period of time. MU was defined:

$$MU = \frac{\Delta TU}{\Delta Q}$$

In Table IV.1 marginal utility is calculatec … quantity from row to row is 1 (ΔQ = 1). Th… can be calculated be subtracting the TU as… that associated with the next quantity. In … derived from 1 unit of the good is 10. The TU… change in total utility (ΔTU) attributable to a… is 8.

TABLE IV.1

TOTAL & MARGINAL UTILITY

Quantity	TU	MU
0	0	--
1	10	10
2	18	8
3	24	6
4	26	2
5	27	1
6	26	-1

$$MU = \frac{\Delta TU}{\Delta Q} = \frac{8}{1} = 8$$

The MU of the third unit is 6

$$\left[MU_3 = \frac{\Delta TU}{\Delta Q} = \frac{24 - 18}{1} = \frac{6}{1} = 6 \right]$$

When the MU is calculated by subtraction, it can be visualized as the slope of the TU between two points. This is shown in Figure IV.A.2

> The MU can be visualized as the slope of the TU between successive units of the good. In the graph to the right the MU of the third unit of Pizza is the slope of the TU between points A and B.
> Think of the slope of a line as rise over run. Δ TU rise and Δ Q is the run. In this example the Δ Q is 1 (from the third to the fourth unit is 1). The Δ TU is 6 (24-18). $\therefore$ rise over run or the slope of TU between points A and B is 6.

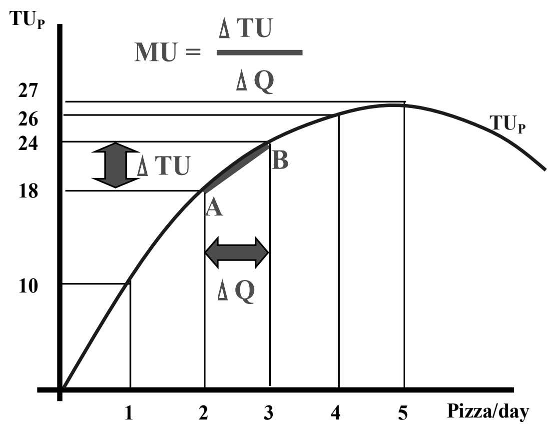


Figure IV.A.2

Marginal utility can be graphed, however remember that the MU calculated by subtraction is “between” successive units of the good. It is the slope of an arc defined by two points on a total utility function. This is shown in Figure IV.A.3

In the graph to the right, one unit of the good yields 18 units of satisfaction while 2 units of the good result in 30 units of satisfaction. Marginal Utility ($MU = \frac{\Delta TU}{\Delta Q}$) can be shown as the slope of a line from point R to B. this is the red "arc" between the two points. The actual TU is shown by the curved blue line between R and B.

$$MU = \frac{rise}{run} = \frac{\Delta TU}{\Delta Q} = \frac{12}{1} = \text{slope of TU}$$

MU can be calculated as a derivative. At 2 units of the good the MU will be the slope of the line GG' tangent to TU at point B.

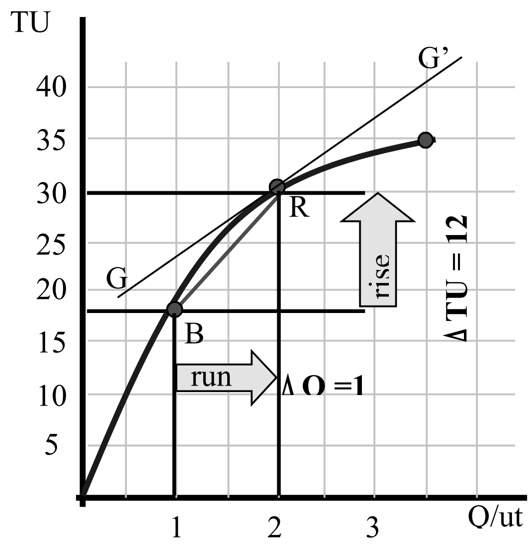


Figure IV.A.3

The relationship between total utility (TU), marginal utility (MU) and average utility can be shown graphically. In Figure IV.A.4 the TU function has some peculiar characteristics so all-possible circumstances can be shown. In this example the total utility (TU) first increases at an increasing rate. Each additional unit of the good consumed up to the Q* amount causes larger and larger increases in TU. The MU will rise in this range. At Q* amount there is an inflection point in TU. This is consistent with the maximum of the MU. When AU is is a maximum, MU = AU. When TU is a maximum, MU is 0. This is shown in Figure IV.A.4

In the graph to the right, TU increases at an increasing rate from 0 to Q* units of the good. At Q* there is an inflection point in TU. This is consistent with the maximum of the MU. Beyond Q* amount the TU increases at a decreasing rate. MU (the slope of TU) decreases. Q* is the "point of diminishing MU."
When MU > AU, AU is "pulled up." When MU < AU, AU is "pulled down." When MU = AU, AU is a maximum. (AU is unchanged, its slope is 0, ∴ AU is a maximum)
At Q_M the TU is a maximum. At this output the slope of TU is 0. MU is the slope of TU ∴ MU = 0.

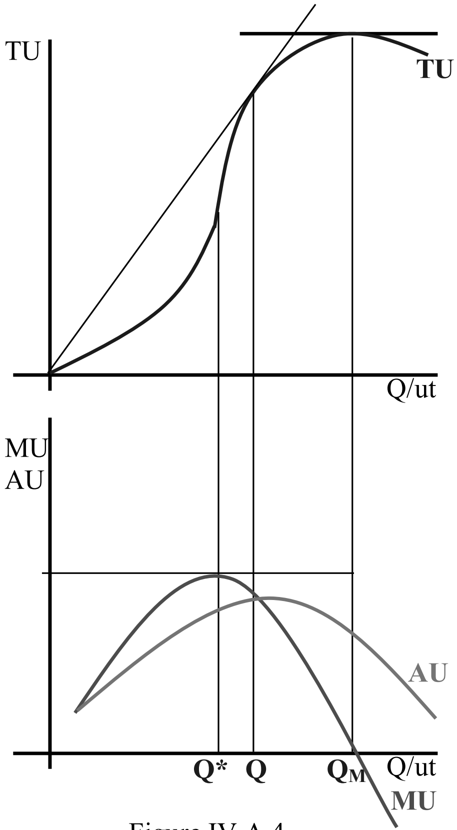


Figure IV.A.4

B. DIMINISHING MARGINAL UTILITY

It is believed that as an individual consumes more and more of a given commodity during a given period of time, eventually each additional unit consumed will increase TU by a smaller increment, MU decreases. This is called "diminishing marginal utility." As a person consumes larger quantities of a good in a given time period, additional units have less "value." Adam Smith recognized this phenomenon when he posed this "diamond-water paradox." Water has more utility than diamonds. However, since water is plentiful, its marginal value and hence its price is lower than the price of diamonds that are relatively scarce.

C. BUDGET CONSTRAINT

When goods are "free," an individual should consume until the MU of a good is 0. This will insure that total utility is maximized. When goods are priced above zero and there is a finite budget, the utility derived from each expenditure must be maximized.

An individual will purchase a good when the utility derived from a unit of the good X (MU_X) is greater than the utility derived from the money used to purchase the good ($MU_\$$). Let the price of a good (P_X) represent the MU of money and the MU_X represent the marginal benefit (MB_X) of a purchase. When the $P_X > MB_X$, the individual should buy the good. If the $P_X < MB_X$, they should not buy the good. Where $P_X = MB_X$, they are in equilibrium, they should not change their purchases.

Given a finite budget (B) and a set of prices of the goods (P_X , P_Y, P_N) that are to be purchased, a finite quantity of goods (Q_X, Q_Y, Q_N) can be purchased. The budget constraint can be expressed,

$$\begin{aligned}
&B \geq P_X Q_X + P_Y Q_Y + \ldots + P_N Q_N \\
&\text{Where } B = \text{budget} \\
&P_N = \text{price of } N^{\text{th}} \text{ good} \\
&Q_N = \text{quantity of } N^{\text{th}} \text{ good}
\end{aligned}$$

For one good the maximum amount that can be purchased is determined by the budget and the price of the good. If the budget were 80€ and the price was 5€, it would be possible to buy 16 units. The amount that can be purchased is the budget (B) divided by the price of the good (P_X).

$$Q_X \text{ that can be purchased} = \frac{\text{Budget}}{\text{Price}} = \frac{B}{P_X}$$

The combinations of two goods that can be purchased can be shown graphically. The maximum of good X that can be purchased is .

$\frac{B}{P_X}$, the amount of good Y is $\frac{B}{P_Y}$

All possible combinations of good X and Y that can be purchased lie along (and inside) a line connecting the X and Y intercepts. This is shown in Figure IV.A.5

In the graph to the right, the budget is 80€. When the price of good Y (P_Y) is 4€, a maximum of 20 units of good Y can be purchased. This is shown as point A on the Y-axis. If the price of good X is 5€, a maximum of 16 units of X can be purchased. This is point H on the X-axis. The line AH represents the maximum combinations of goods X and Y that can be bought given the budget and prices. Any combination of goods that lies in the triangle OAH (yellow area) can be purchased.

An increase in the budget will "shift" the budget constraint out. A decrease in the budget will shift it in.

A change in the relative prices will "rotate" the constraint (change its slope).

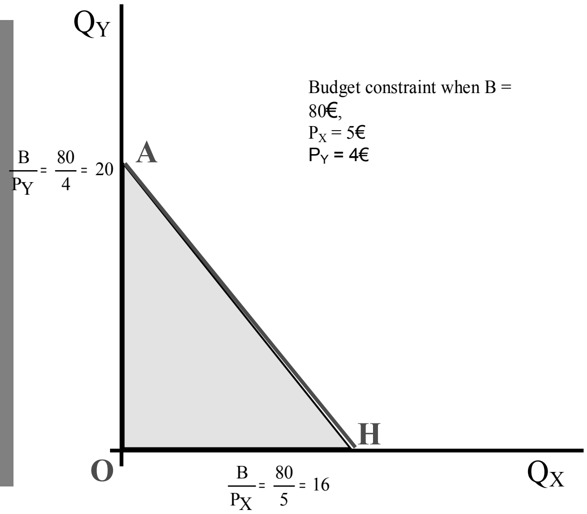


Figure IV.A.5

In order to maximize the utility derived from the two goods, the individual must allocate their budget to the "highest valued use." This is accomplished by the use of marginal analysis. There are two steps to this process. First, the marginal utility of each unit of each good is considered. Second, the price of each good (or the relative prices) must be taken into account.

It is believed that as a person consumes more and more of a (homogeneous) good in a given period of time, that eventually the total utility (TU) derived from that good will increase at a decreasing rate: the point of diminishing marginal utility (MU) will be reached.

When there are two (or more) goods (with prices) and a budget, the individual will maximize TU by spending each additional dollar (euro, franc, pound or whatever monetary unit) on the good with the greatest marginal utility per unit of price .

$$\left[\frac{MU_X}{P_X}\right]$$

Consider the two goods in Table IV.2.

TABLE IV.2
Maximizing TU of Two Goods Given Prices and Budget (B = $5)

Xebecs (Good X) $P_X = \$1$ - $P_{X1} = \$.50$				**Yawls (Good Y)** $P_Y = \$1$			
Q_X	TU_X	MU_X $\left[MU_X/P_X\right]$	MU_X/P_{X1}	Q_Y	TU_Y	MU_Y	MU_Y/P_Y
0	0	--	--	0	0	--	--
1	10	10	20	1	16	16	16
2	18	8	16	2	28	12	12
3	24	6	12	3	36	8	8
4	28	4	4	4	40	4	4
5	30	2	2	5	40	0	0
6	30	0	- 2	6	36	- 4	- 4

In Table IV.2 the preferences for two goods (good X, xebecs and good Y, yawls) is shown. The preferences determine the Total Utility (TU) and marginal utility (MU) that is derived from various units of the two goods. A change in preferences will change the utility as expressed by TU and/or MU. A preference state is one table. A change in preferences would be shown as a different table. Remember that for demand analysis preferences are subject to *ceteris paribus.*

The effects of a change in price (of either good) or the budget can be shown within the given table. In Table IV.2 the preferences are given, the budget is \$5, the P_X is \$1 and P_Y is \$1. The marginal utility per dollar (price) is calculated

$\left[\frac{MU_N}{P_N}\right]$ for each good. The agent then spends each monetary unit (\$, €, ₤ or. . .) on the good that has the highest MU_N/P_N. In Table IV.2 the individual would first buy a unit of good Y (yawls) to get 16 units of satisfaction. If they had bought a unit of good X (xebecs) they would have gotten 10 units of satisfaction for the dollar expenditure.

The consumer decides on their next purchase. They can by an additional unit of yawls (for \$1) and get 12 units of satisfaction or a unit of xebecs to get 10 units of satisfaction. They will by the second unit of yawls. The third dollar is spent on xebecs (10 units of satisfaction is preferred to 8). The fourth dollar is spent on either xebecs or yawls: the buyer is indifferent between the second xebec and third yawl. They have the same satisfaction. If the second xebec is purchased, the fifth dollar will be spent on the third unit of yawls.

Given the preferences, P_X = \$1, P_Y = \$1 and a budget of \$5: the consumer will purchase 2 units of xebecs and three of yawls. The quantity of X purchased at \$1 given P_Y, budget and preferences can be shown as point G in Figure IV.A.6.This is an equilibrium point for the consumer. When they buy two units of good X (2X) and three unit of good Y (3Y), they obtain 54 units of satisfaction (TU_X for 2X is 18 and TU_Y of 3Y is 36). If they bought 1X and 4Y their TU would be 50. If they bought 3X and 2Y their TU is 52. Clearly they cannot increase their utility by altering their purchases.

Given the individual's preferences shown in Table IV.2, a budget of \$5 and P_X =\$1 and P_Y = \$1, the individual will buy 2 units of good X.
This is a ***point*** on the demand function for good X. A point on the demand for good Y could be shown on another graph. Here we will develop the demand for good X.
Note that point G (2 units of X at \$1) represents an equilibrium condition for the consumer. They cannot alter their purchases without reducing the total utility they derive from the \$5 budget.
Point W is derived by lowering the price of xebecs to \$.50

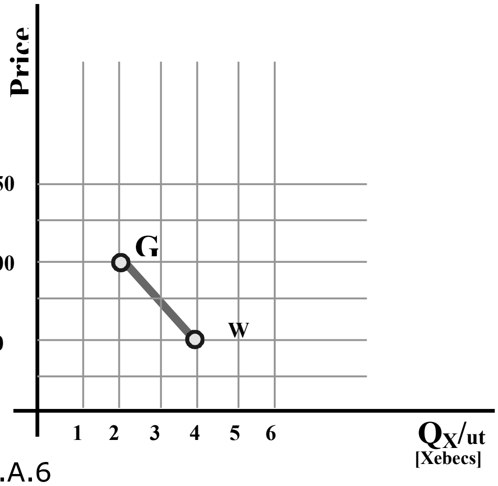


Figure IV.A.6

A second point on the demand for good X can be derived by changing the price of good X while holding preferences, budget and Py constant. Decrease the price of xebecs (P_X) from \$1 to (P_{X1})\$.50. This will increase the marginal utility per dollar spent on good X. This is shown in Table IV.2 in the column [MU_X/P_{X1}]. Following the same logic above the consumer would purchase 4 units of xebecs and 3 units of yawls with their \$5 budget. Note that this results in 64 units of satisfaction. Reduce the amount of X by 2 units to buy one more unit of good Y and utility falls to 58. If the consumer tried to buy more X and less Y we will interpolate so 2.5 units of Y and 5 units of X can be purchased to yield 62 units of satisfaction.

Given preferences in Table IV.2, B = \$5, P_Y = \$1 and P_{X1} = \$.50, the consumer will purchase 4X. This can be shown as point W in our graph for the demand of xebecs in Figure IV.A.6. A portion of the demand function for xebecs has been mapped and is shown as the line segment between points G and W.

It is important to note that the demand function represents a series of equilibrium conditions for the consumer as the price of xebecs changes while other parameters remain constant. If P_Y, Budget or preferences changed, the demand for xebecs would shift.

D. EQUIMARGINAL PRINCIPLE

The process demonstrated in the previous section may be referred to as the equimarginal principle. It is a useful tool and can be used to optimize (maximize or minimize) variables in marginal analysis. It will be used again to find the minimum cost per unit combination of inputs into a production process.

The rule for maximizing utility given a set of price and a budget is straightforward: if the marginal utility per dollar spent on good X is greater that the marginal utility per dollar spent of good Y, buy good X. If the marginal utility per dollar spent on good X is less that the marginal utility per dollar spent of good Y, buy good Y. Utility is maximized when the marginal utility per dollar spent is the same for all goods. This can be expressed for as many goods as necessary. Since there is a budget constraint, if the marginal utility per dollar of one good is greater than the MU/$ of another and the budget is all spent, the individual should buy less of one to obtain more of the other. The equimarginal principle can be expressed:

$$\frac{\mathrm{MU}_x}{P_x} = \frac{\mathrm{MU}_y}{P_y} = \cdots = \frac{\mathrm{MU}_n}{P_n}$$

subject to the constraint, $B \geq P_x Q_x + P_y Q_y + \ldots + P_n Q_n$

Where P_{ni} = price of i^{th} good,

Q_{ni} = quantity of i^{th} good

and B = budget

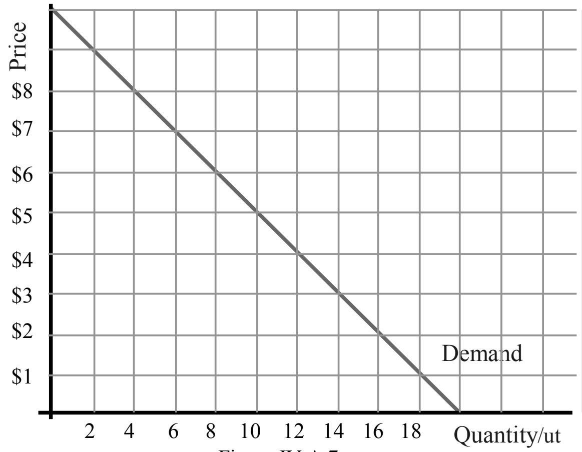


Figure IV.A.7

9.1.2 Individual's Demand Function

The individual will tend to purchase more of a good at lower prices. This was shown in a graph as a negatively sloped function, **Q = f(P)**. This is shown in Figure IV.A.7 (This graph was introduced in Section III). The inverse relationship between price and quantity is caused by the *income* and *substitution* effects.

I INCOME EFFECT

When the price of a good that the individual buys increases and the income or budget remains constant, the "real income" goes down and the individual can't buy as much as they did before the price change. If the price of a good goes down the real income goes up, therefore they effectively have more money and can buy more. This is called the income effect. At higher prices the real income is less so people buy fewer units of a good. At lower prices the real income is greater (even though the nominal income is constant) and they can buy more.

II SUBSTITUTION EFFECT

Individuals react to higher prices by looking for relatively lower priced substitutes. Or, conversely they will react to lower prices of a good by substituting it for a relatively higher priced good.

The income and substitution effects may be greater of smaller depending on the good being considered. Some goods may have a large income effect. Autos, computers and the like may have great income effects. In other cases the substitution effect may be larger. When considering the demand for soft drinks the substitution effect may be important.

9.1.3 Market Demand

If the good has nonattenuated property rights (they are exclusive), the individuals' demand functions can be summed horizontally to obtain the market demand function. This was described in Section III to review the idea note Figure IV.A.8 (Displayed originally as Figure III.A.2).

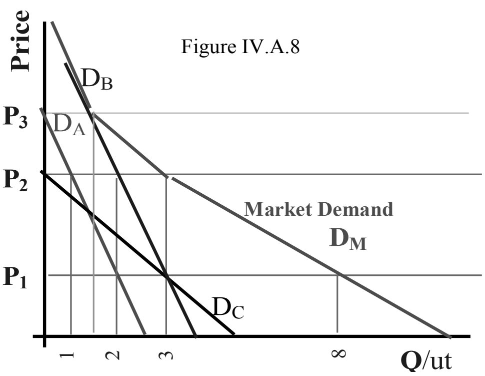


Table III.A.2

Computation of Market Demand by Horizontal Summation of Individual Demand Functions.				
Price	Ann's Demand	Bob's Demand	Cathy's Demand	Market Demand
P_1	2	3	3	8
P_2	1	0	2	3
P_3	0	0	1.5	1.5

9.1.4 Consumer Surplus

The demand function can be viewed as the maximum that someone is willing an able to pay for each unit of a good. In Figure IV.A.9 someone is

In the graph to the right, the supply and demand functions establish the equilibrium price at $5. Consumers are willing and able to pay more than $5 for all units up to the 10th unit. The difference between the market price and what the consumers are willing and able to pay is called ***consumer surplus***. The area PER (in yellow) can be visualized as consumer surplus.
If the market price were $5, note that the sellers are willing to produce and offer for sale the first 10 units at a cost less than $5. This is called ***producer surplus***. It is area CEP (in blue).
The sum of consumer surplus and producer surplus is a measure of social welfare. The market has maximized the well being of both consumers and producers.

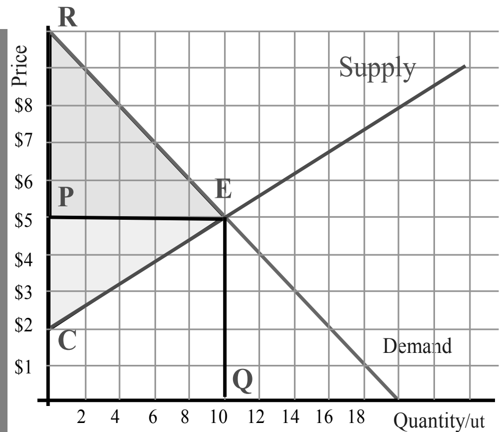


Figure IV.A.9

willing and able to pay $9 or more for the first 2 units. If the market price were at equilibrium ($5 in this graph), the consumer would pay $5 while they were willing to pay in excess of $9 for each of the two units. Therefore, they received more utility (that they were willing and able to pay for) than they had to pay. The difference between the reservation price of the buyer (the maximum the buyers are willing and able to pay for each unit) and the market price is called consumer surplus.

9.1.5 Producer Surplus

The welfare of the producers can be shown in a similar manner. The supply function represents the minimum price the sellers will accept for each unit. Therefore, the difference between the market price and the reservation price of the seller (the minimum the seller will accept for each unit) represents producer surplus. This is represented by area CEP in Figure IV.A.9.

9.1.6 ELASTICITY

Elasticity is a tool that is used to describe the relationship between two variables. Decision makers would like to describe how a change in price might alter the quantity demanded. A measure of this relationship is called the "***own" price elasticity*** of demand. It is also useful to describe how a change in buyers' income shifts the demand function for a good: this measure is called ***income elasticity***. When the price of a related good (substitute or compliment) changes, the demand for a good will shift. ***Cross elasticity*** is a measure of the responsiveness of buyers of a good to changes in the prices of related goods.

Elasticity is defined as

$$E = \frac{percentage \quad change \quad of \quad the \quad dependent \quad variable}{percentage \quad change \quad of \quad the \quad independent \quad variable}$$

This is the percentage change in the dependent variable caused by a percentage change in the independent variable.

(A) "OWN" PRICE ELASTICITY OF DEMAND [EP OR ϵP]

I. DEFINITION OF E_P

The "own" price elasticity of demand is sometimes called price elasticity or price elasticity of demand. The price elasticity of demand measures the responsiveness of buyers to changes in the goods "own" price. It reflects a movement along a given demand function or a change in quantity demanded. For illustrations of elasticity the demand function will be a linear function: Q = 10 – 1P. This simple demand function can also be expressed P = 10 – 1Q. It is important to note that less simple functions may not have this property. The graphical representation of this demand function (Q = 10 –1P) is shown in Figure IV.A.10.

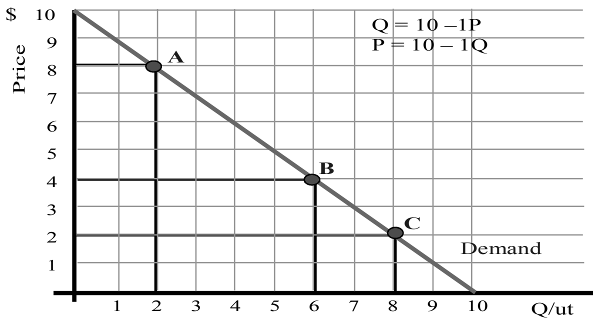


Figure IV.A.10

II. CALCULATION OF E_P

Price elasticity measures the percentage change in the quantity demanded "caused" by a percentage change in the price. In Figure IV.A.10, when the price of the good is $4 (at point B), six units will be purchased. Should the price increase to $8 (point A), the quantity purchased will decrease to 2 units. A decrease in price to $2 will cause an increase in the quantity demanded to 8 units of the good (point C).

Notice that as the price increases from $4 to $8 (a + 100% ΔP), there is a change in quantity from 6 units to 2 units (a - 67% ΔQ). Using the definition of price elasticity,

$$E_P = \frac{\%\Delta Q}{\%\Delta P} = \frac{-67}{+100} = -.67$$

At the price of $4, the coefficient of "own" price elasticity of demand is -.67. This is the elasticity at a point on the demand (point B) for a specific price ($4) and quantity (6 units).

A formula for calculating point price elasticity is:

$$E_P = \frac{\dfrac{Q_1 - Q_2}{Q_1}}{\dfrac{P_1 - P_2}{P_1}} = \frac{\dfrac{\Delta Q}{Q_1}}{\dfrac{\Delta P}{P_1}} = \frac{\Delta Q}{\Delta P} x \frac{P_1}{Q_1}$$

$$\begin{aligned}
&Q_1 = 6 \text{ units},\ P_1 = \$4 \\
&Q_2 = 8 \text{ units},\ P_2 = \$2 \\
&\Delta Q = +2,\ \Delta P = -2 \\
&E_P = \frac{\Delta Q}{\Delta P} * \frac{P_1}{Q_1} = \frac{+2}{-2} * \frac{4}{6} = -1 * \frac{4}{6} = -.67
\end{aligned}$$

Calculating the EP for a price change from $4 to $2 in Figure IV.A.10 , a move from point B to point C:

Note that the E_P is the same whether the price is increased from $4 to $8 or decreased from $4 to $2. The magnitude of the change does not affect the E_P either. The coefficient of "own" price elasticity is unique to each point on the demand function. To calculate EP as the price falls from $8 to $4 (a move from point A to point B in Figure IV.A.10):

$$Q_1 = 2\ units,\ P_1 = \$8$$
$$Q_2 = 6\ units,\ P_2 = \$4$$
$$\Delta Q = +4,\ \Delta P = -4$$
$$E_P = \frac{\Delta Q}{\Delta P} * \frac{P_1}{Q_1} = \frac{+4}{-4} * \frac{8}{2} = -1 * \frac{4}{1} = +-2$$

E_P at \$8 is –2, at \$4 it is -.67. The coefficient is different at every point on the demand function even though the slope of the demand function is the same at every point. E_P is determined by the slope of the demand $[\Delta Q \Delta P]$ and the location on the demand $[P_1 Q_1]$.

The demand, E_P at every price, and total revenue (TR) are displayed in Table IV.3.

Table IV.3 Q = 10 – 1P Demand, E_P and Total Revenue (TR)			
Price	Quantity	E_P	TR
\$0	10	0	0
\$1	9	-0.11	\$9
\$2	8	-0.25	\$16
\$3	7	-0.43	\$21
\$4	6	-0.67	\$24
\$5	5	- 1.00	\$25
\$6	4	- 1.50	\$24
\$7	3	- 2.33	\$21
\$8	2	- 4.00	\$16
\$9	1	- 9.00	\$9
\$10	0	undefined	0

The information in Table IV.3, The absolute value of E_P can be categorized by its relationship to 1. Table IV.4 shows the categories of elastic, unitary elasticity and inelastic coefficients.

- When $|E_p| > 1$, we call demand *elastic*, the percentage change in quantity is greater than the percentage change in price. When demand is elastic price and total revenue (TR) move in opposite directions. When $\Delta P > 1$, TR will decrease: when $\Delta P < 1$, TR will increase.
- When $|E_p| < 1$, we call demand *inelastic*, the percentage change in quantity is less than the percentage change in price. When demand is inelastic, price and TR move in the same direction. When $\Delta P > 1$, TR will increase: when $\Delta P < 1$, TR will decrease.
- Where $|E_p| = 1$, TR will be a maximum. This is called *unitary elasticity*

Table IV.4

Q = 10 – 1P

Demand, E_P and Total Revenue (TR)

Price	Quantity	$\|E_P\|$	TR
$0	10	0<1 (inelastic)	0
$1	9	.11<1 (inelastic)	$9
$2	8	.25<1 (inelastic)	$16
$3	7	.43<1 (inelastic)	$21
$4	6	.67<1 (inelastic)	$24
$5	5	1 = 1 (unitary)	$25
$6	4	1.50>1 (elastic)	$24
$7	3	2.33>1 (elastic)	$21
$8	2	4.00>1 (elastic)	$16
$9	1	9.00>1 (elastic)	$9
$10	0	undefined	0

To solve the problem of a different coefficient of price elasticity at every price, average or "arc" elasticity between two prices will be used. The two prices should represent reasonable upper and lower bounds that the price might be expected to fall between.

The average or "arc" price elasticity is calculated by:

$$E_{P\text{arc}} = \frac{\Delta \mathrm{Q}}{\Delta \mathrm{P}} * \left(\frac{P_1 + P_2}{Q_1 + Q_2} \right)$$

If the price of the good in the example were expected to generally be between \$2 and \$4, the average elasticity would be calculated:

The average elasticity between \$2 and \$4 is - .43 and is inelastic. An increase in the price in this range will increase TR. A decrease in price will decrease TR.

$$\begin{aligned}
&Q_1 = 6 \text{ units},\ P_1 = \$4 \\
&Q_2 = 8 \text{ units},\ P_2 = \$2 \\
&\Delta Q = +2,\ \Delta P = -2 \\
&E_P = \frac{\Delta Q}{\Delta P} * \frac{P_1 + P_2}{Q_1 + Q_2} = \frac{+2}{-2} * \frac{4+2}{6+8} = -1 * \frac{6}{14} = -.43
\end{aligned}$$

III MID-POINT AND EP

A useful short cut to understanding the relative elasticity along a demand function is to use the mid-point. For any linear demand function the mid-point can be located by dividing the Q-intercept (or P-intercept) by 2. In Figure IV.A.11 the mid-point is at 5 units and \$5. At this quantity (and price), E_P will be unitary or its absolute value is 1. This will also be the maximum of

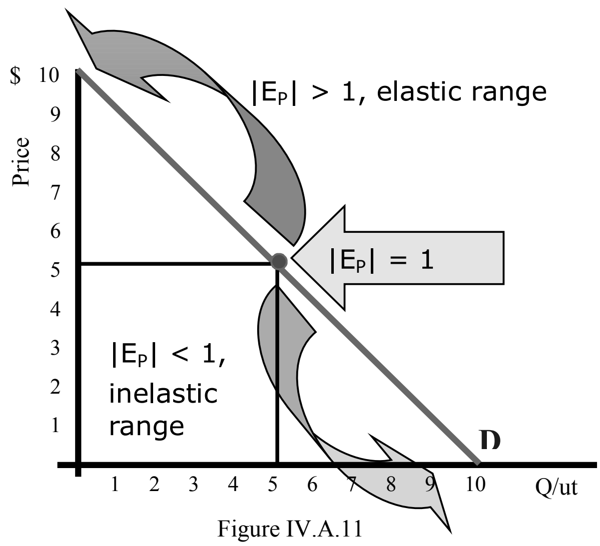


Figure IV.A.11

the total revenue (TR). The “top” half the linear demand function (at higher prices) will be elastic. The "lower" half the demand function (lower prices) will be inelastic.

IV PRICE ELASTICITY AND TOTAL REVENUE

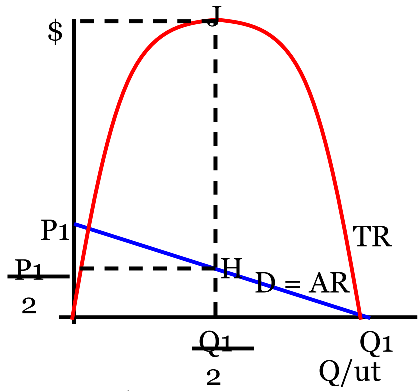


Figure IV.A.11.5

The demand function is a relationship between price and quantity. Price elasticity is determined by the slope of the demand function and the location (price and quantity) on the demand function. Total Revenue (TR) is the product of price and quantity. (TR = PQ). As a consequence, demand, E_P and TR are related. Table IV.4 shows the relationships. The demand function is elastic in the upper portion. At the mid-point of a linear demand function, E_P is unitary ($E_P = -1$). It is also at this mid-point that TR will be at a maximum.

In Figure IV.A.11.5, the demand (or average revenue, AR) has a Q-intercept of Q_1 and a P-intercept of P_1. At point H (the mid-point of the demand at one half P_1 and Q_1) the value of E_P is −1. The upper portion of the demand is elastic. Note that the demand has a negative slope and TR has a positive slope. This will help you remember that price and TR move in the opposite directions. As price rises, TR will decrease. As price decreases, TR will increase. In the lower portion, the demand is inelastic. Both TR and demand have negative slopes. As price increases, TR will rise. As price falls, TR will decrease. The maximum value of TR will occur at the quantity were E_P is unitary. The maximum value of TR is at point J. The slope of TR at this point is 0.

Price elasticity is useful to explain the relationship of price and TR. It does not provide information about profits. Profits (Π) are defined as total revenue minus total costs ($\Pi \equiv TR - TC$). To determine the output and price that result in maximum profits, we must know both TR and TC.

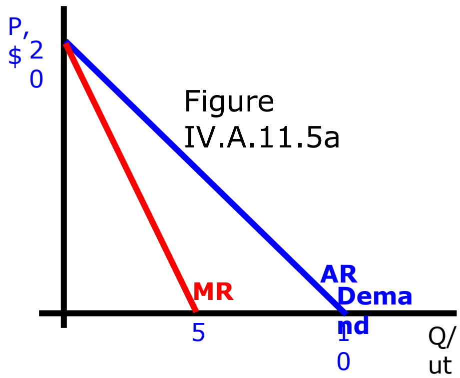
Demand (D) is a functional relationship between price and quantity that will be purchased. Total revenue (TR) is the product of price and quantity. (TR = PQ). Therefore, the demand for a firm's product determines the revenues the firm

$$\text{Average Revenue} = \text{AR} = \frac{\text{TR}}{Q}$$

obtains from the sale of its output.

The average revenue (AR) and marginal revenue (MR) are also of interest in the analysis of a firm's behavior. AR is the revenue per unit sold. It is calculated by dividing the total revenue by the quantity,

Marginal revenue (MR) is the change in TR caused by a (1 unit) change in the quantity sold.



$$\text{Marginal Revenue} = \text{MR} = \frac{\Delta \text{TR}}{\Delta Q}$$

Consider an example demand function P = 20-2Q (shown in Figure IV.A.11.5a).

Total revenue is TR = PQ, and P=20-2Q.

By substitution,

$$TR=(20-2Q)Q = 20Q-2Q^2$$

Average revenue the revenue per unit,

$$AR = \frac{TR}{Q} = \frac{20Q - 2Q^2}{Q} = 20 - 2Q$$

Notice that the AR is the same as the demand function. This will always be true.

Marginal revenue (MR) is defined as the change in TR caused by a one unit

$$MR = \frac{\Delta TR}{\Delta Q} \approx \frac{dTR}{dQ} = 20 - 4Q$$

change in the quantity.

Notice that the MR function (MR = 20 – 4Q) has twice the slope as the demand (D) and AR functions. Since MR decreases twice as fast as AR (or D), it will intersect the Q axis halfway between the origin and the intercept of the AR function. Note that if the slope of the Demand were 0, and the MR fell at twice the rate, the slope of MR would also be 0 (2 times 0 is still 0). As a result when the demand is perfectly elastic (has a slope of 0, demand is horizontal) the AR and MR will coincide.

Profits (∏) are defined as the difference between the total revenue (TR) and total cost (TC), ∏ = TR –TC. The relationship between demand an revenue

V DETERMINANTS OF E_P

Price Elasticity of demand is influenced by:

1. Availability of substitutes

   Generally, the more substitutes that are available, the more elastic the demand for a good. The demand for a class of goods (soft drinks) is usually more inelastic than the demand for a specific brand of the good (Pepsi or Coca-Cola). A Firm may try to differentiate their product to make the demand relatively more inelastic.

2. Proportion of item in budget

   When the expenditures on a product are a relatively small portion of a budget, the demand is relatively more elastic.

3. Time available to adapt

   The longer that consumers or buyers have to make adjustments in their behavior, the more elastic the demand is likely to be. The absolute value of the short run price elasticity of demand for gasoline would be smaller than the absolute value of the long run price elasticity of demand. The longer time allows consumers more opportunity to adjust to price changes.

VI INTERPRETATION OF E_P

Some examples of price elasticities of demand reported in *Microeconomics for Today*, [Tucker, p 123, South-Western College Publishing, 1999. Sources Archibald and Gillingham, Houthakker and Taylor, Voith] are presented in Table IV.5. Note that the demand is relatively more elastic for longer periods. Some goods, like movies, are inelastic in the short run and elastic in the long run.

The coefficient or price elasticity can be used to estimate the percentage change in the quantity that consumers are willing and able to buy given a percentage change in the price. It is important to understand that this measure does not apply to the equilibrium conditions in the market.

Table IV.5 **Selected Price Elasticities**		
Item	Short Run E_P	Long Run E_P
Automobiles	-1.87	-2.24
Movies	-.087	-3.67
Medical Care	-.31	-.92
Gasoline	-.20	-.70

In Table IV.5 the short run E_P for gasoline is -.2. This suggests that a 1% increase in price will reduce the quantity demanded by .2%. A 10% decrease in price would increase the quantity demanded by 2%. In the case of movies, a 1% increase in the price would change the quantity demanded by 3.67% in the long run.

(B) INCOME ELASTICITY OF DEMAND

The responsiveness of buyers to changes in their incomes is measured by income elasticity. While E_P measures a movement along a demand function as the price changes, income elasticity (E_M) measure a shift of the demand function caused by a change in income.

Income elasticity (E_M) is defined:

$$\left[E_M \equiv \frac{\Delta\ Q}{\Delta\ \text{Income}} \right]$$

In Figure IV.A.12 the original demand function is represented as **D**. $\mathbf{D_1}$ represents a decrease in demand (at each price a smaller quantity is purchased. When a larger quantity is purchased at each price, this will represent an increase of demand to $\mathbf{D_2}$.

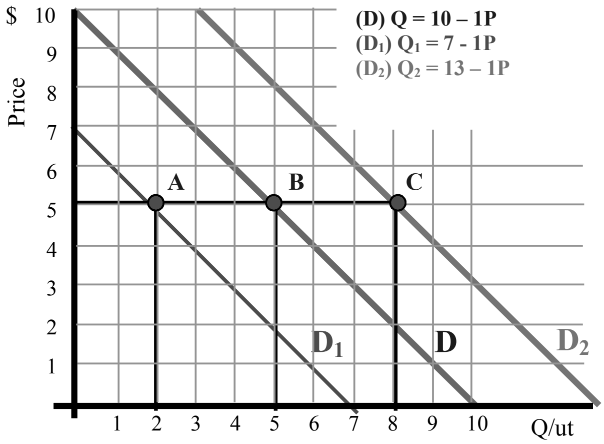


Figure IV.A.12

Given the original demand function (**D**), consumers are willing and able to purchase 5 units of the good. If income increased by 50% and "caused" the demand to shift to **D_2**, where 8 units are purchased at $5. This is a 60% increase in demand. Income elasticity (E_M) is calculated:

$$E_M = \frac{\%\Delta Q}{\%\Delta M} = \frac{+60}{+50} = +1.2$$

In this case, an increase in income resulted in an increase in demand. A decrease in income might decrease the demand (to **D_1**). In this case income

$$E_M = \frac{\%\Delta Q}{\%\Delta M} = \frac{-60}{-50} = +1.2$$

elasticity would be

When E_M is positive, the good is called a normal good. If an increase in income reduces demand (or a decrease in income increases demand), E_M will be negative and the good is categorized as an inferior good.

a. $E_M < 0$ means the good is inferior, i.e. for an increase in income the quantity purchased will decline or for a decrease in income the quantity purchased will increase

b. $1 > E_M > 0$ means the good is a normal good, for an increase in income the quantity purchased will increase but by a smaller percentage than the percentage change in income.

c. For $E_M > 1$ the good is considered a superior good.

CROSS ELASTICITY

Cross elasticity (E_{XY}) is used as a measure of the relationship between two goods. E_{XY} is defined as:

$$E_{XY} \equiv \frac{\% \Delta Q_x}{\% \Delta P_y}$$

Consider two goods that are substitutes: butter and margarine. Cross elasticity cam be used to measure the relationship between the price of butter and the demand for margarine ($E_{Margarine\text{- } butter}$) or the relationship between the demand for butter and the price of margarine ($E_{butter\text{-}margarine}$). The value of E_{XY} is not the same as or equal to E_{YX}. In Figure IV.A.13 the concept of E_{XY} is shown.

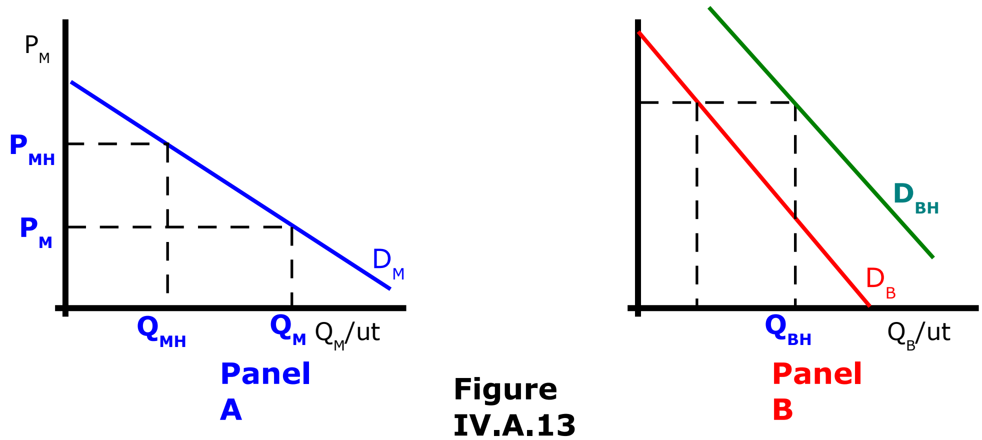


Figure IV.A.13

In panel A, the demand for margarine (D_M) is shown. At a price of P_M, the quantity demanded is Q_M. In Panel B, the demand for butter (D_B) is shown. At a price of P^B, the quantity demanded is Q_B. If the price of margarine increased to P_{MH} (in Panel A), the quantity of margarine demanded decreases to Q_{MH}. Since less margarine is purchased, the demand for butter increases to D_{BH} (in Panel B). Given the higher demand for butter the butter demanded (given the higher price of margarine) has increased. A decrease in the price of margarine would shift the demand for butter to the left (decrease). The coefficient of cross elasticity would be positive.

In the case of complimentary goods, an increase (decrease) in the price of tennis balls would reduce (increase) the demand for tennis rackets. The coefficient of cross elasticity would be negative. If E_{XY} is close to zero, that would be evidence that the two goods were not related. If E_{XY} were positive or negative and significantly different from zero, it could be used as evidence that the two goods are related. It is possible that E_{XY} might be positive or negative and the two goods are not related. The price of gasoline has gone up and the demand for PC's has also increased. This does not mean that gasoline and PC's are substitutes.

- When $\mathbf{E_{xy} > 0}$, [a positive number] this suggests that the two goods are substitutes
- When $\mathbf{E_{xy} < 0}$, [a negative number] this suggests that the two goods are compliments

9.1.6.1 Elasticity and Buyer Response

Elasticity is a convenient tool to describe how buyers respond to changes in relevant variables. Price elasticity (E_P) measures how buyers respond to changes in the price of the good. It measures a movement along a demand function. It is used to describe how much more of less the quantity demanded is as the price falls or rises.

Income elasticity (E_M) is a measure of how much the demand function shifts as the income(s) of the buyer(s) changes. Cross elasticity (EXY) measures how much changes in the price of a related good will shift the demand function.

Elasticity can be calculated to estimate the relationship between any two related variables.

10 Production and Cost

Decisions about production require individual agents to make decisions about the allocation and use of physical inputs. Objectives of agents, technology, availability and quality of inputs determine the nature of these decisions. Since the objectives are often pecuniary, it is often necessary to relate the decisions about the physical units of inputs and outputs to the costs of production.

If the prices of the inputs and the production relationships are known (or understood), it is possible to calculate or estimate all the cost relationships for each level of output. In practice however, the decision maker will probably have partial information about some of the costs and will need to estimate production relationships in order to make decisions about the relative amounts of the different inputs to be used.

10.1 Production

Production is the process of altering resources or inputs so they satisfy more wants. Before goods can be distributed or sold, they must be produced. Production, more specifically, the technology used in the production of a good (or service) and the prices of the inputs determine the cost of production. Within the market model, production and costs of production are reflected in the supply function.

Production processes increase the ability of inputs (or resources) to satisfy wants by:

- a change in physical characteristics
- a change in location
- a change in time
- a change in ownership

At its most simplistic level, the economy is a social process that allocates relatively scarce resources to satisfy relatively unlimited wants. To achieve this objective, inputs or resources must be allocated to those uses that have the greatest value. In a market setting, this is achieved by buyers (consumers) and sellers (producers) interacting. Consumers or buyers wish to maximize their utility or satisfaction given (or constrained by) their incomes, preferences and the prices of the goods they may buy. The behavior of the buyers or consumers is expressed in the demand function. The producers and/or sellers have other objectives. Profits may be either an objective or constraint. As an objective, a producer may seek to maximize profits or minimize cost per unit. As a constraint the agent may desire to maximize "efficiency," market share, rate of growth or some other objective constrained by some "acceptable level of profits. In the long run, a private producer will probably find it necessary to produce an output that can be sold for more than it costs to produce. The costs of production (Total Cost, TC) must be less than the revenues (Total Revenue, TR).

Given a production relationship (Q = f (labor, land, capital, technology, …)) and the prices of the inputs, all the cost relationships can be calculated. Often, in the decision making process, information embedded in cost data must be interpreted to answer questions such as:

- "How many units of a good should be produced (to achieve the objective)?"
- "How big should may plant be?' or How many acres of land should I plant in potatoes?"

Once the question of plant size is answered, there are questions,

- "How many units of each variable input should be used (to best achieve the objective)?"
- "To what degree can one input be substituted for another in the production process?"

The question about plant size involves long run analysis. The questions about the use of variable inputs relate to short-run analysis. In both cases, the production relationships and prices of the inputs determine the cost functions and the answers to the questions.

Often decision-makers rely on cost data to choose among production alternatives. In order to use cost data as a "map" or guide to achieve production and/or financial objectives, the data must be interpreted. The ability to make decisions about the allocation and use of physical inputs to produce physical units of output (Q or TP) requires an understanding of the production and cost relationships.

The production relationships and prices of inputs determine costs. Here the production relationships will be used to construct the cost functions. In the decision making process, incomplete cost data is often used to make production decisions. The theory of production and costs provides the road map to the achievement of the objectives.

10.1.1 (1) Production Unit

In the circular flow diagram found in most principles of economics texts, production takes place in a "firm" or "business." When considering the production-cost relationships it is important to distinguish between firms and plants. A plant is a physical unit of production. The plant is characterized by physical units of inputs, such as land ® or capital (K). This includes acres of land, deposits of minerals, buildings, machinery, roads, wells, and the like. The firm is an organization that may or may not have physical facilities and engage in production of economic goods. In some cases the firm may manage a single plant. In other instances, a firm may have many plants or no plant at all.

The cost functions that are associated with a single plant are significantly different from those that are associated with a firm. A single plant may experience economies in one range of output and diseconomies of scale in another. Alternatively, a firm may build a series of plants to achieve constant or even increasing returns. General Motors Corp. is often used as an example of an early firm that used decentralization to avoid rising costs per unit of output in a single plant.

Diversification is another strategy to influence production and associated costs. A firm or plant may produce several products. Alfred Marshall (one of the early Neoclassical economists in the last decade of the 19^{th} century) considered the problem of "joint costs. " A firm that produces two outputs (beef and hides) will find it necessary to "allocate" costs to the outputs.

Unless specifically identified, the production and cost relationships will represent a single plant with a single product.

10.1.2 (2) Production Function

A production function is a model (usually mathematical) that relates possible levels of physical outputs to various sets of inputs, eg. Q = f (Labor, Kapital, Land, technology, . . .). To simplify the world, we will use two inputs Labor (L) and Kapital (K) so,

Q = f (L, K, technology, ...).

Here we will use a Cobb-Douglas production function that usually takes the form: $\mathbf{Q = AL^aK^b}$. In this simplified version, each production function or process is limited to increasing, constant or decreasing returns to scale over the range of production. In more complex production processes, "economies of scale" (increasing returns) may initially occur. As the plant becomes larger (a larger fixed input in each successive short-run period), constant returns may be expected. Eventually, decreasing returns or "diseconomies of scale" may be expected when the plant size (fixed input) becomes "too large." This more complex production function is characterized by a long run average cost (cost per unit of output) that at first declines (increasing returns), then is horizontal (constant returns) and then rises (decreasing returns).

10.1.3 (3) Time and Production

As the period of time is changed, producers have more opportunities to alter inputs and technology. Generally, four time periods are used in the analysis of production:

"**market period**" -
A period of time in which the producer cannot change any inputs nor technology can be altered. Even output (Q) is fixed.

"**Short-run**"-
A period in which technology is constant, at least one input is fixed and at least one input is variable.

"**Long-run**" -
A period in which all inputs are variable but technology is constant.

"**The very Long-run**" -
During the very long-run, all inputs and technology change.

Most analysis in accounting, finance and economics is either long run or short-run.

10.1.4 (4) Production in the Short-Run

In the short-run, at least one input is fixed and technology is unchanged during the period. The fixed input(s) may be used to refer to the "size of a plant." Here K is used to represent capital as the fixed input. Depending on the production process, other inputs might be fixed. For heuristic purposes, we will vary one input. As the variable input is altered, the output (Q) changes. The relationship between the variable input (here L is used for "labor") and the output (Q) can be viewed from several perspectives.

The short-run production function will take the form

$$\mathbf{Q = f\,(L)}, \text{ K and technology are fixed or held constant}$$

A change in any of the fixed inputs or technology will alter the short-run production function.

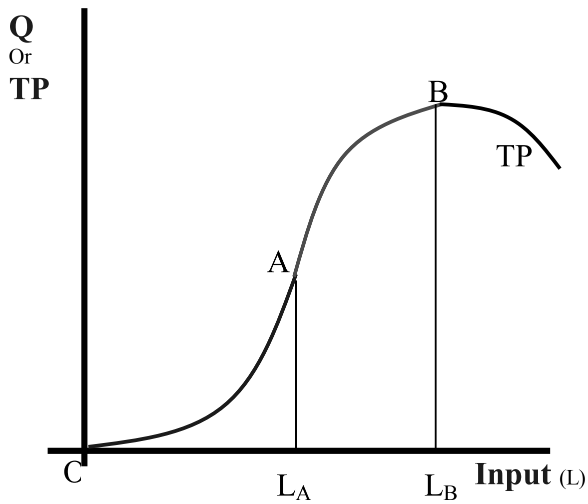


Figure V.1

In the short run, the relationship between the physical inputs and output can be describes from several perspectives. The relationship can be described as the total product, the output per unit of input (the average product, AP) or the change in output that is attributable to a change in the variable input (the marginal product, MP).

Total product (**TP** or **Q**) is the total output. Q or TP = f(L) given a fixed size of plant and technology.

Average product (**AP_L**) is the output per unit of input. AP = TP/L (in this case the output per worker). **AP_L** is the average product of labor.

$$AP_L = \frac{\text{output}}{\text{Input}} = \frac{TP}{L} = \frac{Q}{L}$$

Marginal Product (**MP_L**) is the change in output "caused" by a change in the variable input (L),

$$MP_L = \frac{\Delta TP}{\Delta L} = \frac{\Delta Q}{\Delta L}$$

(A) TOTAL AND MARGINAL PRODUCT

Over the range of inputs there are four possible relationships between Q and L

(1) TP or Q can increase at an increasing rate. MP will increase, (In Figure V.1 this range is from O to L_A.)

(2) TP may pass through an inflection point, in which case MP will be a maximum. (In Figure V.1, this is point A at L_A amount of input.) TP or Q may increase at a constant rate over some range of output. In this case, MP will remain constant in this range.

(3) TP might increase at a decreasing rate. This will cause MP to fall. This is referred to as "diminishing MP." In Figure V.1, this is shown in the range from L_A to L_B.

(4) If "too many" units of the variable input are added to the fixed input, TP can decrease, in which case MP will be negative. Any addition of L beyond L_B will reduce output: the MP of the input will be negative. It would be foolish to continue adding an input (even if it were "free") when the MP is negative.

The relationship between the total product (TP) and the marginal product (MP) can be shown. In Figure V.2, note that the inflection point in the TP function is at the same level of input (L_A) as the maximum of the MP. It is also important to understand that the maximum of the TP occurs when the MP of the input is zero at L_B.

(B) AVERAGE, MARGINAL AND TOTAL PRODUCT

The average product (AP) is related to both the TP and MP. Construct a ray (OR in Figure V.2) from the origin to a tangent point (H) on the TP. This will locate the level of input where the AP is a maximum, L_H. Note that at L_H level of input, AP_L is a maximum and is equal to the MP_L. When the MP is greater than the AP, MP "pulls" AP up. When MP is less than AP, it "pulls" AP down. MP will always intersect the AP at the maximum of the AP.

Figure V.2

In **Figure V.2**, the total product (TP) function is shown in the upper panel. TP = f (L) This is a short run function which implies that there is a set of fixed inputs (a scale of plant) and a given state of technology.

The TP initially increases at an increasing rate. This may be caused by specialization and division of labour. At point A there is an inflection point in the TP function. Beyond L_A amount of labour, the TP increases at a decreasing rate until it reaches a maximum at point B. If additional units of labour are used beyond L_B, the output (Q or TP) will decline.

In the lower panel of Figure V.2 the average product (AP) and marginal product (MP) are shown. At L_A amount of labour (determined by the inflection point in TP at point A in the top panel), the MP will reach a maximum at point A'. When the TP increases at an increasing rate, MP rises. When TP increases at a decreasing rate, MP decreases. When TP is a maximum, MP is zero at point B' in the lower panel. MP is the slope of the TP function.

At L_H amount of labour the AP will be a maximum at point H'. this is consistent with the tangency of the ray from the origin with the TP function in the top panel. When the AP is a maximum it will be equal to the MP.

When MP >AP, AP will increase. When MP<AP, the AP will decrease.

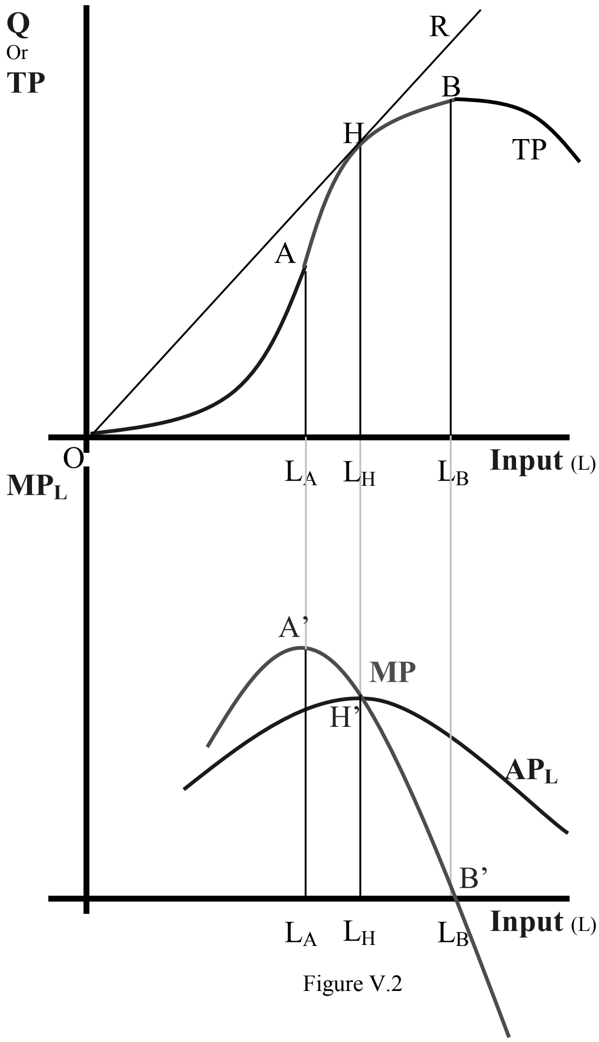


Figure V.2

$$Technical\ \ Efficiency = \frac{Output}{Input}$$

Technical efficiency was defined as a ratio of output to input,

$$AP = \frac{TP}{L} = \frac{output\ (Q)}{input\ (L,\ given\ K)}$$

The AP is a ratio of TP or Q or output to a variable input and a set of fixed input(s).

The maximum of the AP is the "technically efficient" use of the variable input (L) given plant size. Remember that K is fixed in the short-run.

(C) REVIEW OF PRODUCTION RELATIONSHIPS

In the short-run, as a variable input is added to a fixed input (plant size) the TP may increase at an increasing rate. As TP increases at an increasing rate MP for the variable input will rise. So long as the MP is greater than the AP of the variable input, AP will rise. This range is caused by a more "efficient mix" of inputs. Initially, there is "too much" of the fixed input and not enough of the variable input.

Eventually, as more variable inputs are added there may be an inflection point in the TP. It is also possible that the TP might increase at a constant rate in a range. An inflection point in the TP is where the "curvature" of the TP changes: it is changing from increasing at an increasing rate (concave from above or convex from below) to increasing at a decreasing rate (convex from above or concave from below). At this point, the MP of the variable input will be a maximum. AP will be rising.

At some point, the TP will begin to increase at a decreasing rate. There is "too much variable input" for the fixed input. Productivity of each additional input will be less: MP will fall in this range. AP of the variable input may be greater or less than the MP in this range. If MP is greater than AP, AP will be increasing. If MP is less than AP, AP will be decreasing.

A ray from the origin and tangent to the TP function (line OR in Figure V.2) will identify the level of variable input where the AP will be a maximum. At this point MP will equal AP. Since the fixed input is constant, AP is the equivalent of out measure of technical efficiency for a given scale of plant determined by the fixed input:

$$Tech.\ Efficiency = \frac{output}{input} = \frac{TP}{L\left(given\ \ fixed\ \ input\right)} = \text{AP of the varible input}$$

10.1.5 Cost

Producers who desire to earn profits must be concerned about both the revenue (the demand side of the economic problem) and the costs of production. Profits (Π) are defined as the difference between the total revenue (TR) and the total cost (TC). The concept of "efficiency" is also related to cost.

10.1.5.1 (1) Opportunity Cost

The relevant concept of cost is "opportunity cost." This is the value of the next best alternative use of a resource or good. It is the value sacrificed when a choice is made. A person who opens their own business and decides not to pay himself or herself any wages must realize that there is a "cost" associated with their labor, they sacrifice a wage that they could have earned in some other use.

A worker earns a wage based on their opportunity cost. An employer must pay a worker a wage that is equal to or greater than an alternative employer would pay (opportunity cost) or the worker would have an incentive to change jobs. Capital has a greater mobility than labor. If a capital owner can earn a higher return in some other use, they will move their resources. The opportunity cost for any use of land is its next highest valued use as well. It is also crucial to note that the entrepreneur also has an opportunity cost. If the entrepreneur is not earning a "normal profit" is some activity they will seek other opportunities. The normal profit is determined by the market and is considered a cost.

10.1.5.2 (2) Implicit and Explicit Cost

The opportunity costs associated with any activity may be **explicit**, out of pocket, expenditures made in monetary units or **implicit** costs that involve sacrifice that is not measured in monetary terms. It is often the job of economists and accountants to estimate implicit costs and express them in monetary terms. Depreciation is an example. Capital is used in the production process and it is "used" up, i.e. its value depreciates. Accountants assume the expected life of the asset and a path (straight line, sum of year's digits, double declining, etc) to calculate a monetary value.

In economics both implicit and explicit opportunity costs are considered in decision making. A "normal profit" is an example of an implicit cost of engaging in a business activity. An implied wage to an owner-operator is an implicit opportunity cost that should be included in any economic analysis.

10.1.6 Costs and Production in the Short-Run

If the short-run production function (Q =f(L) given fixed input and technology) and the prices of the inputs are known, all the short-run costs can be calculated. Often the producer will know the costs at a few levels of output and must estimate or calculate the production function in order to make decisions about how many units of the variable input to use or altering the size of the plant (fixed input).

Fixed Cost (**FC**) is the quantity of the fixed input times the price of the fixed input. FC is total fixed cost and may be referred to as TFC.

Average Fixed Cost (**AFC**) is the FC divided by the output or TP, Q, (remember Q=TP). AFC is fixed cost per Q.

Variable Cost (**VC**) is the quantity of the variable input times the price of the variable input. Sometimes VC is called total variable cost (TVC).

Average Variable Cost (**AVC**) is the VC divided by the output, AVC = VC/Q. It is the variable cost per Q.

Total Cost (**TC**) is the sum of the FC and VC.

Average Total Cost (**AC** or **ATC**) is the total cost per unit of output. AC = TC/Q.

Marginal cost (**MC**) is the change in TC or VC "caused" by a change in Q (or TP). Remember that fixed cost do not change and therefore do not influence MC. In Principles of Economics texts and courses MC is usually described as the change in TC associated with a one unit change in output,

$MC = \frac{\Delta TC}{\Delta Q}$ (for infinitely small ΔQ, $MC = \frac{dTC}{d\,Q}$)

MC will intersect AVC and AC at the minimum points on each of those cost functions.

10.1.7 Graphical Representations of Production and Cost Relationships

The short-run, total product function and the price of the variable input(s) determine the variable cost (VC or TVC) function.

In Figure V.3, the short-run TP function and VC function are shown.

Figure V.3

In Figure V.3 the production relationship is linked to the variable cost. In the upper panel, the TP function is shown.

Q = f(L)

(Given fixed input and technology)

TP initially increases at an increasing rate to point A where L_A amount of variable input is used. There is an inflection point at point A. TP then increases at a decreasing rate to a maximum at point B produced by L_B amount of input. Beyond L_B amount of input the TP declines.

Using L_A amount of labour, Q_A amount of output is produced. At input level L_B, Q_B output results.

In the lower panel, VC is expressed as a function of Q,

VC = f(Q)

(Given fixed input and technology)

The vertical axis, (TP or Q) in the upper panel becomes the horizontal axis (Q) in the lower panel.

The horizontal axis (L) in the upper panel is multiplied by the P_L and becomes the vertical axis in the lower panel.

The VC function is the TP function "rotated and looked at from the back side."

When the TP increases at an increasing rate, the VC increases at a decreasing rate.

When the TP increases at a decreasing rate, VC will increase at an increasing rate.

When the TP decreases at the quantity of input increases, the VC would increase while output would decrease.

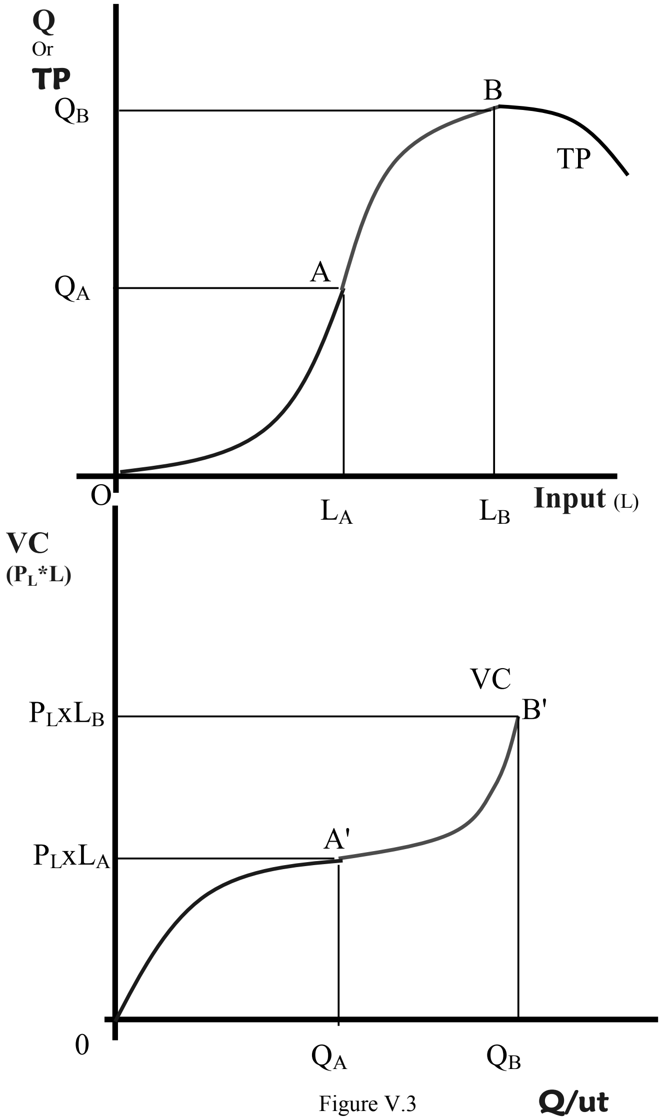


Figure V.3

In the range from 0 to L_A amount of labor, the output increases from 0 to Q_A. TP increases at an increasing rate in this range. The MP_L is increasing as additional units of labor are added. Since the VC (total variable cost) is the price of labor times the quantity of labor used (LP_L), VC will increase at a decreasing rate. The MC will be decreasing in this range.

In the range from L_A to L_B amount of labor the output rises from Q_A to Q_B, TP increases at a decreasing rate (MP will be decreasing in this range.). Variable cost (VC) will increase at an increasing rate (MC will be rising).

At the inflection point (A) in the production relationship, MP will be a maximum. This is consistent with the inflection point (A′) in the VC function.

At the maximum of TP (L_B amount of labor, output Q_B) at point B, the VC function will "turn back" and as output decreases the VC will continue to rise. A "rational" producer would cease to add variable inputs when those additions reduce output.

10.1.7.1 (1) Variable Cost (VC or TVC) and Average Variable Cost (AVC)

The total variable cost is determined by the price of the variable input and the TP function. The average variable cost is simply the variable cost per unit of output (TP or Q), $\mathrm{AVC} = \frac{\mathrm{VC}}{Q}$.

In Figure V.4 the VC is shown with 3 points identified. A′ is on the TVC at the level of output where there is an inflection point. This will be the same output level were the MC is a minimum. Point C is found by constructing a ray, OM from the origin to a point of tangency on the VC. The level of output will be the minimum of the AVC (also the maximum of the AP). At this point the MC will equal the AVC. When MC is less than AVC, AVC will decline. When MC is greater than AVC,C will rise. MC will always equal AVC at the minimum of the AVC.

Figure V.4

In Figure V.4 The relationships among the variable cost (VC), average variable cost (AVC) and the marginal cost (MC) are shown. In the top panel there are three points that are unique and can be used to identify what is happening to the MC and AVC. At point A′ there is an inflection point in the VC. At point B′ the slope of the VC is infinity. Point C is identified by a ray from the origin that is tangent to the VC at point C.

Point A′ is associated with Q_A amount of output. At Q_A output the MC will be a minimum at A* in the lower panel. As the TP increases at an increasing rate, the MP rises, the VC increases at a decreasing rate and MC decreases. Beyond Q_A output, the TP increases at a decreasing rate, MP falls, VC increases at an increasing rate and MC will increase.

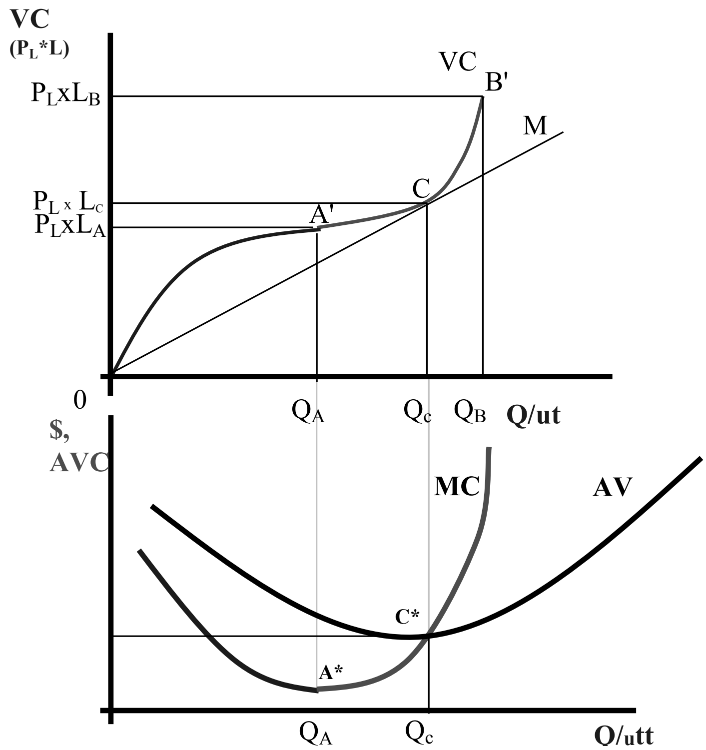


Figure V.4

10.1.7.2 (2) ATC, AVC, MC AND AFC

The fixed cost is determined by the amount of the fixed input and its price. In the short-run the fixed cost does not change. As the output (Q) increases the average fixed cost (AFC) will decline. Since

$$\text{AFC} = \frac{\textit{Fixed Cost}}{Q}$$

as long as Q increases, AFC will decrease, it approaches the Q axis "asymptotically."

The average total cost (ATC) is the total cost per unit of output.

$$ATC = \frac{TC}{Q} = AFC + AVC$$

In Figure V.5, the AFC is shown declining over the range of output. The vertical distance between the ATC and AVC is the same as AFC. The location or shape of the AVC is not related to the AFC.

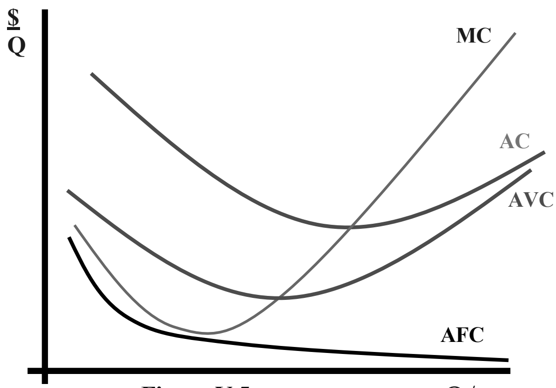


Figure V.5

The MC is not relate to the AFC but will intersect both the AVC and ATC at their minimum points.

10.1.8 Relationship of MC and AVC to MP_L and AP_L

In Figure V.6 there are three panels. The first shows the TP or short-run production function. The second is the marginal (MP) and average (AP) product functions associated with the short-run production function. In the third panel the related marginal cost (MC) and average variable cost (AVC) function are shown.

There are three points easily identifiable on the TP function: the inflection point (A), the point of tangency with a ray from the point of origin (H) and the maximum of the TP (B). Each of these points identifies a level (an amount) of the variable input (L) and a quantity of output. These points are associated with characteristics of the MP and AP functions.

Figure V.6

The average variable cost (AVC) and the average product (AP) are closely related. Marginal cost (MC) reflects the marginal product (MP). In the three panels of Figure V.6, the total product (TP in the upper panel) is related to the AP and MP in the middle panel. The lower panel shows the relationship of average variable cost (AVC) and marginal cost (MC) to AP, MP and TP.

As the variable input (L in this example) increases to L_A the TP in the upper panel increases at an increasing rate to point A. In this range the marginal product (in the middle panel) will rise. When more than L_A amount of the labour input is used, the MP will decrease for each additional unit. The inflection point at A in the upper panel is consistent with the maximum of the MP at point A* in the middle panel.

Point H on the TP function (in the upper panel) is constructed by passing a ray from the origin to a point of tangency on the TP function. This identifies L_H amount of labour. In the middle panel the AP of labour will rise up to L_H amount of input. Notice that in this range the MP is above or greater than the AP. When MP>AP, the AP will be increasing. At point H* in the middle panel, AP will be a maximum. At this point MP = AP.

As the input is increased above L_H, the AP will fall. When MP < AP, AP will be decreasing. At the maximum of the TP (at point B in the upper panel) L_B amount of the variable input is used. At this level of labour (L_B), the MP will be zero. It is important to note that when MP = 0, TP is a maximum.

In the lower panel, MC will be at a minimum at the output level (Q_A) where MP is a maximum (Q_A output at L_A input). AVC will be a minimum at Q_H output. This is where MC=AVC. This is at output level Q_H produced by L_H labour. When AVC is a minimum, AP will be a maximum.

When MC<AVC, AVC will be decreasing. When MC>AVC, AVC will increase. When AVC=MC, AVC is a minimum.

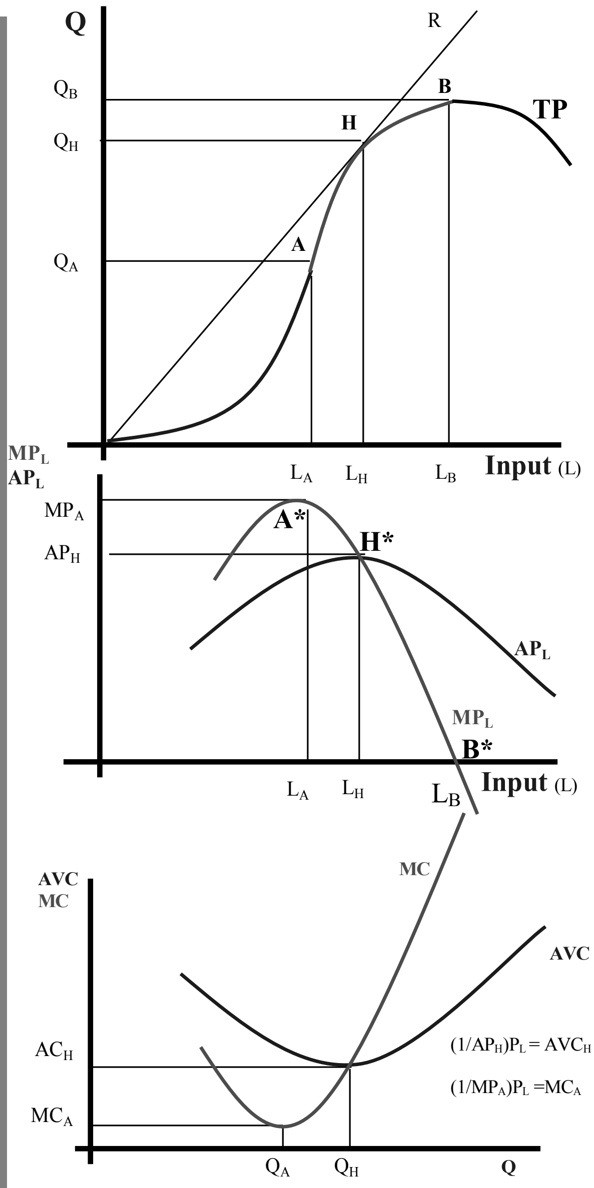


Figure V.6

At point A, with L_A amount of labor and Q_A output the inflection point in TP is associated with the maximum of the MP. This maximum of the MP function is associated with the minimum of the MC.

$$\mathrm{MC} = \frac{1}{\mathrm{MP}_L}(\text{price of labour}).$$

Since MP>AP, the AP is increasing. MC<AVC, so AVC is decreasing.

At point H, the AP is a maximum at this level of input (L_H). At this level of input use the output (QH) has a minimum of the average variable cost (AVC). At this AVC, the MC will equal the MC. Point B represents the level of input (L_B) where the output (Q_B) is a maximum. At this level the MP_L will be zero.

10.1.9 Production and Cost Tables

The data from production functions and the prices of inputs determines all the cost functions. In the following example a short-run production function is given. In the table below the columns K, L and TP reflect short-run production. The plant size is determined by capital (K) that is 5 in the example. Since the P_K = \$3, the fixed cost (FC) is \$15 at all levels of output. The price of the variable input (L) is \$22. The variable cost (VC) can be calculated for each level of input use and associated with a level of output (Q). Total cost (TC) is the sum of FC and VC. The average cost functions can be calculated: AFC = FC/Q, AVC - VC/Q and ATC =AFC + AVC =TC/Q. Given the production function and the prices of the inputs, the cost functions are shown in Table V.1.

Marginal cost in the table is an estimate. Remember that $MC = \frac{\Delta TC}{\Delta Q}$.

Since quantity is not changing at a constant rate of one, the MP will be used to represent ΔQ. This is not precisely MC but is only an estimate.

Table V.1
Production and Cost

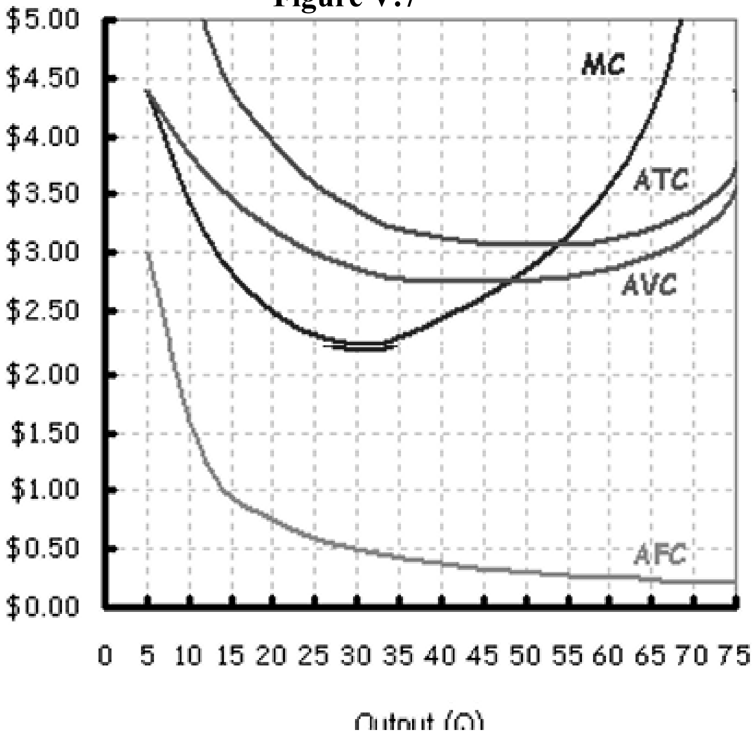
K	L	TP (Q)	MP	FC	VC	TC	≈ MC	AFC	AVC	ATC
5	0	0		$15	$0	$15		#DIV/0!	#DIV/0!	#DIV/0!
5	1	5	5	15	22	37	$4.40	$3.00	$4.40	$7.40
5	2	12	7	15	44	59	3.14	1.25	3.67	4.92
5	3	21	9	15	66	81	2.44	0.71	3.14	3.86
5	4	31	10	15	88	103	2.20	0.48	2.84	3.32
5	5	40	9	15	110	125	2.44	0.38	2.75	3.13
5	6	48	8	15	132	147	2.75	0.31	2.75	3.06
5	7	55	7	15	154	169	3.14	0.27	2.80	3.07
5	8	61	6	15	176	191	3.67	0.25	2.89	3.13
5	9	66	5	15	198	213	4.40	0.23	3.00	3.23
5	10	70	4	15	220	235	5.50	0.21	3.14	3.36
5	11	73	3	15	242	257	7.33	0.21	3.32	3.52
5	12	75	2	15	264	279	11.00	0.20	3.52	3.72
5	13	76	1	15	286	301	22.00	0.20	3.76	3.96
5	14	76	0	15	308	323	#DIV/0!	0.20	4.05	4.25
5	15	75	-1	15	330	345	-22.00	0.20	4.40	4.60

The cost functions constructed from the data in Table V.1 are shown in Figure V.7. Note that the MC intersects the AVC and ATC at the minimum points on those functions. The vertical distance between ATC and AVC is the same as the AFC. The AFC is unrelated to the MC and AVC. In this example the average fixed cost is less than the average variable cost and MC at every level of output. This is coincidence. In some other production process it might be greater at each level of output.

It is relevant that the AVC and MC are equal at the first unit of output. This will always be true. This also means that

$$MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta VC}{\Delta Q}.$$

Figure V.7



10.1.10 Production and Cost in the Long-run

Long-run Production describes a period in which all inputs (and Q) are variable while technology is constant. A Cobb-Douglas production function can be used to describe the relationships. There are a variety of other forms production functions can take, however the Cobb-Douglas is the simplest to describe. A short-run production function (Q = f(L) is a cross section from a long-run production function.

10.1.10.1 (1) Long Run Production

The long run production function is multidimensional, two or more inputs and output changes. If there are 2 inputs and one output, the long run production relationship is 3 dimensional. Using a topological map of "isoquants," three dimensions can be shown in two dimensions.

Figure V.8 is a representation of a long run production model using isoquants and isocosts. This model is an attempt to represent a three-dimensional model in two dimensions. It can be thought of as a "topological map" of production. In Figure V.8, two different levels of output of the good are shown. The term "isoquant" means equal quantity. In the graph two isoquants are shown. Q_1 and Q_2 represent two different levels of output. There are an infinite number of isoquants, one for each possible level of output but only two are shown. The isoquant (Q_1) represents all combinations of labor (L) and capital (K) that will produce Q_1 amount of output. Three input combinations that will produce Q_1 output are identified in the graph (points J, B and H). while there are an infinite number of input combinations that lie along the isoquant (Q_1), only these three are marked.

Isoquant Q_2 is a larger output than Q_1. Only input combination L_A, K_A at point A is identified.

Two isocost functions are also shown in Figure V.8. These are TC_1 and TC_2. “Isocost” means equal cost. All output combinations that lie on TC_1 require the same expenditure. All output combinations that cost less than TC_1 lie inside the isocost. Output combinations that cost more than TC_1 lie outside the isocost. TC_2 represents a greater cost than TC_1. The isocost function can be located by finding the intercepts on the K-axis (capital axis) and L-axis (labor axis). The L-intercept is found by dividing the total cost (TC_1 by the price of labor. If TC_1 were $200 and the price of labor were $5 the L-intercept (L*) would be 40 units of labor, i.e. 40 units of labor at $5 each will cost $200. If the price of capital were $4, the K-intercept for TC_1 is K* (200/4 = 50). A straight line between these two intercepts identifies all combinations of labor and capital that cost $200.

In Figure V.8, the isoquants are represented as Q_1 and Q_2. There are an infinite number of isoquants, one for each possible quantity of output. In our example only two are shown. Along a given isoquant (Q_1) there is a constant level of output. Q_2 represents a greater output level. Along Q1 the output remains constant for different combinations of inputs (L and K) Input combination depicted by point J (K_A capital and L_J labour) results in the same output as the input combination K_B and L_B at point B. The slope of the isoquant between point J and B represent the marginal rate of substitution, the rate at which one input can be substituted for another holding output constant. The line TC_1 represents a given expenditure or isocost. Each point along the isocost represents different combinations of inputs that costs the same amount (TC_1). Point B (using K_B and L_B) is the lowest cost combination of inputs to produce Q_1 amount of output.

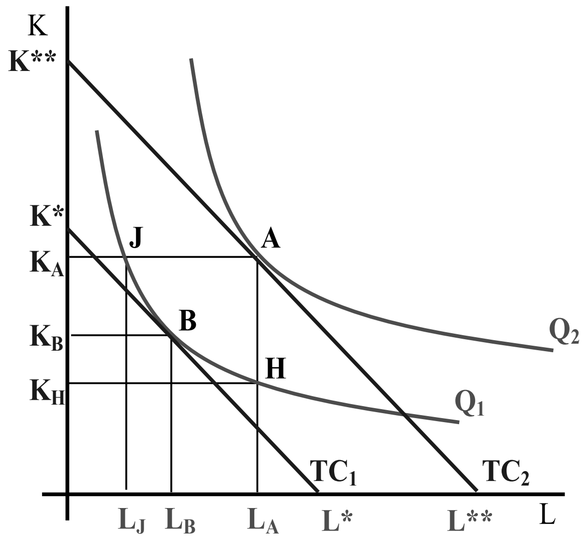


Figure V.8

Q_1 output could be produced by using K_A capital and L_J labor (point J on Q_1). Point H (L_A labor and K_H capital will also result in Q_1 output. Notice that both points J and H lie outside the isocost TC_1. Since point B lies on TC_1, that input combination cost less than those at point J and H. If Q_1 output is desired, TC_1 is the lowest cost of production that can be attained. This is accomplished by using L_B labor and K_B capital. The lowest cost of producing Q_2 given the price of labor and capital is at point A.

The slope of the isoquant represents the rate at which one input can be substituted for another and still produce the same output. The slope of the isocost represents relative price so of the inputs. The lowest cost combination of inputs is at the point of tangency between the isocost and the isoquant. When the isocost function is tangent to an isoquant, it identifies the combination of inputs that minimizes the cost per unit for that level of output.

The short-run production relationships are cross-sections taken out of the isoquant map. In intermediate microeconomics you will study the cost and production relationships in the isoquant map.

10.1.10.2 (2) Long-run Costs

The long-run costs are derived from the production function and the prices of the inputs. No inputs are fixed in the long run, so there are no fixed costs. All costs are variable in the long run. The long run can be thought of as a series of short-run periods that reflect the cross-sections taken out of Figure V.8.

Consequently, the long run costs can be derived from a series of short-run cost functions. In principles of economics the "envelope curve" is used as an approximation of the long run average cost function. In Figure V.9, there are series of short run average cost (AC) functions shown. Each represents a different size plant. Plant size A is represented by AC_A. As the plant gets larger, up to plant size AC_D,, the short-run AC function associated with each larger plant size is lower and further from the vertical axis. This range is sometimes referred to as "economies of scale." Generally it happens from specialization and/or division of labor. Plant D, represented by AC_D, represents the plant with the lowest cost per unit. As the plant size increases above D, the short-run average cost begins to rise. This region is often referred to as "diseconomies of scale." Lack of information to make wise production choices is usually given as the reason for the increasing cost per unit as plant size increases above plant D.

The

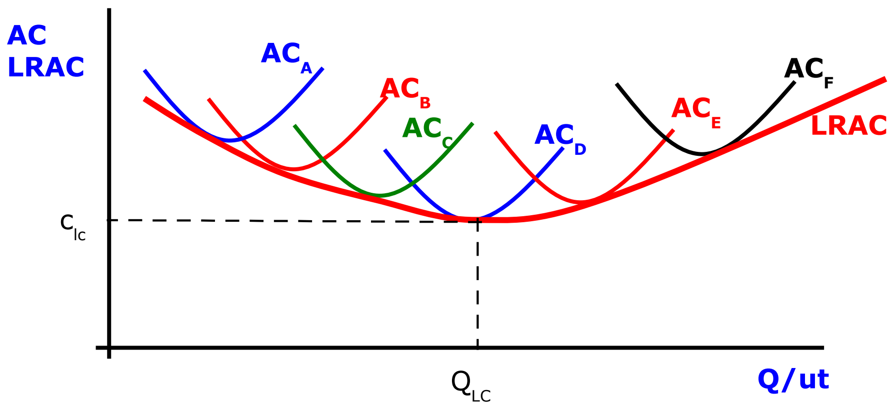


Figure V.9

envelope curve or LRAC is constructed by passing a line so it is smooth and just touches each of the short-run AC functions. Within each short-run period there is a short run AC, MC, AVC and AFC. The firm or plant will move from one set of short-run curves by changing the fixed input. In Figure V.8 this would be the same as moving from one cross section to another.

RETURNS TO SCALE

The terms "economies of scale," "increasing returns to scale," "constant returns to scale," "decreasing returns to scale" and "diseconomies of scale" are frequently used. These terms involve subtle and complicated concepts that apply to the long run production process. In principles of economics they are simplified. Conceptually, returns to scale implies that all inputs are variable. Given a Cobb-Douglas production function of the form $\mathbf{Q = A\ L^{\alpha}\ K^{\beta}}$. Q is output or quantity, L is quantity of labor and K is the quantity of capital. A, α and β are parameters that are determined by the technology of producing a specific product. When $\boldsymbol{\alpha+\beta = 1}$, the production process demonstrates "constant returns to scale." If L and K both increased by 10%, output (Q) would also increase by 10%. This is consistent with a long run average cost (envelope) function that has a slope of 0.

When $\boldsymbol{\alpha+\beta > 1}$, production has increasing returns. A 10% increase in both L and K results in a larger percentage (say 20%) increase in output (Q). This is consistent with the declining portion of the long run average cost function (LRAC). This tends to be the result of specialization and division of labor. It is sometimes referred to as economies of scale or economies of mass production. There may be a variety of forces that cause the LRAC to decline. Not all these forces are actually economies of scale. A larger firm (or monopsonist) may be able to negotiate lower prices for inputs. This is not economies of scale, it is a transfer of income or wealth from one group to another.

When $\boldsymbol{\alpha+\beta < 1}$, decreasing returns are said to exist. As both inputs increase 10%, output (Q) will increase by a smaller percentage (say 6%). This condition is consistent with the rising portion of the long run average cost function (LRAC). As a firm gets larger it may lack the information about various aspects of the production process and be unable to coordinate all the processes. This is the reason that a planned economy does not always produce optimal results.

In Figure V.9 economies of scale are said to exist up to output Q_{LC}. Diseconomies of scale occur as output expands about Q_{LC}.

11 Optimization and Markets

Economics can be viewed as a social science or as a tool for decision science. As a tool economics provides some insights that help identify optimal choices with respect to specific alternatives. One of the basic precepts of Neoclassical microeconomics is that voluntary markets for goods with nonattenuated property rights will provide the information and incentives that coordinate individual behavior to achieve the maximum utility for society. Most of Neoclassical economics presumes that the agent is trying to maximize or minimize (optimize) some objective with respect to a set of constraints.

Rational choices require three basic steps:

- Identify the objective
- Identify all feasible alternatives
- Develop a criteria to evaluate each alternative with respect to the objective

11.1 Objective, constraints and alternatives

The objective is a function of the values and preferences of the individual agent. Experience, social background as well as many other social and psychological characteristics that relate to the individual determine the nature of the agent's objectives. Economic agents have a variety of objectives.

(1) There are a variety of objectives that an agent might have. These include profits, utility, sales, market share, income, growth,...With in a firm different individuals may have different objectives. The CEO may want to maximize profits while the Vice president of engineering may want to minimize the cost per unit and the person in charge of marketing may want to maximize the growth in sales or market share. The objectives may not be consistent so some sort or hierarchical or bureaucratic process must resolve the

inconsistency. In a market setting, competing objectives of individuals is believed to be reconciled by voluntary transactions or exchanges.

(2) The achievement of any objective is subject to a set of constraints. Constraints may be technology, quantity of factors of production, quality of factors, profits, utility, sales, market share, income, growth, social institutions, values, law or a myriad of other possibilities. The constraints and objectives can be structured in a variety of ways. For instance, a firm may try to maximize market share (objective) subject to the constraint that they earn a 12% return on capital investment. Alternatively, a firm might try to maximize the rate of return on capital subject to the constraint that they maintain a 20% market share. An individual might try to maximize income subject to the constraint that they have 30 days of leisure time per year or they might try to maximize their leisure time subject to the constraint that they have at least $50,000 income per year.

11.2 Criteria to evaluate alternatives

Choice implies that the agent has alternatives to choose among. Once the agent has identified the objective and constraints they must evaluate each alternative with respect to the objective. The criteria they use for this evaluation is crucial to their choice. Generally, the criteria will involve two aspects: efficiency and ethics.

(1) Efficiency is the measure of how well one achieves objectives given a set of constraints. Efficiency is not in and of itself the objective. The word "efficiency" is a popular term and is often used to justify choices and behavior. Reconsider the concepts of efficiency discussed in the Introduction.

$$\text{Technical Efficiency} = \frac{\text{Objective}}{\text{constraints}} = \frac{\text{output}}{\text{input}} = \frac{Q_y + Q_x}{(\text{L, K, …, technology})}$$

Technical efficiency is conceptually measured as a ratio of output to input. For any given set of inputs, technology and output of one good, the maximum output of the other good is technically efficient.

Technical efficiency can be considered in the production of a single good. In the short run where one input is fixed (say K), the maximum efficiency of the variable input (say L) occurs at the maximum of the AP_L (where $MP_L = AP_L$). The level of technical efficiency of labor is a function of the amount of K as well as technology.

Technical efficiency does not consider the value or relative prices of either inputs or outputs. In physics efficiency the concept of efficiency can be calculated by the different measures of energy (or the capacity to do work). Foot-pounds, foot-pounds per sec, Ergs, Joules, horsepower, horsepower-hours, BTU, kilowatts are all measures of energy. The input and output of energy of a particular process (internal combustion engine, electric motor, etc) can often be measured. From the perspective of economics technical efficiency can be more problematic. What is the efficiency of an automobile? This depends on the measures of inputs and outputs chosen. Typically, miles per gallon may be used as a measure. Miles traveled is the presumed output and "gallons of fuel" is the input. This measure presumes that the number of miles traveled is the sole objective output. Passenger miles, passenger safety, status of owner, or many other measures may better reflect the desired output or objective of the automobile. The same problem exists for the inputs. The presumption is that fuel is the only input. The other inputs such as energy to produce the tons of steel to create the car may be ignored.

The optimization (maximization) of technical efficiency can occur by maximizing the outputs for a given input or by minimizing the inputs for a given output. It is not possible to maximize output and minimize inputs at the same time. If a public health agency instituted a policy to immunize preschoolers for DPT (diphtheria, pertussis and tetanus) and wanted to maximize efficiency, the problem could be framed in two ways. First, they might be allocated a set of recourses (vaccine, personnel, offices, etc) and then try to vaccinate as many children as possible. Alternatively, they might try to vaccinate all children by using as few resources as possible. Neither the process nor the results are the same.

In the transformation or production possibilities model, technical efficiency lies on the transformation or production possibilities frontier. Review the earlier discussion of technical efficiency in the **Introduction**.

The location and shape of the PPF is determined by technology, quantity and quality of inputs. It represents all output combinations possible. The quantity and quality of inputs are fixed. The task is to maximize the outputs. The output combination identified at point H is "technically inefficient." More of good Y or good X (or more of both) can be produced with the same set of inputs and technology. All technically efficient solutions lie on the PPF. Technical efficiency does not answer the question about which output combination is preferred or most valuable. Allocative or economic efficiency is required to answer that question.

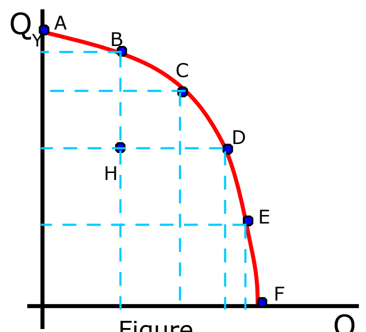


Figure I.A.6

Allocative or economic efficiency includes the values or relative prices of outputs and inputs. The benefit or value of a choice is represented by the product of the price and quantity of each good or output (value of output = $P_xQ_x + P_yQ_y + \ldots + P_nQ_n$). The value of the inputs or cost is represented by the product of the prices and quantities of the inputs (cost = $P_LL + P_KK + \ldots + P_iQ_i$). Allocative efficiency is attained when we maximize the value of the outputs relative to the value of the inputs. The cost is minimized for a given output or output is maximized for a given cost. The economically efficient solution must lie on the production possibilities function.

Pareto efficiency is the condition where there are no alternatives that will increase the welfare (utility) of one person without reducing the welfare (utility) of any other person(s). Once an output combination on the production possibility function is attained, that output combination is Pareto Optimal.

The output combination at point H is not Pareto Optimal. Irrespective of individual preferences a move from point H to output combinations at point B or D (or any where in the area HDB represent "Pareto Improvements." Each alternative in the area HDB is "Pareto Superior" to the alternative represent by point H.
If the current output combination were at point E, it would be Pareto Optimal even if it were not he highest valued output. Any increase in good Y (or X) would require a decrease in good X (or Y). The individuals who prefer X (or Y) to Y (or X) would be "worse off" (their utility or welfare is lower).
If the output is currently at point H, the area HDB is called "Pareto Safe."

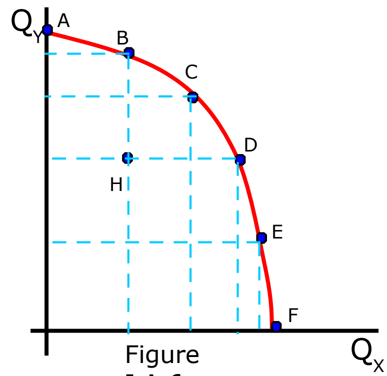
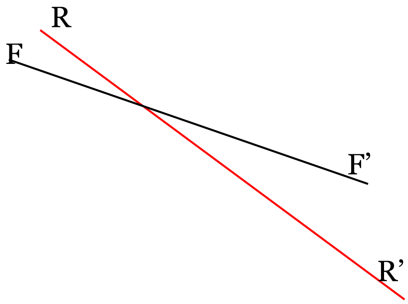


Figure I.A.6

Pareto efficiency is a restrictive criteria and tends to promote the *status quo*. Most choices involve marginal benefits and marginal costs that change the welfare or utility of more than one individual. The Pareto efficiency criterion fails to justify choices that result in the highest valued use of resources (economic efficiency). To remedy this problem the criterion of **Pareto Potential** is used. Pareto Potential justifies the choice of an alternative so long as the "winners" (individuals whose utility increased) can hypothetically compensate the "losers" (individuals whose utility decreased) and still be better off. This is the foundation of criteria such as Benefit/cost analysis, rate of return on investment and internal rates of return. The problem with Pareto Potential is that it introduces the question of equity. Consider the problem of breaching dam is the Pacific Northwest. There are winners and losers. Environmentalists, individuals who benefit from anadromous fish and agents who earn income from tourists are some of the winners. Electricity generators and farmers are examples of losers. Even if the marginal benefits of breaching the dam exceeded the marginal costs, there is no mechanism to insure the winners would compensate the losers. There is necessarily a judgment about the morality of the dams and the imposition of costs and benefits of various groups of individuals. This example also illustrates the issue that the *status quo* tends to be supported by the Pareto Optimality criterion. Building the dams imposed costs and conferred benefits on different groups of people just as breaching the dams will. As societies and individuals change their preferences, technology and environments change and alter the objectives and optimal use of scarce resources. In an ideal world, informed individuals engaged in voluntary exchanges will result in transfers of property rights that are Pareto improvements and lead to economic efficiency.

(2) Equity is a judgment about the rightness or wrongness of the objective. Earlier, deontological and consequentialist ethics were discussed. Any objective can be ethical or unethical based on the type of ethical system used. Remember that microeconomics relies primarily on a consequential ethic called "Utilitarianism" and is directly related to the concept of Pareto Potential. If the benefits exceed the costs of an action, the consequence is an increase in utility. This does not mean that deontological ethics (based on duty) are not necessary for a reasonably functioning society. It is important to consider the morality of our objectives and the sacrifices that must be made to achieve them.

11.2.1 Marginal Analysis



The Marginalist Revolution in economics during the last half of the 19th century provided economists with a useful tool to find maximums and minimums given functional relationships between variables. Basically, this Marginalist Revolution was the application of calculus to economic analysis. One of the purposes of economics is to maximize of minimize a given variable by making choices. Choices are always made at the margin. A saying attributed to some anonymous Chinese philosopher is "The longest journey begins with the first step." This is used here to point out that every decision is a change from an initial state. In production, the manager must understand that a change in an input such as labor "*causes*" a change in output. A consumer must understand that a change in quantity consumed alters the level of utility. A seller must understand that a change in price alters the quantity sold and the total revenue. Marginal analysis is the analysis of rates of changes in variables. Every time the word "marginal" is used in economics it is related to a change in a dependent variable "*caused*" by a change in an independent variable. The rate of change can be interpreted as the slope of a line. The slope of a line is often defined as "*rise over run.*" The rise is usually the change in the dependent variable while the run is the change in the independent variable. For example, the cost of producing more of one good, given full employment, requires a sacrifice of some other good. This was demonstrated in a Production Possibilities model. The slope of the PPF is called the "Marginal Rate of Transformation" (MRT). This is shown in Figure VI.1. The PPF function shows all combinations of Yawls (Y) and Xebecs (X) that can be produced given inputs and technology.

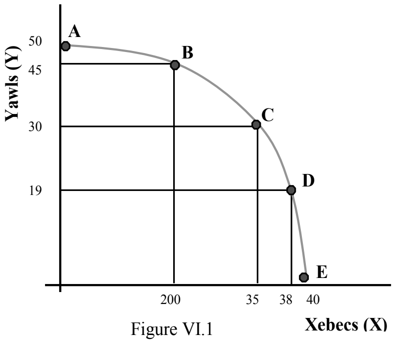


Figure VI.1

At point B, an increase in X (Δ X=15, the run) requires a sacrifice of 15 units of Y (Δ Y=-15) This tradeoff is called the Marginal Rate of Transformation (MRT) and is illustrated by the line RR'. When the MRT (or slope) is calculated by subtracting values (Δ), the marginal value is the slope of an arc between the points.
When the slope is calculated by a derivative, the value of Δ X approaches 0, so the marginal value is represented by the slope of a tangent. In this example, it the slope of FF' at point B.

If the output were at X = 20, Y = 45 (shown as point B in Figure VI.1), an increase in Xebecs would require a decrease in the output of Y. The increase in X from 20 to 35 is 15 units of X. This is labeled as ΔX = 15 (35-20=15) and is the "*run*." The change in Y (ΔY) is -15 (30-45= -15) and is called the "*rise.*" The line RR′ represents the change in Y (ΔY) caused by the change in X (ΔX).

$$\text{Slope of RR'} = \frac{\text{rise}}{\text{run}} = \frac{\Delta Y}{\Delta X}, \text{ or the change in Y caused by a change in } X$$

The slope of RR′ is

$$\frac{\text{-15 (rise)}}{\text{15 (run)}} = -1$$

Calculus lets the change in X approach 0. When the change in X approaches 0, the change in Y is shown by the line FF′ which is tangent to the PPF at point B. In principles of economics calculus is not normally required so the term marginal is calculated by differences and is represented by the slope of a straight line. When a function is nonlinear, the slope between two points is the slope of an arc.

It is crucial to remember that the marginal value (cost, benefit, etc) is the value associated with a specific choice.

(1) marginal benefit (MB) is the change in total benefits associated with a choice. For an individual MB might be MU for a firm it may be MR

(2) marginal cost (MC) is the change in total cost (or variable cost since fixed costs don't change) caused by a change in and activity, usually production.

(3) marginal decision rule You should engage in any activity so long as the MB > MC, the optimal level of activity is where MB = MC, when MC>MB you should not undertake the activity. There is a variation of this rule called the equimarginal rule.

The marginal decision rule can be illustrated by the decision to gather wild blackberries (good X). The cost of travel to the blackberry patch is treated here as a sunk (fixed) cost, we are already at the patch. How many berries shall we pick? The answer depends on our analysis of the benefits and costs of each unit of berries we pick. Generally, the marginal benefits of berries will tend to decrease primarily because of diminishing marginal utility. The marginal benefit (MB) of each unit of berries is shown in Figure VI.2. Typically we will gather the berries that are easiest to pick first. These are the berries

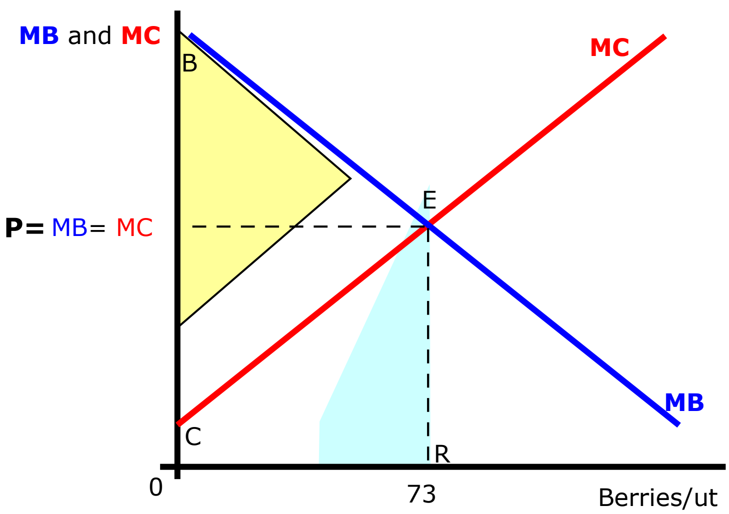


Figure VI.2

that are approximately waist level and on the outside of the bushes. As we pick more berries we have to reach further up or down and into the bushes where there are thorns. The marginal cost (MC) of berries rises. The MC of each unit of berries is also shown in Figure VI.2. The MB function decreases as more berries are obtained. The area under the MB function up to the quantity obtained represents the total benefits (TB). In Figure VI.2 when 73 units are picked, TB is the area 0REB. The MC rises as berries become more difficult to pick. MC represents the marginal cost of each unit. The total costs (TC) is the area under the MC function. When 73 units of berries are picked, the TC will be represented by the area 0REC (the area in blue). The first units of berries are picked because the marginal benefit of each unit (MB) is greater than the marginal cost (MC). There is a net benefit obtained from each unit. Seventy-three units of berries are picked because the MB of the first 73 units is greater than the MC of those units. The TB is 0REB: the TC is 0REC. The net benefit is the area CEB (in yellow). Net benefits are maximized when MB = MC.

This rule has several applications.

- Where MR = MC, profits are maximized
- Where MB = P (cost), utility is maximized

This rule was first clearly stated by the French engineer/economist, Jules Dupuit in the 1830's.

11.2.2 Market Exchange and Efficiency

The ideal market has two important characteristics:

- Individuals voluntarily contract among themselves. There is no coercion and each is informed of their preferences (objectives) and alternatives. They make informed judgments about the outcomes of their choices.
- The individuals exchange goods that are characterized by nonattenuated property rights. Nonattenuated property rights are exclusive, enforceable and transferable. The benefits and cost associated with the production or consumption of any good falls only on the agents engaged in the contract or transaction.

Under these conditions, from a utilitarian perspective, no one would rationally engage in a voluntary exchange if it made them worse off. Therefore, any voluntary exchange must lead to *Pareto superior* results. Individual agents know their preferences (objectives) and react to any changes by altering their choices. The idealized market results in individuals who constantly reappraise their objectives and alternatives and alter choices to maximize their welfare. Since exchanges are perceived to be voluntary, no individual would choose to make themselves worse off. Voluntary markets of goods with nonattenuated property rights are consistent with the Utilitarian Ethic and Pareto Efficiency.

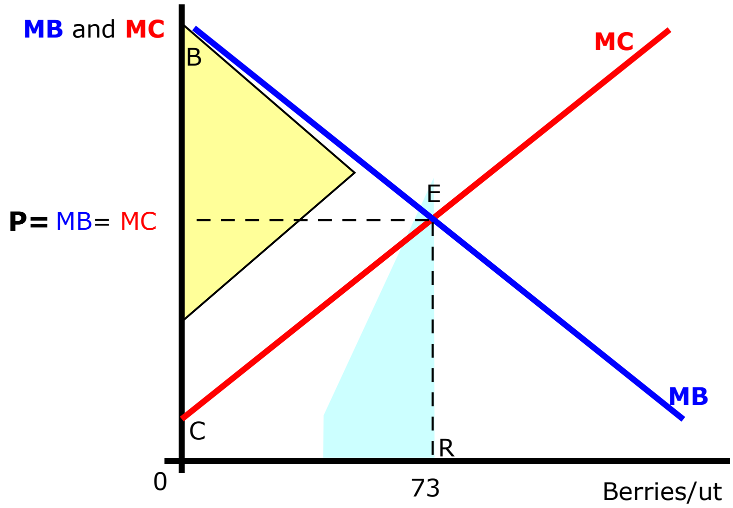


Figure VI.2

11.2.3 Prices as Information

The function of the market is to coordinate the preferences and behavior of the buyers and sellers. There are two important elements that are necessary if markets are to perform this task of coordination. First, buyers and sellers must have information. Prices, or more precisely relative prices perform this task. Secondly, buyers and sellers must have an incentive to respond to the information contained in prices.

Using Figure VI.2 again, the role of prices can be shown. The MB function represents the buyers' evaluations of their marginal benefits. As the quantity of berries increases, the marginal value goes down, The MB function is negatively sloped and resembles a demand function. It is not a demand function because it does not include the ability to buy the goods. It only measures the buyers' evaluation of marginal benefits. Notice the MB of the 73rd unit to the buyers is P. Similarly, the MC function represents the opportunity cost or producing each unit. The MC of producing the 73rd unit is also P. For all unit of berries, up to and including, the 73rd unit, the MB is greater than the MC. We could restate this: the marginal benefit from each of the first 73 units is greater than its opportunity cost. The value (MB) that buyers have for each of the first 73 units is greater than the market price of P. The sellers sacrifice an opportunity cost of less than P on each of the first 73 units. The price of P represents the marginal value (MB) of the last unit exchanged to the buyers. P also represents the marginal value (MC) of the last unit exchanged to the sellers. A price of P provides information about both the buyers and sellers evaluations. Since MB = MC produces maximum net benefit, the ideal is where the price reflects MB and MC, **MB = P = MC.**

So long as the price is less than the MB of the buyers, additional units will be purchased. Once the P > MB buyers cease to purchase the good.

When the P > MC, sellers will produce and offer units for sale. Once the P < MC, the sellers will cease production.

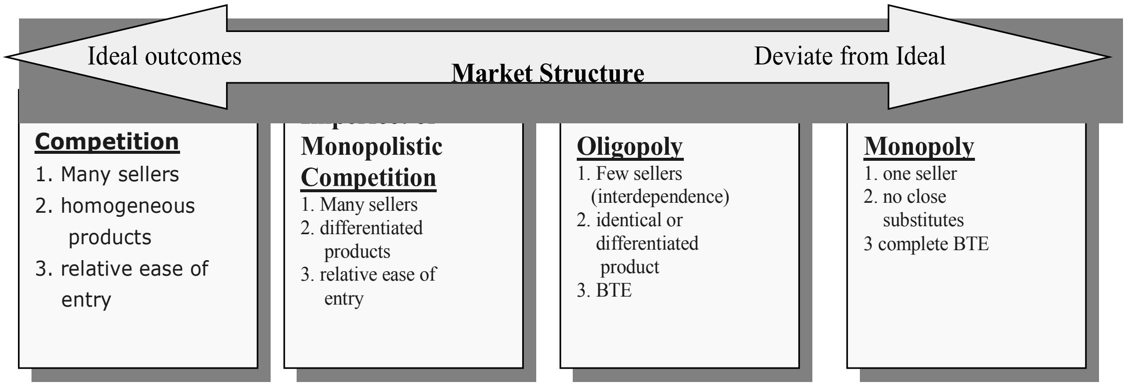
12 Pure Competition

Purely competitive markets are used as the benchmark to evaluate market performance. It is generally believed that market structure influences the behavior and performance of agents within the market. Structure influences conduct which, in turn affects performance.

12.1 Market Structure

Neoclassical microeconomics is an explanation of the behavior of individuals, firms, and organizations within a market context. Their behavior is thought to be a function of their objectives and the constraints that exist because of technology, quantity/quality of inputs and market structure. Market structures can be characterized by sellers or buyers or both. Most economics texts classify markets by seller. Generally, they identify 4 basic types of markets: (1) pure (or perfect) competition, (2) monopolistic (or imperfect) competition, (3) oligopolistic competition, and (4) monopoly. Pure competition is believed to produce ideal results in the allocation of resources. Monopoly is usually depicted as having less than optimal outcomes. The basic market structures based on sellers is shown in Figure VII.1

Figure VII.1



Pure competition and Monopoly are at each end of the spectrum of markets. In fact, probably neither occur in market economies. Pure competition and monopoly are the boundaries and the "real world" (wherever that is) lies somewhere between the two extremes. Pure competition provides the benchmark that can be use to evaluate markets. The physician who attends you knows that 98.6° is a benchmark. Your temperature may not be precisely 98.6°, but if it deviates significantly, that deviation suggests problems. It might be in your best interests to know what the "normal" temperature is and the cause of the deviation from "normal."

12.1.1 Characteristics of Pure Competition

The idealized purely competitive market insures that no buyer or seller has any market power or ability to influence the price. The sellers in a purely competitive market are ***price takers***. The market sets the price and each seller reacts to that price by altering the variable input and output in the short run. In the long rung they can alter the scale of plant (size of the fixed input in each short run period). The conditions that ensure no seller has any market pose are:

Large number of sellers (and buyers), no one of which can influence the market.

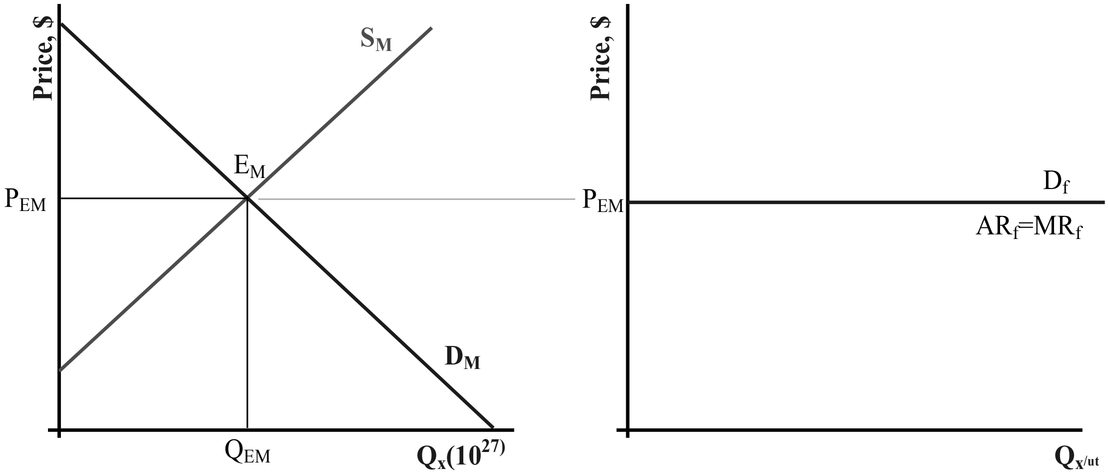
- Homogeneous output, buyers see goods as perfect substitutes.
- Relatively "free" entry and exit to and from the market.

Sellers cannot charge a price above the market price because sellers see all other goods in the market as perfect substitutes. They can buy those goods at the market price.

12.2 The Firm in Pure Competition

A purely competitive market is characterized by a large number of relatively small firms. No single firm can influence the market price and are considered *price takers*. In Figure VII.2 graphs representing a purely competitive market and one firm are shown.

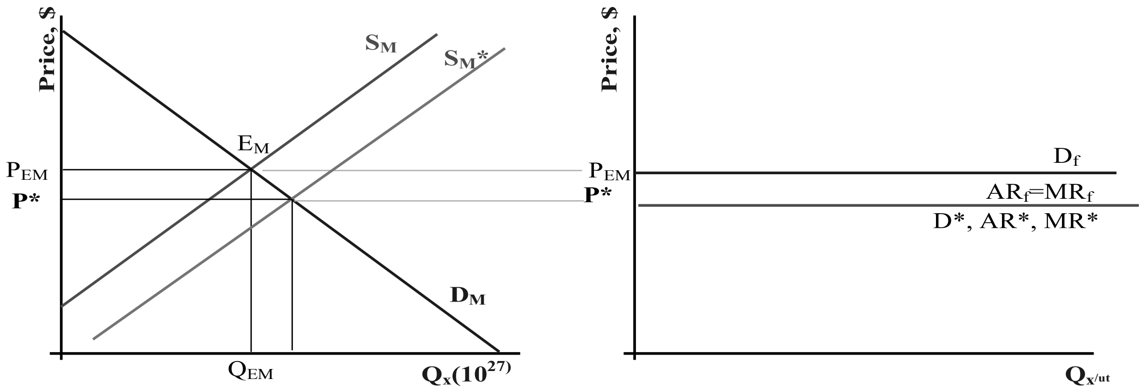
Panel A.VII.2 represents the market. D_M and S_M represent the market demand and supply functions. If the market is in equilibrium the equilibrium price and quantities are P_{EM} and Q_{EM} respectively. Notice that the quantity measured along the Q-axis in Panel A represent large quantities.



Panel A.VII.2
(Market)

Panel B.VII.2
(Firm)

Figure VII.2



Panel A.VII.3
(Market)

Panel B.VII.3
(Firm)

Figure VII.3

Panel B.VII.2 represents a single firm in the market. Note that the quantity measured along the Q-axis in Panel B is small relative to that in Panel A. The firm accounts for a very small portion of the goods offered for sale in the market. Since there are a a large number of firms in the market with identical or homogeneous products, buyers have no preference for any one firm's product. The demand faced by a single firm is perfectly elastic at the market price. This is represented as a horizontal line at the price of P_{EM} in Panel B. Remember that demand and AR coincide. Marginal revenue decreases at twice the rate (has twice the slope of the AR) as a linear AR function. Since the slope the AR for the purely competitive firm is 0, the MR does not decrease and lies along the demand and AR functions.

Consider an increase in the market supply shown in Figure VII.3.

The market supply function increases from S_M to S_M* in Panel A.VII.3. As a result, the equilibrium price (in Panel A) in the market falls from P_{EM} to P*. The equilibrium quantity will rise. Since the market price has fallen, the demand, AR and MR functions faced by the firm will fall to D*, AR* and MR*. (As shown in Panel B.VII.3.) Note that a decrease in market supply will shift the firm's demand function up. An increase (decrease) in market demand would shift the firm's demand up (down).

Changes in the conditions in the market alter the price. These changes in price provide information to the firms who then react to those changes.

12.2.1 Profit Maximization in the Short Run

If the firm's objective is to maximize profits (∏), they must maximize the difference between total revenue (TR) and total cost (TC). ∏ = TR –TC. It is possible to identify the output level that will maximize profits for the firm if the MR and MC functions are known. Where MR = MC, profits will be maximized (or losses minimized).

Before we consider these problems there are several points to reconsider.

- A normal profit is included as a cost of production just as wages, interest, rent and materials costs are expenses.
- The objective of the firm is to maximize profits (not revenue)
- MC is the change in TC (or VC) caused by a change in output.

$$MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta VC}{\Delta Q}$$

- AC is the total cost per unit. It is calculated by dividing TC by Q. AC tends to fall and then rise as output increases. When MC is less than AC, AC is decreasing. When MC is greater than AC, AC will be increasing. When MC equals AC, AC will be a

$$AC = \frac{TC}{Q}$$

minimum.
- AVC is the variable cost per unit. AVC is the variable cost per unit. It is calculated by dividing VC by Q. AVC tends to fall and then rise as output increases. When MC is less than AVC, AVC is decreasing. When MC is greater than AVC, AVC will be increasing. When MC equals AVC, AVC will be a minimum. $AVC = \frac{VC}{Q}$
- The vertical distance between AC and AVC is the AFC. (AFC = AC-AVC) AFC will tend to decrease as long as output (Q) increases.
- Demand faced by a purely competitive firm is perfectly elastic (horizontal, straight line) at the market price.
- The AR is the same as the demand function.
- MR falls at twice the rate of AR. Since AR has a slope of 0 in a purely competitive market, MR and AR are the same in a purely competitive market.
- MR = price in a purely competitive market.
- A firm will offer additional units for sale so long as the price they obtain is greater than the opportunity cost (MC) of producing the units.

The behavior of the firm in the short run can be shown using total values (TR and TC) or unit values (MR, MC and AC)

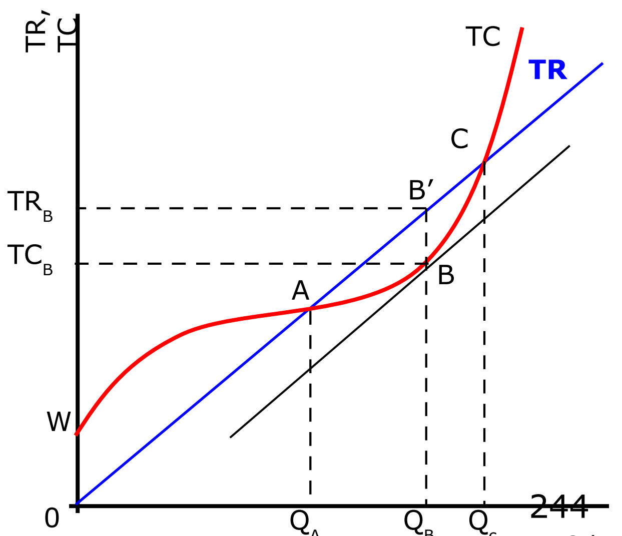


Figure VII.4

12.2.1.1 Short Run Profits using TR and TC

Maximum profits will occur at the output level where there is the greatest vertical distance between TR and TC, when TR>TC. In

Figure VII.4 the TR and TC functions for a firm are shown. The TR is a straight line (with a constant slope). TR is price times quantity. Since TR is a linear function this implies that the price for all quantities are the same, the firm is in a purely competitive market (the demand is perfectly elastic at the market price.). MR is defined as the change in TR associated with a change in Q. MR is the slope of TR, so MR is the price.

The TC intercept is at W, which is the fixed cost and shows that this is a graph depicting a short run condition. The TC function increases at a decreasing rate that implies that MC is falling and MP of the variable input is rising. Beyond the inflection point in the TC, TC increases at an increasing rate. The model shows "break-even" points (A and C) at output level Q_A and Q_C. At these break-even point the firm is earning a normal profit. (Remember normal profits are included in the cost functions.) Between output levels Q_A and Q_C, the TR>TC. This means that economic profits (∏) exist. Maximum ∏ occur at output level $Q_{B.}$, the greatest vertical distance between TR and TC. Note that at point A (producing Q_A) the firm obtains a normal profit. If they produce and additional unit the MC (slope of TC at point A) is less than the slope of the TR (MR), i.e. they can produce additional units for less than someone is willing to pay for them. At output level Q_B, the slope of the TC (MC) is equal to the slope of the TR (MR). If they attempt to increase output above Q_B, the cost of additional units (shown by the slope of the TC) increases faster the increase in TR (shown by the slope to TR). Where the slope of the TC (MC) is the same as the slope of the TR (MR), profits (the vertical distance between TR and TC) are maximized.

12.2.1.2 Short Run Profits using Unit Cost and Revenue

The process of determining the output level that maximizes profits in the short run can also be made by an analysis of the unit cost and revenue functions. MC and MR determine whether to produce a given output of not. If the cost of and additional unit (MC) is less than the revenue obtained from that same additional unit (MR), producing the additional units will add to profits (or reduce losses). If the cost of additional units of output (MC) cost more than they add to revenue (MR), the firm should not produce the additional units. The rules for profit maximization are simple:

- MR >MC, produce it!
- MR < MC, don't produce it!
- When MR = MC, you are earning maximum profits!

The process of determining the profit maximizing level of output using unit cost and revenue functions is shown in Figure VII.5.

Figure VII.5 represents a single firm in a purely competitive market. It must be pure competition because of the perfectly elastic demand function at the price P. D, MR and AR are all horizontal functions at the price P. As output increases from 0 to Q_C the AVC decreases. AC decreases up to output Q_B. Both AVC and AC are U-shaped functions. Remember the AP of the variable input increases while the AVC falls. The MC falls (up to output QA) and then rises intersecting AVC and AC at their minimum points. At outputs Q_A and Q_J the firm has break-even points, normal profits exist at output level Q_A and Q_J. The firm produces where MR = MC (point H) to maximize profits at output level Q_H. Since AR > AC at this level, the firm earns above normal profits.

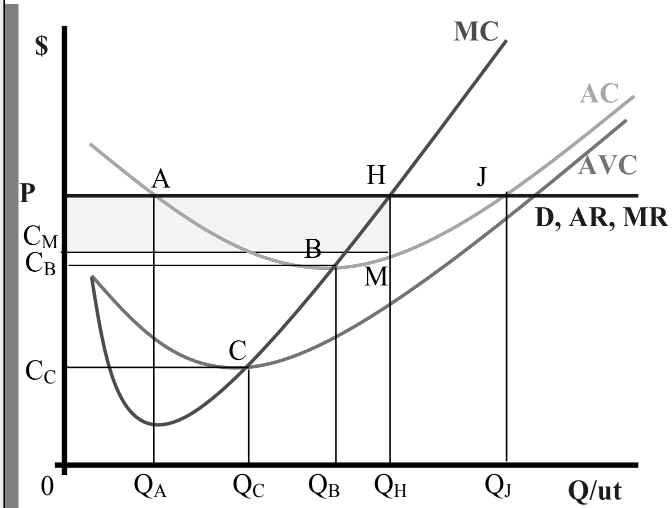


Figure VII.5

The firm will produce units so long as the market price (P, which is equal to MR when Demand is perfectly elastic.) is greater than the cost of producing the additional unit (MC). If MC is greater than the price (or MR) the firm will not produce. All possible profits are captured where MR = MC. This is shown as point H at output level Q_H in Figure VII.5.

At output level QH, where MR = MC, profits are a maximum and can be shown as the area C_MMHP (the area in yellow). Total revenue (TR) is area $0Q_H$HP. TR is calculated by price multiplied by quantity, in this model, $P*Q_H$ is the area $0Q_H$HP. Total cost (TC) is area $0Q_HMC_M$ (the product of the AC and quantity, which is C_M*Q_H. Profits are the difference between TR and TC, area C_MMHP or $(P-C_M)Q_M$.

12.2.1.3 Loss Minimization and Shutdown in the Short run

In the short run the maximum the firm must loose is its fixed cost. If the firm can recover all its variable cost it may as well operate unless it sees no hope of improvement in the future. In Figure VII.5 the firm is earning above normal profits by producing at Q_H output. If the price were to fall to C_B (which is consistent with the minimum of the AC function) the firm would earn normal profits. (Remember that normal profits are included in the cost functions as an opportunity cost for the entrepreneur.) If the price falls below C_B, the firm will lose money, i.e. will earn less than normal profits. So long as the price is above C_C, the firm is recovering all the variable cost and a little more to offset the fixed cost that it would have lost if the firm would have shutdown. At a price of C_C, the firm is recovering all its variable cost and losing its fixed cost (which it would have done anyway if it had closed down.). Therefore, so long as the firm can recover all its variable costs at a price of C_C, it may as well operate in the short run. Point C, at a price of CC and output of QC is called the shutdown point. It will always be at the point where the MC intersects the AVC (the minimum of the AVC).

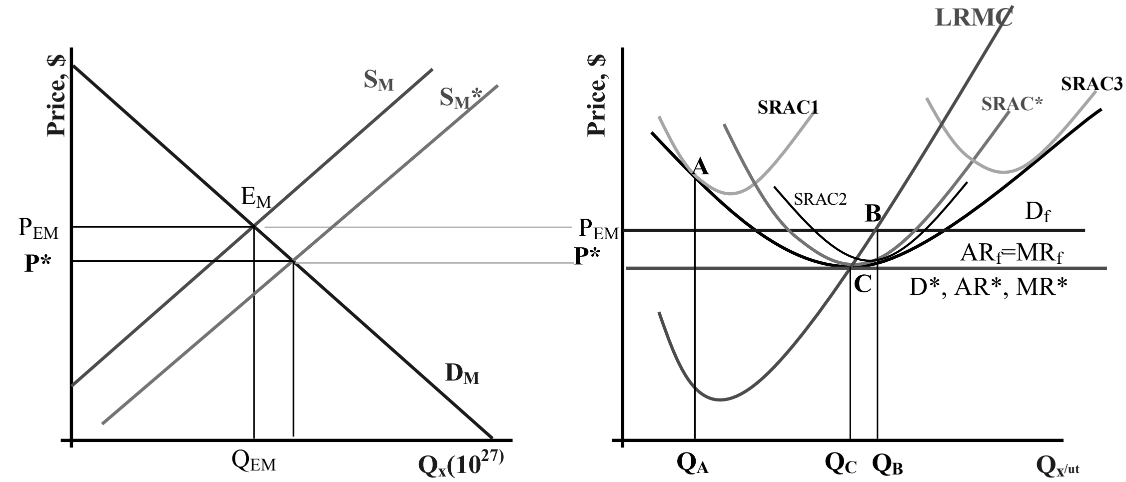
In the long run all costs are variable, therefore the shut down point in the long run is the minimum of the LRAC where MC= LRAC.

There may be other reasons for operating a production facility. In some cases individuals may operate at less than normal profits because the get non-monetary benefits from being in a particular line of work or being "their own boss." A government may encourage firms that produce particular products to operate for reasons of national defense or national pride. In these cases public policy may be used to subsidize the firms that would find it necessary to shut down in a free market economy.

12.2.2 Profits in Long Run Pure Competition

In the long run, producers are able to alter their scale of plant. The LRAC or envelope curve was constructed from a series of short run periods with different plant sizes. In the long run the firm is essentially able to select the scale of plant (or a specific set short run production and cost functions associated with a specific fixed (in the short run) input). The is essentially the meaning of "relative ease of exit and entry from the market.

Another crucial aspect of long run pure competition is that the demand faced by the firm is perfectly elastic at the market price. The AR and MR functions coincide with the firm's demand function. Because the firm's demand function is perfectly elastic, they cannot raise their price above the market price. If they do, their sales will fall to 0. There is no reason to lower their price below the market price because they can sell all they want to a the market price. The firms in pure competition have no "***market power.***" Market power, in microeconomics, refers to the ability of an agent to raise the price and not have their sales fall to 0. A quick review of price elasticity suggests that market power is influenced by a firm's demand function. Purely competitive firms are price takers. These firms have no incentive to advertise. The largest producer in a purely competitive market can sell all they can produce or none at all and the market price will be unaltered.



Panel A.VII.6
(Market)

Panel B.VII.6
(Firm)

Figure VII.6

In Figure VII.6 The market demand an supply functions (in Panel A) are initially D_M and S_M. Given thess demand and supply functions, the market equilibrium is at point EM resulting in an equilibrium price (P_{EM}) and quantity (Q_{EM}). When the market price is P_{EM}, the firm reacts to that price (The firm is a price taker.). If the firm's objective is to maximize profits, it will operate at the point where MR = MC. This equality of MR and MC occurs at point at Point B in panel B. Note that the short run MC will lie to the right of the LRMC at this point, so short run output would be greater. The firm will select plant size SRAC2 since it will minimize the cost per unit at that output level (Q_B). This SRAC2 is not the most efficient size plant (SRAC*). The AR is greater than the AC at this point. The firm can earn "***economic profits***" under these conditions. Remember "***normal profits***" are included in the cost functions.
Since entry is relatively free, other entrepreneurs will desire to capture some of these economic profits and enter the industry. The supply function will increase (shift to the right) causing the equilibrium price to fall from P_{EM} to P*. The equilibrium quantity in the market rises but there are more firms. The firm represented in Panel B must adjust to the lower market price, P*.The new demand and revenue functions faced by the firm is D*, AR* and MR*.MR* = MC at point C. The firm reduces output to Q_C and adjusts plant size to SRAC*.
The firm now is operating where:

- the plant that has allows the lowest cost per unit (most efficient size plant),
- they operate that plant at the level of output that has the lowest cost per unit,
- they earn a normal profit,
- They are maximizing their profits given circumstances (They have no incentive to change output or plant size, they are in equilibrium.),
- The price is equal to the MC (This is the condition to optimize the welfare of the individuals in society given the income distribution.)

The process of long run equilibrium in pure competition can be shown in Figure VII.6. You may remember part of Figure VII.6 as Figure VII.3. Both the market and an individual firm's demand and cost (supply) functions are shown.

In Figure VII.6, it is apparent that a market price below P* would result in the firm's AC exceeding the AR at all levels. If this were the case firms would earn less than normal profits and would have an incentive to leave the market. As firms leave the market, the market supply decreases (shifts to the left) and the market price would rise.

There are two important features in pure competition. First each firm is a price taker and has no market power. The demand function faced by the firm is perfectly elastic at the equilibrium price established in the market. This is because the output of the purely competitive firms is homogeneous and there are a large number of sellers, none of whom can influence the market price. Secondly, entry and exit from the market is relatively free. Above normal profits attract new producer/seller that increases the market supply driving the market price down. If profits are below normal, firms exit the market. This reduces the market supply and drives the price up.

Long run equilibrium in a purely competitive market is established when the D (AR and MR) is just tangent to the long run average cost function (LRAC). This will be at the minimum of the LRAC where its slope is 0 (the demand function faced by the firm has a slope of 0). Firm earn normal profits at this point and there is no incentive to enter or leave the market. There is no incentive to alter plant size or change the output level.

At the point of long run equilibrium in Figure VII.6 at point C, the following conditions will exist:

- **AR = AC**: Firms earn a normal profit. There is no incentive for firms to enter or leave the market.
- **LRMC = LRAC**: the firm is operating with the plant size that results in the lowest cost per unit, i.e. the fewest resources per unit of output are used.
- **MR =LRMC**: the firm has no incentive to alter output or plant size.
- **P = MR =MC**: the price reflects the marginal value of the good to the buyers and the marginal cost to the producer/seller.

Long run equilibrium in pure competition results in an optimal allocation of resources. The price reflects the marginal benefits of the buyers and the marginal cost of production. The user of the last unit of the good places a value (the price they are willing and able to pay) on the good equal to the cost of producing that unit of the good. Units of the good between 0 and the equilibrium quantity have a greater value than the cost of production.

The purely competitive model provides a benchmark or criteria to evaluate the performance of a market: **MB = P = MC**. The marginal benefit (MB) to the buyer is suggested by the price they are willing and able to pay. The MB to the seller is the marginal revenue (MR) they earn. The marginal cost (MC) reflects the opportunity cost to society.

13 Firms With "Market Power"

Pure competition results in an optimal allocation or resources given the objective of an economic system to allocate resources to their highest valued uses or to allocate relative scarce resource to maximize the satisfaction of (unlimited) wants in a cultural context. Pure competition is the ideal that is be benchmark to evaluate the performance markets. The economic theory of monopolistic competitive markets, oligopoly and monopoly is used to suggest the nature of problems that may exist when firms or agents have market power and are able to distort prices away from the purely competitive optimum.

The existence of market power is tied to the demand conditions the firm faces. If their product is (or can be differentiated), consumers may have a preference for one firm's output relative to others. A negatively sloped demand function (less than perfectly elastic) allows the firm to raise its price and not have its sales fall to zero. In pure competition, the firms may all try to influence market demand (eat Colorado Beef, Eat Black Angus Beef, Drink Florida orange juice, etc) but individual producers do not advertise their own product (Eat Rancher Jones's Beef). Many agricultural markets are close to pure competition. In many cases some producers try to differentiate their products. Organic produce is one example.

In pure competition, the firms' outputs are homogeneous. If the firm has is no opportunity to differentiate their product they have no incentive to advertise and to try to influence the demand for their product. If a product can be differentiated by altering the characteristics of the good or simply by convincing the consumers that the product is different, the firm achieves market power. Market power is the ability to have some control over the price of the good offered for sale. Advertising can be used to differentiate a product or increase the demand for a product. The crucial factor is the demand for the firm's output must be negatively sloped: the firm becomes a "***price maker***." The extent to which a firm is a price maker (i.e. has market power) is partially determined by the price elasticity of demand in the relevant price range. Note that when the seller selects a price (price maker) the demand function determines the quantity that will be purchased.

The conditions of entry or barriers to entry (BTE) are also important determinants of market power. If there are significant BTE, a firm or firms may be able to sustain above normal profits over time because other firms are prevented from entry to capture the above normal profits.

Monopoly is the market structure that is usually associated with the greatest market power. The monopolist produces a good with no close substitutes (increased probability the demand is relatively inelastic) and there are barriers to entry. Firms in monopolistic competition or imperfectly competitive markets are more likely to have limited market power because there are many firms with differentiated products (there are substitutes) and there is relative ease of entry and exit into the market.

13.1 MONOPOLY

A monopoly is a market characterized by a single seller of a good with no close substitutes and barriers to entry. Monopolies rarely occur in a pure form. There are almost always substitutes or methods of possible entry into a market. When the term "monopoly" is used it is usually referring to a degree of monopoly or market power. In many cases the existence of a monopoly results in regulation or the enforcement of antitrust laws that attempt to introduce competition to reduce market power.

The definition of monopoly requires a judgment about the phrase "no close substitutes" and what "barriers to entry" mean. I might be the only producer of mink lined, titanium trash cans. This is not relevant as a monopoly since there are many good substitutes: plastic or steel containers or even brown paper bags will serve as trash containers. There are substitutes for the electricity (KWH) produced by a public utility. It is possible to purchase a portable generator powered by an internal combustion engine or use candles for use in your home. However, neither of these can be regarded as a close substitute. The concept of cross elasticity of demand can be used to identify whether two goods are substitutes on not.

$$(\text{Cross price elasticity of demand})\ E_{\text{XY}} \equiv \frac{\%\Delta\, Q_X}{\%\Delta\, P_Y}$$

$$[a \text{ change in the quantity of good X, caused by a change in the price of good } Y]$$

Barriers to entry are another important characteristic of monopoly. Complete barriers to entry (BTE) make it impossible for competing firms to inter a market. However, in n most cases, BTE are not complete but are relative. Firms' entry into a market can be restricted by a variety of factors. BTE's can be due to:

- The ownership of a key resource or location maybe important. ALCOA's monopoly in aluminum was at first due to a patent on a low cost process to reduce bauxite into aluminum. After the patent expired, their ownership of bauxite reserves allowed them to maintain their monopoly position. In earlier times there may have been only one location on a river where a dam could be built to power a gristmill. A movie theatre gains monopoly power over its sale of popcorn by prohibiting customers from bringing their own food into the theatre.
- Information or knowledge not available to others. (Industrial secrets). Knowledge about a process may kept secret (rather than using a patent since patent information is publicly available).
- Legal barriers such as license, franchise, patent, copyright, etc. ALCOA's monopoly began when the government gave them a patent on a low cost method of reducing bauxite to aluminum. Other methods of making aluminum are possible but cannot compete with the method pioneered and patented by ALCOA. A State park might license a firm to provide prepared foods within the boundary of the park. This would confer market power on the firm unless their price was regulated. A city that licenses a taxi company gives them market power. They may license several taxi companies so that there is some competition and or they may regulate the services and rates. Public utilities often have a license to operate in a specific area. In return for this monopoly power, they are subject to regulation. In fact, the British colonies that became the United States and Canada were the result or grants from the British government. Hudson Bay Company and the East India Companies were firms that were granted rights to operate in specific areas.
- Natural monopoly caused by economies of scale usually associated with a cost structure with a high fixed cost relative to variable costs. A natural monopoly is the result of significant economies of scale due to a high fixed cost. As the output increases the LRAC falls. If the market demand intersects the LRAC as it falls (or at its minimum), a natural monopoly exists.

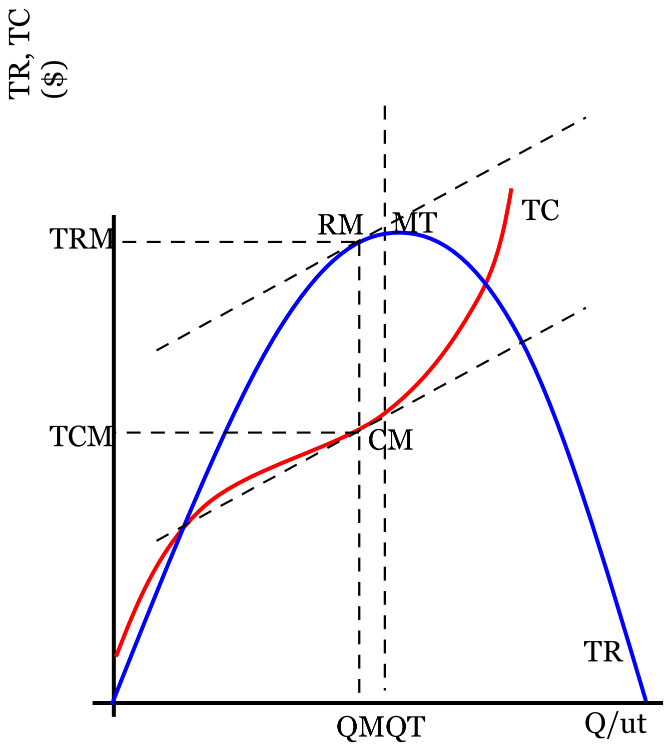


Figure VIII.1

13.1.1 Profit Maximization In a Monopoly

Since a monopoly is characterized by a single seller, the market demand and the demand faced by the firm are the same. The demand will tend to be negatively Figure VIII.1 represents profit maximization by a firm in a monopoly market.

The TR function increases up to an output level of Q_T then it declines. Remember that any negatively sloped demand function is elastic at high prices (top half of demand where price increases reduce TR) and inelastic at low prices (bottom half of demand where price increases increase TR). The TC increases at a decreasing rate, passes an inflection point and then increases at an increasing rate. Maximum profits is occurs at the output level where TR >TR by the greatest vertical distance. This occurs at output Q_M. Profits are reflected by the vertical distance, C_MR_M, or TR_M-TC_M. At point C_M the slope of the TC (MC) is the same as the slope of the TR at point R_M (MR). The maximum TR occurs at point M_T at output level Q_T. If the firm increases output from Q_M to Q_T profits will decrease because the costs of the additional units (Q_T-Q_M) is greater than the additional revenue produced by those units of output.

Unit cost and revenue functions can also be used to show the output and price decisions of a monopolist. In Figure VIII.2 the demand, AR, MR, MC and AC cost functions are shown.

In Figure VIII.2, revenue and cost functions for a monopolist are shown. The demand and AR are negatively sloped, so the MR falls at twice the rate and intersects the Q-axis half way between the origin and AR (or demand) intercept.
The firm will maximize profits where MC = MR (at point Z) producing Q_H output. Buyers are willing and able to pay a price of P_H for the Q_H^{th} unit produced (they would be willing to pay more for units from 0 to Q_H, but don't if there is no price discrimination
The cost per unit is CF, so profits are area C_FFHP_H or (P_H-C_F)Q_H. Profits are above normal but BTE prevent others from entering the market to capture the above normal profits.

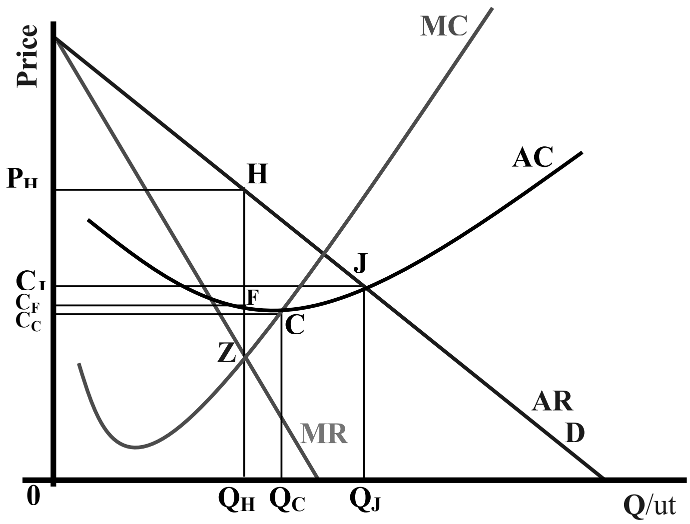


Figure VIII.2

Figure VIII.2 represents a monopolist. In the long run the monopolist might adjust the scale of plant, but BTE prevents other firms from entering and driving profits to normal. Monopoly or market power is suggested by two things. First, the price is greater than the marginal cost (P>MC). Secondly, above normal profits will persist over time.

13.1.2 Imperfect Competition and Monopolistic Competition

During 1933 Edward H. Chamberlin [1899-1967] and Joan Robinson [1903-1983] independently published similar theories on "monopolistic" and "imperfect" competition. The terms "monopolistic competition" and "imperfect competition" originally were basically the same even though there were subtle differences. Currently, the use of "imperfect competition" is more generic, it refers to all market structures that lie between pure competition and monopoly. In this usage monopolistically competitive and oligopolistic markets are considered imperfect.

Monopolistically competitive markets are characterized by:

- a large number of sellers, no one of which can influence the market,
- differentiated products,
- relative free entry and exit from the market.

Relaxing the characteristic of outputs from homogeneous to "differentiated products" was the basic change from the purely competitive market model. The differentiation of output results in the demand faced by each seller being less than perfectly elastic. Since there are "many sellers," many substitutes for each seller's output is implied. This suggests that the demand faced by a firm in a monopolistically competitive market is likely more elastic than in a monopoly. The elasticity obviously depends on the preferences and behavior of the buyers. The negative slope of a firm's demand function in imperfect competition results in a different result than in pure competition.

The conditions of entry and exit to and from a monopolistically competitive market are similar to the purely competitive market: there are no major BTE. Entry and exit are relatively easy. The relative ease of entry/exit makes the long run results of an imperfectly competitive market different from a monopoly.

13.1.3 Demand Faced by Monopolistically (Imperfectly) Competitive Firm

The market demand is the result of a horizontal summation of the individual buyer's demand functions. The market demand function can be divided among the sellers. A simplified example is shown in Figure VIII.3. If 80 units are demanded in the market at a price of $5, a sum of 80 units is demanded from the sellers in the market. To simplify, assume 3 firms in the market. The demand for firm A's product at $5 is 17 units. The demand for firm B's output is 30 units. Therefore, 33 units of output from firm C must be demanded. If a fourth firm entered the market, there is no reason to believe that the buyers would desire more at a price of $5. The demand for one or all firms' products would necessarily shift to the left (decrease in demand) by the same number of units that the entrant (firm C) would sell at that price.

The entry of firms will mean each existing firm will have a smaller share of the market and are faced by more substitutes. Entry implies that the demand each firm faces for its

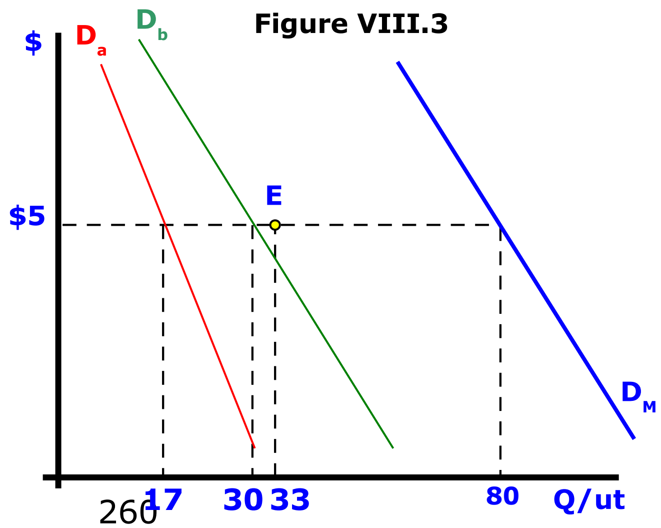


Figure VIII.3

product will decrease (shift to the left) and become relatively more elastic at each price.

Each firm would like to capture a larger share of the market and make the demand for its product more inelastic. Advertising is an attempt to alter buyers' perceptions and increase the demand. Economists identify two types of advertising: informative and persuasive. Informative advertising provides buyers with information about availability, features and relative prices. It helps the market to perform allocation processes. A grocery who advertises milk at $1.39 per gallon in its store (plant) at the corner of High Street and Broadway, has helped the market to perform. Persuasive advertising is an attempt to alter preference functions. Driving a new SUV makes one a member of the right social group. Smoking a (given brand) makes one sexier or more macho, independent or whatever. It is not clear that persuasive advertising improves the ability of the market to allocate resources.

It must also be noted that advertising increases the costs of the firm and alters the output decisions and profits.

13.1.4 Profit Maximization in Imperfect or Monopolistic Competition

If the firm in an imperfectly competitive market has profit maximization as an objective, they will produce the output where marginal cost is equal to the marginal revenue. Short run profit maximization is shown in Figure VIII.4.

Short run profit maximization for a firm in imperfect competition occurs at the output Q_J. This output level is found at point J where MR=MC. At this level of output, the vertical intersects AC at R. The firm is producing Q_J units at a cost of C* per unit. Total cost (TC) would be C^*Q_J or area $0Q_JRC^*$ (the area in yellow).
The firm can sell QJ units at a price of P*. Total Revenue (TR) is P^*Q_J or area $0Q_JHP^*$. Profits (? =TR-TC) are shown by area C*RHP* or $(P^*-C^*)Q_J$.
Short run equilibrium in monopolistic competition resembles the equilibrium conditions in a monopoly. However, entry in monopolistic competition will drive profits to normal in the long run.

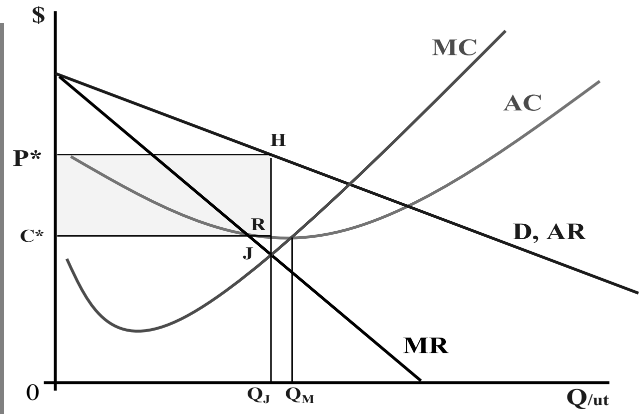


Figure VIII.4

In the long run, above normal profits will attract the entry of firms into monopolistic competition. Below normal profits will encourage firms to exit. As firms enter the market demand is split among a larger number of firms which will shift the demand for each firm to the left (decrease) and probably make it more inelastic. There are more substitutes. Exit of firms will shift the demand for each firm's output to the right (increase). Entry to and exit from the industry occur until the profits for each firm are normal, i.e. the AR = AC. The results of long run equilibrium in a monopolistically competitive market are shown in Figure VIII.5.

The logical result of profit maximizing monopolistically competitive markets is to encourage firms to build plants that are smaller than optimal, i.e. a larger plant can produce with fewer inputs per unit of output (or costs per unit of output). Further inefficiency is expected since the inefficient plant is operated at an output level that is less than the minimum point on the SRAC. This result is due to the fact that the MR must be lower than AR when AR is negatively sloped. Therefore MR=MC at less than the price which lies on the demand (or AR) function. Since the demand is negatively sloped and AC is usually U-shaped, the point of tangency between AR and LRAC (normal profits) will lie to the left of the minimum cost per unit of output. This is sometimes called the "excess capacity theorem:" firms build plants that are too small and operate them at less than full capacity.

> Above normal profits attract firms to enter the market. The demand for each firm's output is reduced and becomes more elastic (shifts to the left and is flatter at each price). If AR is less than LRAC firms leave and demand faced by each firm increases. Equilibrium is attained when AR = AC and firms cannot make adjustments to increase profits above normal. Where MR+MC, at point J, the firm produces Q_J output that is sold at a price of P*. At Q_J output, the cost per unit of output is also P*. Firms are earning a normal profit. Note that P* is necessarily above MC and the firm has a plant size that is less than optimal and operates at less than the minimum cost per unit.

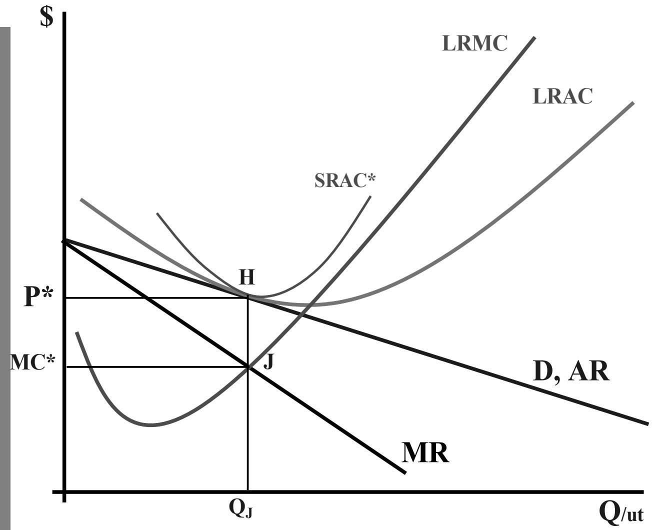


Figure VIII.5

13.2 Oligopoly

An oligopoly is a market that is characterized by the interdependence of firms. The outcomes that follow from the decisions of one firm are dependent on what the other firms do. Augustin Cournot (1801-1877), a French mathematician/economist developed the theory of monopoly and then considered the effects of two interdependent competitors (sellers) in a ***duopoly***. Cournot's analysis of two sellers of spring water clearly established that the price and output of one seller was a reaction to the price and output of the other seller. If the two collude they can act as a single monopolist and divide monopoly profits. If they compete, Cournot concluded that the output would be $\left[\frac{N1}{(N+1)}\right]$ times the competitive output. As the number of competitors (N) increases, the result approaches the purely competitive result.

Cournot's recognition of the interdependence of sellers provided the foundation for a variety of approaches to explain the interdependent behavior of oligopolists. In the 1930's the "kinked demand" model [published by Paul Sweezy in August 1939 and by R.L. Hall and C.J. Hitch in May 1939] and the "administered price hypothesis" [Gardner C. Means in 1935] were developed as an attempt to explain price rigidities in some markets during the great depression. In 1943 John von Neumann and Oskar Morgenstern published a path breaking work on game theory. Game theory has been used to try to explain the behavior of independent competitors. There have been a variety of other models that attempted to explain the interdependent behavior in oligopolies. The number of models is evidence that it is a difficult task and there are problems with most approaches. The kinked demand model is used here to emphasize the interdependence of oligopolistic behavior rather than to explain the determination of price.

13.2.1 Kinked Demand Model

The kinked demand model begins with an oligopoly that has two sellers of a homogeneous good. The typical characteristics that constitute an oligopoly are:

- A "few" firms: the concept of "few" means that there are few enough sellers that they recognize their interdependence.
- The output may be homogeneous or differentiated. Primary metals industries are examples of oligopolies with homogeneous goods. Instant breakfast drink mixes are an example of an oligopoly with differentiated products.
- In an oligopoly there are usually significant barriers to entry.

Figure VIII.6 is a graphical representation of the demand and revenue functions of a firm in a oligopoly that is modeled as a kinked demand.

A single firm in a two firm duopoly is represented. The current price is P and output is Q. Point H must lie on "the" demand function. The nature of the perceived demand depends on what the firm believes its competitor will do. There are two possibilities with respect to price. Either the competitor will follow every price change or they will ignore every price change. D*D* assumes the competition will follow every price change; DD assumes that price changes are ignored. MR* is associated with D*D* and MR is associated with DD. If there is "excess capacity" the firm may realistically expect that their price cuts will be followed and price increases will be ignored. The demand for price increases is D*H and for price cuts is HD. The total demand is D*HD. The sections of the MR associated with the demand D*HD is D*J, then a gap from JF and then the remainder of MR.

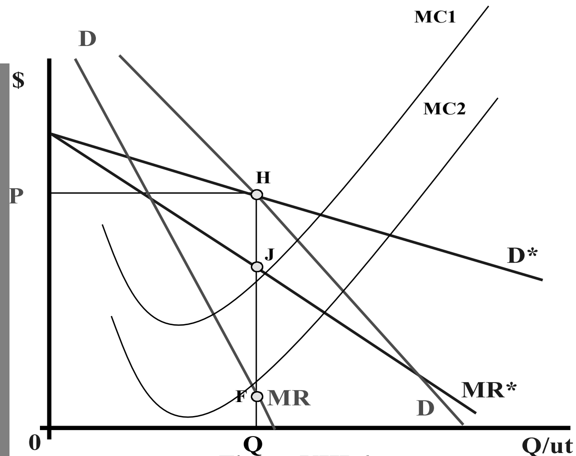


Figure VIII.6

The kinked demand model is dependent on the firm believing that the competitor will follow price cuts but not price increases. If there is additional capacity available (firms can increase output without increasing plant size), a price cut will followed. The reasoning is that if the competitor does not follow the price cut, firm will entice customers away from the competitor. Therefore, the competition must follow price cuts or lose customers and sales. The demand function relative to price cuts in inelastic: cut price and TR falls. The perception is that the competition will not follow a firm's price increases. If they do not follow they will get the firm's customers and sales. The demand above the prevailing price is relatively elastic: raise price and TR falls. At the prevailing price, there is a kink in the demand function and an associated gap or discontinuity in the MR (shown as the gap from J to F in Figure VIII.6). The marginal cost function can rise to MC1 or fall to MC2 with no change in output or price. The kinked demand model of the Great Depression was used as evidence that concentrated markets were rigid and failed to respond to changing conditions. Pro market advocates obviously attached the model and its conclusions.

All models of market structure must be considered as examples. When analyzing a market, it is not a mater of selecting and applying one of the market models presented in principles of microeconomics. You must consider all the relevant characteristics of the firms and the market and then construct a workable model to explain the question you have asked.

13.2.2 Performance

The function of a market system is to provide the information and incentives that will result in the allocation of relatively scarce resources and goods to their highest valued use within a social system. From an equity perspective we tend to believe that anyone who uses or consumes a good should bear the opportunity costs that result from that use. The price should equal the marginal cost. Rational consumers will buy goods so long as their marginal benefits are greater than or equal to the price they pay. Sellers will produce and offer goods for sale so long as the marginal cost of producing the goods is less than the price they can get. The optimal allocation of resources is characterized by the simple equation:

MB = P = MC

Long run equilibrium in purely competitive markets is the ideal and provides the benchmark for market performance. As market power is increased the price tends to rise above the MC suggesting less than an optimal allocation. When price is greater than MC, it should be considered as evidence that something may be amiss. It does not mean that it must be corrected. Just as a body temperature of 99.8^0 suggests a problem it does not mean you should be taking an antibiotic or undergoing surgery. In a market the price may exceed the MC but the cost of correcting the problem may exceed the benefits of the correction.

14 Markets for Inputs and Distribution of Income

The factor markets allocate the factors of production among the various producers/sellers. In a market economy, the inputs [land ®, labor (L), capital (K) and entrepreneurial ability] are owned by individual agents who make decisions about the amount of each input they want to supply. The decisions of the producers determine the demand for the inputs. Remember that the decisions of the producers reflects the preferences and ability

In the **goods markets**, each individual consumer will maximize their utility

$$\frac{\mathrm{MU}_X}{P_X} = \frac{\mathrm{MU}_Y}{P_Y} = \cdots = \frac{\mathrm{MU}_N}{P_N}\,, \text{ subject to: } P_X Q_X + P_Y Q_Y + \cdots + P_N Q_N \leq \text{BUDGET}$$

when:

This is an equilibrium condition. The consumer cannot alter their expenditure and improve their welfare or increase their utility. Income (budget), preferences (MU_N) and the relative prices determine the outcomes. The market demand reflects these conditions to the market. The demand function is a schedule of the maximum price (reservation price) that buyers are willing and able to pay for a schedule of quantities of a good in a given period of time (ut), *ceteris paribus*. The supply function in the market reflects the opportunity cost or producing each unit of output. It can be defined as the minimum price (reservation price) that the seller will accept for each unit of output. Market equilibrium is determined by the interaction of the buyers and sellers.

The equilibrium of the buyers and market equilibrium depends on the income of the buyers. The way in which income is distributed in a system determines the allocation decisions. The judgment about the criteria used to distribute income has both an ethical and efficiency dimension. In most social groups, it is considered desirable that income be distributed in proportion to the contributions to the achievement of objectives. Clearly, most societies make exceptions: most societies refuse to let individuals who are incapable of making contributions do without resources and goods to support life. In industrial societies there is a range of judgments regarding what things should be provided. At one extreme few resources are provided. At the other extreme a higher level of comfort is considered appropriate.

From an efficiency perspective, each factor should receive a share of income in proportion to the factor's contribution to the value of the output. John Bates Clark (1847-1938) was one of the architects of the "marginal productivity theory of income distribution." In concept the idea is simple, in practice it is difficult to measure the contributions of each factor to the production process.

The production process was described by a production function. In its simplistic form it is: **Q = f(labor, kaptial, land, technology, . . .)** The marginal product of each factor describes the contribution of each factor to the production of the output. The marginal product of a factor can be described as:

$$\mathrm{MP}_F \equiv \frac{\Delta \mathrm{Q}}{\Delta \mathrm{F}},\ \text{the change in output } (Q)\ \textit{caused}\ \text{by } \textit{a}\ \text{change in } F\ (\text{the factor})$$

With the use of calculus the marginal products of a set of inputs can be described as partial derivatives. Given a production function:

$Q = AL^{\alpha}K^{\beta}$, the marginal products of the factors is:

$$\mathrm{MP}_L = \frac{\partial Q}{\partial L} = A\alpha L^{\alpha-1} K^{\beta}$$
$$\mathrm{MP}_K = \frac{\partial Q}{\partial K} = \mathrm{A}L^{\alpha} K^{\beta-1}$$

If the marginal products are known and the relative prices of goods in the markets reflect the values of the outputs, the value of each factors contribution can be calculated as the product of MP_F and the price of the output. The marginal productivity theory of income distribution suggests that the income share each factor of production should receive is determined by the marginal product of the input and the price of the output. The change in the value of the output associated with a change in an input is called the **value of marginal product** (**VMP**) or the **marginal revenue product** (**MRP**). Originally the VMP was used to describe the demand for an input into production process for a purely competitive firm and the MRP was used to describe the demand for an input used to produce a product where market power (a negatively sloped product demand) existed. Most texts currently use MRP as a generic term that covers both VMP and MRP.

14.1 A. The Demand for Inputs

The demand for a factor of production is a **derived demand.** You do not have a direct demand for an auto mechanic: rather you have a demand for an automobile that functions properly. The demand for the mechanic is a derived demand. You probably do not have a demand for 2X4's (they really aren't 2" by 4"), you have a demand for a house that is constructed with the lumber. The demand for an input is determined by the relative value of the good produced and the productivity of the input.

The demand for an input can be derived by using the production function (the MP for an input) and the price of the good. The marginal revenue product is shown in Table IX.1.

Table IX.1 shows a short run production function. Capital is fixed at 4 units. As labor is added, the output (Q or TP) increases at an increasing rate. In this example the marginal product of labor (MP_L) declines from the first unit. This makes the MRP_L or demand for labor less messy.

The constant price at all levels of output (P_X = \$11 at all output levels) is the result of the firm being in a purely competitive market: the demand faced by the firm is perfectly elastic.

The marginal revenue product is a measure of the value of the output that is attributable to each unit of the input. The first unit of labor "produces " 8 units of output (MP_L = 8). These 8 units of output can be sold for \$88 (P_X=\$11, MP_{L1}= 8: so P_X*MP_L= 8*11=88). The maximum that an employer would be willing to pay the first unit of labor would be \$88. The MRP of the second worker is \$77. The second worker produces 7 units of output valued at \$11 each.

Table XI.1

Short Run Demand for Labor in Pure Competition

Kaptial (fixed)	Labor (L)	Q, TP	MP_L	Product price, P_X	$(MP_L)P_X$ MRP_L
4	0	0		\$11	
4	1	8	8	\$11	\$88
4	2	15	7	\$11	\$77
4	3	21	6	\$11	\$66
4	4	26	5	\$11	\$55
4	5	30	4	\$11	\$44
4	6	33	3	\$11	\$33
4	7	35	2	\$11	\$22
4	8	36	1	\$11	\$11
4	9	36	0	\$11	\$0

The MRP of each unit of input is the maximum an employer would be willing to pay each unit of input and can be interpreted as a demand function. Notice that if 35 units could be sold, 7 units of labor would be hired. The MRP_{L7} is \$22. The maximum the employer would be willing to pay the 7th unit of labor is

The MRP is the maximum the employer will pay each unit of labour in a given period of time given the productivity (MP) and the price of the output (P_X). At a wage of W_R, the firm will hire N workers. All N workers are paid the same wage rate; i.e. there is no price discrimination.

The wage bill or expense is shown as area $0NRW_R$, measure by NW_R. the producer surplus is area W_RRA. The producer surplus is not the same as profit. The payment to the fixed factor must be subtracted from the producer surplus to calculate profit.

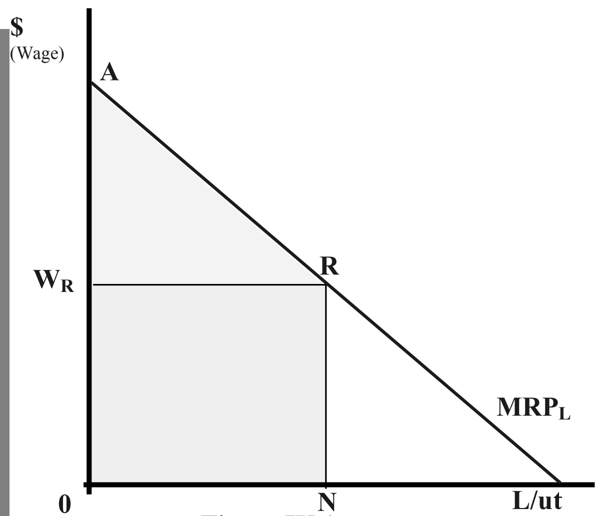


Figure IX.1

$22. Wage/price discrimination is technically illegal, all workers are paid $22. The employer gains $66 on the first unit of labor ($88-$22), $55 on the second, $44 on the third, $33 on the forth, $22 on the fifth, $11 on the sixth and nothing on the seventh. This is shown graphically in Figure IX.1

The MRP of an input used by a firm with market power (a negatively sloped demand for it output) is shown in Table IX.2.

Table XI.2					
Short Run Demand for Labor For Firm in Imperfect Competition or Monopoly					
Kapital (fixed)	**Labor (L)**	**Q, TP**	**MP_L**	**Product price, P_X**	**$(MP_L)P_X$ MRP_L**
4	0	0		$13	
4	1	8	8	$11	$91
4	2	15	7	$10	$70
4	3	21	6	$9	$53
4	4	26	5	$8	$39.00
4	5	30	4	$7	$28
4	6	33	3	$6	$19
4	7	35	2	$6	$12
4	8	36	1	$6	$6
4	9	36	0	$6.00	$0

Note that the only difference in Table IX.1 and IX.2 is that he price of the output must be decreased if more units are to be sold. This makes the demand for the input relatively more inelastic.

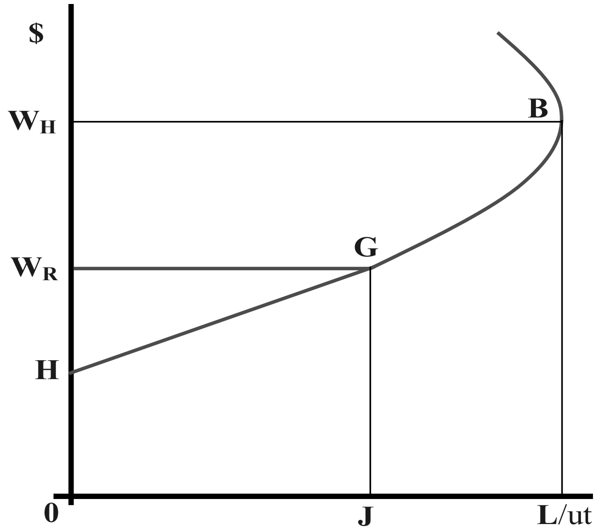


Figure IX.2

14.1.1 Supply of Inputs

The individual agent who owns the input will decide how much of a factor they want to offer for sale at each price offered for the input. A worker must decide how many units of labor (hours, days, weeks, years, etc) they will offer for sale at each possible wage rate. The supply of labor is a function of the wage rate, the value of leisure, alternatives available, taxes and other circumstances. Generally it is believed that more labor will be offered for sale at higher wage rates, up to a point. Owners of other factors of production (land, capital, entrepreneurial ability) make decisions that determine the supply functions of those factors. Figure IX.2 illustrates several possible supply functions. The segment HGB is one possibility, it represents a supply where the worker is willing to offer more labor at higher wage rates. The maximum labor that will be offered for sale is at point B. At a wage rates higher than W_H, the supplier substitutes leisure for income and offers less labor for sale as the wage increases. Another possibility is a supply of labor that is represented by segment W_RGB. A horizontal segment at the prevailing wage rate is caused by a worker or workers who refuse to work at any wage that is less than the prevailing wage, W_R.

14.1.2 Market for Inputs

The market for an input includes all potential buyers and sellers of an input. The demand reflects the decisions of the buyers of the inputs and is based on the MRP for the factor. The supply function represents the decisions of the factor owners to supply the input at various prices. Figure IX.3 represents a market for labor. MRP represents the demand and S is the supply of L. The market equilibrium occurs at point G where the quantity of labor offered for sale is equal to the quantity of labor that is demanded at a the wage rate W_R. J units of labor are hired.

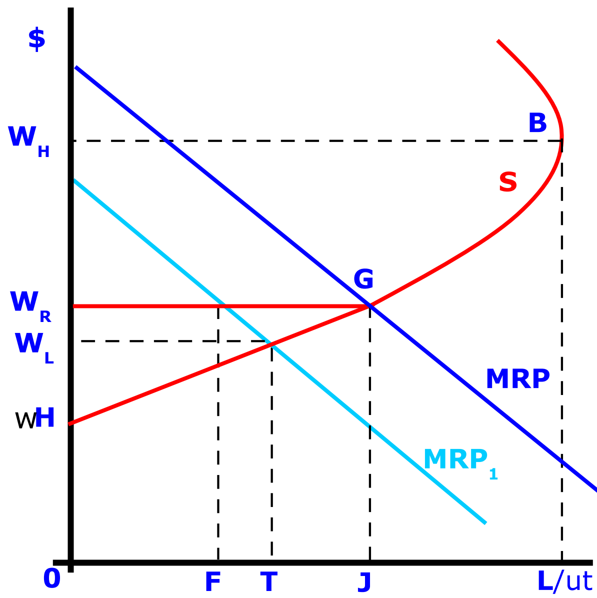


Figure IX.3

An increase in the productivity of labor or the price of the good produced (P_X) will increase the demand (MRP). A decrease in productivity or PX will shift the MRP to the left (MRP_1). If worker are unwilling to work for less than the market wage, W_R, the supply is represented by line W^RGB. The level of employment would fall to F units of labor. If HGB were the relevant supply, unemployment would fall to T units and the wage would fall to W_L.

If the MRP increased so the wage rate exceeded W_H, workers would supply a smaller quantity of labor in a given period of time.

14.1.3 Income Distribution

Income distribution can be described as a functional or personal distribution. The functional distribution of income describes the allocation of income among the factors of production. The distribution of income among the members of society, individuals and families, is called the personal distribution of income.

Adam Smith, David Ricardo, Karl Marx and other early economists were primarily concerned about the distribution of income among social classes that were partially based on economic criteria. During the feudal era labor (serfs) and land owners (aristocracy and church) were the important factors of production. Generally, the social classes were the serfs, aristocracy and clergy. Economic behavior was coordinated by a complex set of social institutions that were based on deontological ethics (duty). Reciprocity and command were the primary organizing mechanisms. Markets existed and were used in many cases. Market towns and fairs were used to allocate some goods while labor, land and many goods were allocated through obligations specified by tradition and command.

The personal distribution of income describes the allocation of income among economic agents. In most modern, industrial societies, markets are the primary organizing institution of economic processes. Markets determine the allocation of income as well as the allocation of scarce resources. Other social institutions such as welfare and philanthropy play a minor role in the personal distribution of income.

Irvin Tucker (*microECONOMICS for Today*, South-Western 2000, p 283) shows the distribution of income based on the head of household. His data is based on the Census data and is shown in Table IX.3.

Table IX.3

Income Distribution Based on Head of Household - 1997

Irvin Tucker, *microECONOMICS for Today*, South-Western 2000, p 283

Characteristic By Head of Household	Median Income
All Families	$44,568
Male	$32,960
Female	$21,023
Age 25-34	$39,979
Age 65+	$30,660
Head non High School Grad	$25,465
Head High School Grad	$40,040
Head with Bachelor's degree	$67,230

The information in Table IX.3 poses several issues. When considering income distribution by age of household, there is a "life cycle" of a person's earnings and needs that should be considered. It should be noted that the distribution of wealth and income are two related but different problems. Another issue is the role of education and training. Disease and the industrial revolution significantly altered the social classes and the distribution of income. Technological change is a fundamental feature of modern industrial societies and will change the nature and role of education and training in the distribution of income.

A "Lorenz Curve" can also describe the personal distribution of income. A Lorenz curve can be used to show either the distribution of income or wealth and can be applied to the world, a country or a sub category of individuals (the military, lawyers, or . . .). A Lorenz curve plots the cumulative proportion of income units and cumulative proportion of income received when income units are arrayed from lowest to highest.

The data for a Lorenz curve is shown in Table IX.4. (Irvin Tucker, *microECONOMICS for Today*, South-Western 2000, p 282) The income distribution is arrayed from lowest to highest. The data in Table IX.4 suggest that the income distribution became more equal from 1929 to 1970 and less equal from 1970 to 1997. The trends in income distribution are subject to controversy. There are many forces that influence income distribution. It is highly unlikely that the MRP is the single determinate of the income share received by a factor or individual who owns the factor. Political forces, technological change, tradition, law and a variety of other forces influence the distribution of income. Discrimination by gender or race are hotly debated issues.

Table IX.4 **Income Distribution Among Families 1929-1997**						
% Families	1929		1970		1997	
Lowest 20%	3.50%	3.5%	5.5%	5.5%	4.2%	4.2%
Second Lowest 20%	9.0%	12.5%	12.2%	17.7%	9.9%	14.1%
Middle 20%	13.8%	26.3%	17.6%	35.3%	15.7%	29.8%
Second highest 20%	19.3%	45.6%	23.8%	59.1%	23.0%	52.8%
Highest 20%	54.4%	100%	40.9%	100%	47.2%	100%
Highest 5%	30%	Cumulative	15.6%	Cumulative	20.7%	Cumulative

A Lorenz curve is usually shown as plots of the cumulative proportion of income units and cumulative proportion of income received when income units are arrayed from lowest to highest. In Figure IX.4 data from 1929, 1970 and 1997 are compared to an equal income distribution. An equal income distribution is shown as a diagonal line AB. The further the Lorenz curve deviates from the diagonal, the more unequal the distribution of income.

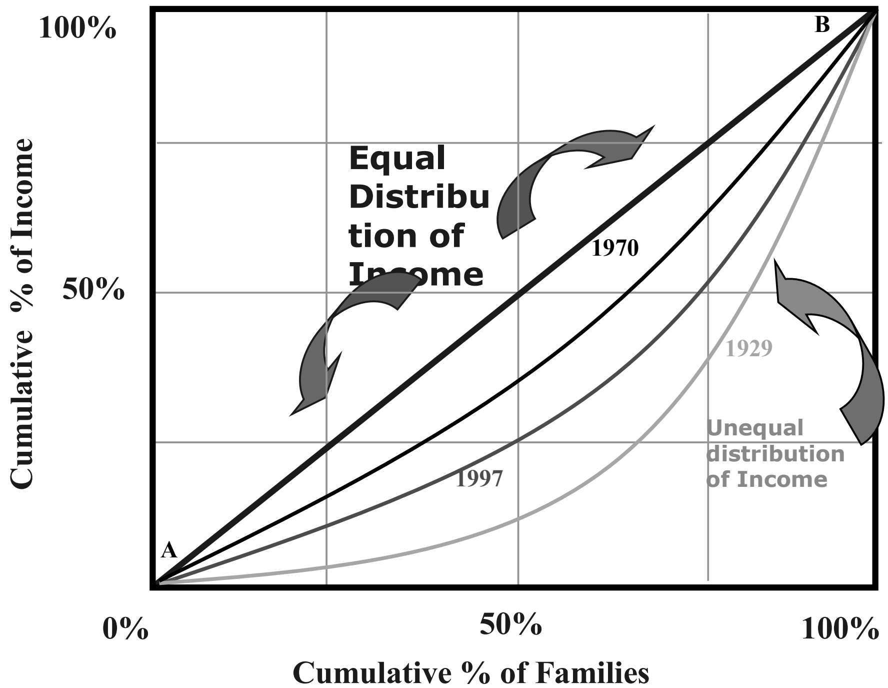

100%
50%
Cumulative % of Income
B
Equal
Distribu
tion of
Income
1970
1929
Unequal
distribution
of Income
1997
A
0%
50%
100%
Cumulative % of Families

Figure IX.4

15 Property Rights and Markets

The optimal solution to the allocation problem requires the participants to have accurate information about the marginal costs and marginal benefits associated with specific alternatives. Most of Neoclassical microeconomics is a story about the way market exchange reveals, communicates and uses individual evaluations about marginal benefits (MB) and marginal costs (MC). The information about MC and MB revealed by market exchanges (like all information) is never perfect. Problems arise when exchange is not voluntary and property rights are attenuated. Pure competition is one way to ensure that no one buyer or seller has the ability to alter the outcome of market exchanges and the information revealed in prices. The existence of market power allows a buyer or seller to influence the outcome of a market exchange and distort the information about MB and MC.

Attenuated or weakened property rights also may distort information about MB and/or MC and result in an allocation that is less than optimal. "Nonattenuated" or strong private property rights have three important characteristics: exclusive, enforceable, and transferable.

15.1 Private Property Rights

Private property rights have three important characteristics that contribute to the efficient functioning of the market: exclusivity, enforceability and transferability. A lack of any one of these characteristics will distort market exchanges and result in less than optimal results.

Furuboton and Pejovich define property rights as:

> *Property rights are understood as sanctioned behavioral relations among men [sic] that arise from the existence of goods and pertain to their use. These relations specify the norms of behavior with respect to goods*

> *that each and every person must observe in his daily interactions with other persons, or bear the cost of non-observance. The term "good" is used here for anything that yields utility or satisfaction to a person. Thus, and this point is important, the concept of property rights in the context of the new approach applies to all scarce goods. The concept encompasses both the rights over material things (to sell my typewriter) as well as 'human' rights (the right to vote, publish etcetera). The prevailing system of property rights in the community is, them, the sum of economic and social relations with respect to scarce resources in which individuals stand to each other.* [Eriik Furuboton and Svetozar Pejovich, The Economics of Property Rights, Cambridge, Mass.: Ballenger, 1974, p 3]

This definition implies that an individual has a bundle of rights or claims empowering him or her to control the outcome of specific events or alternatives. Secondly, it implies these claims are sanctioned by social institutions and are social in character. Private property rights implies that the individual has the power to determine the use of an economic "good" and incurs all benefits and cost associated with that use.

15.2 Transferability

Clearly a good must have property rights that can be transferable before it can be exchanged in a market. In some cases it may be physically impossible to transfer a property right (I cannot buy some one else's good health or height or athletic skills). In other cases it may be illegal to transfer or acquire the property rights to a good (I cannot legally sell my kidney in the US or UK). In cases where it is technically possible to transfer a property right but illegal, a "black market" may emerge. Part of the cost of acquiring or selling a good is the risk an punishment of violating the law. There is a large literature on the economics of crime not addressed here.

15.3 Enforceability

Property rights can be enforced in formal or informal ways. Both Adam Smith and Karl Marx believed that one of the primary functions of government was to enforce property rights. Explicit laws enforced by the state are often used to define and determine the nature of property rights. Property rights can also be enforced by implicit social institutions. Respect for others and social sanctions are important determinants of property rights.

The property rights to "material things" are more obvious and clear cut than intellectual property rights. The property rights to computer software, books, music and the like are more difficult to define and enforce due the nature of the goods and the technical ability to copy and communicate. Patents and copyright laws are attempts by the government to assign and protect property rights.

15.4 Exclusivity

When private property rights are exclusive, all the costs and benefits of an alternative are exclusive to the person(s) engaged in the exercise of the property right. In some cases the exchange or use of an economic good may have "third-party" or "spillover" effects. There may be costs or benefits that impact individuals who are not engaged in the actual use of the good. When this happens it is called an **externality**. Externalities can be positive (a benefit is conferred on a third party) or negative (a cost is imposed on individuals). These externalities may occur in consumption (smoking a cigar can impose costs on others) or production (producing paper generates air and/or water pollution).

In some cases it is technically impossible to exclude (prevent an individual) individuals from the consumption and benefits of a produced economic good. These are called **collective or public goods**. National defense is an example of a public good. In other cases it may be technically possible to exclude individuals from the benefits of a good but the cost of doing so makes it impractical. These are often referred to as **quasi-public goods**.

There are also "fugitive or fugacious" goods. A fugitive good is one that is owned by no one until some one "captures" it. The process of capture and use of these goods imposes cost on others. These goods are called "**common property resources**."

15.5 "Market Failure" and Property Rights

With the presence of externalities, public or collective goods and common property resources, the information generated by market transactions may be distorted and incorrect signals result in misallocation of resources.

15.5.1 Externalities

Externalities may be positive or negative.

POSITIVE EXTERNALITY

A positive externality exists when there are "Social Benefits" that result from a market transaction or the use of a good. In Figure X.B.1 a positive externality is shown. Individual J perceives the marginal costs of X as MC and the marginal benefits as MB_P. To optimize the net benefits the individual would want X amount. However, there are other individuals

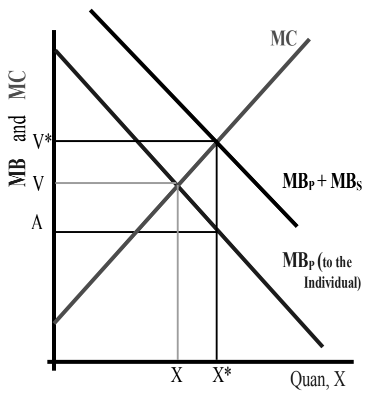


Figure X.B.1

who benefit from the J's use of good X. The MB of others or society is MB_S. The marginal benefit to society is $MB_P + MB_S$. the optimal amount of good X is X*, not X. In the case of a positive externality, market exchanges result in less than the optimal amount of the good. One solution is to subsidize good X by the amount V*-A.

NEGATIVE EXTERNALITY

A negative externality exists when an alternative results in costs being imposed on individuals who are not involved with the transaction or use of the good. An individual who smokes a cigarette in a restaurant has made a decision to smoke based on the marginal benefits and marginal costs to themselves. The second hand costs impose marginal costs on others. In Figure X.B.2 the individual recognizes the costs and benefits to themselves as MCP and MBP. Recognizing these costs and benefits, the individual will maximize net benefits by consuming X amount of good X. Since the consumption of good X imposes costs on others, the MPP + MPS reflects the marginal costs to the individual and society. The optimal amount of the good from a social perspective is X** rather than X. A negative externality results in decisions to produce and consume more than the socially optimal amount of a good. One solution is levy a tax of V*-A on good X.

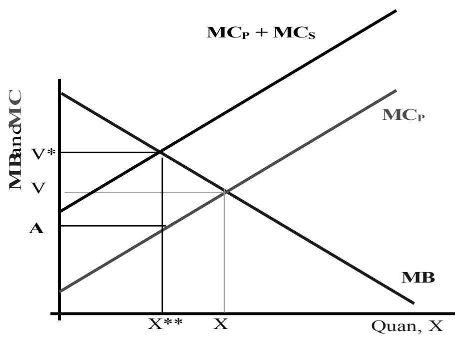


Figure X.B.2

15.5.2 Public or Collective Goods

A public good has two important characteristics. First, it is technically impossible to exclude any individual from consuming the good. Second, the marginal cost of the additional consumer is zero.

The optimal result in a market is that the output occur at the level where the MB = MC and the price should reflect both the MB and MC:

MB = P = MC

When the MC of another user is zero the optimal price is also zero. It is not possible for a private provider to produce and offer a public good for consumption (unless they are an altruistic philanthropist). National defense is the primary example of a public good. A private market will not produce a public good.

Since individual cannot be excluded and there is no reason for them to contribute to the costs of production, they become "free riders." In some cases free riders can be encouraged to contribute through social mechanisms such as feelings of philanthropy or guilt. In cases where a society decides to undertake an alternative, and an individual prefers not to be a participant, the individual may become a forced rider.

15.5.3 Common Property

A common property resource is a fugitive resource that is owned by the individual who "captures" it. The use of a common property resource imposes costs on others in the society. Buffalo, whales, "commons" and water quality are examples of common property resources.

Garret Hardin's article on the *Tragedy of the Commons* discusses the tradition of a common pasture in villages. Each person can use the commons to graze their animal. Since no one owns the commons the incentive is to get another animal to graze. Since everyone has the same incentive every one takes more animals to graze and eventually the commons is overgrazed and every one loses.

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