Lecture 1. **Introduction to Microeconomics. Economic models.**

1. The Economic problem.
   1.1.Scarcity in economics.
   1.2.Opportunity cost and allocation of resources.
   1.3. Economic decision-makers. Microeconomics.
   1.4. Households and firms: thr problem of coordination.
2. Economic model and its main elements.
   2.1.Exogenous and endogenous variables, parameters.
   2.2.Circular flow model.
   2.3.Rationing devices. Systems of coordination

1. The Economic problem.

1.1. Every society - centrally planned, market oriented, or mixed - must make choice on utilization of its scarce resources. Virtually all resources are *scarce*, meaning that there are not enough of them to satisfy needs of everybody. Scarcity in economics differs from scarcity in physics: scarcity of economic resource is not absolute, but relative feature. It means that at any moment the needed amount of this resource is greater than its actual stock. There are two kinds of scarce resources in economy: *1) productive resources* used for production (*inputs)* of *2) goods for consumption (outputs).*

Because of scarcity, no one can have everything he or she wants. Every society must develop some kind of mechanism for *allocating* the output among its members. As a result, every society inescapably has to answer three questions: What is to be produced? How is it to be produced? Who gets the output?

The two questions - What is to be produced? and How is it to be produced? - assume that there are *the alternatives sets* of resources combinations in the processes of production and structures of output.

Economics - the study of how scarce resources are allocated among alternative uses.

Scarcity is the reason for the existence of *price systems:* as quantities of goods are limited, consumers must bid for desired goods. *Economic goods* are scarce and limited in their quantity; therefore, their prices are positive. *Free goods* are those which are not scarce. Their prices are zero because of their unlimited quantity (air).

1.2. Resource scarcity leads us to an important concept in economics: *opportunity cost*. When more of commodity *X* is produced, resources are used up. These resources could be used to produce alternative commodities. The best of these foregone alternatives is the **opportunity cost** of *X*.

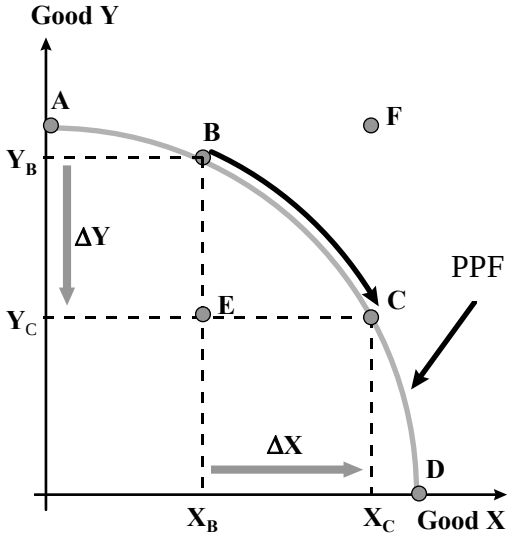

Fig. 1.1 Production Possibilities Frontier (PPF).

At any moment the society's productive possibility is constrained by resources stocks and by productive technologies. *The production possibilities frontier* (Fig.1.1) is a simple way to show that with limited resources and given technology, the society could produce more of one good *X* (ΔX) only by reducing the produced amount of other good *Y* ($-\Delta Y$).

This frontier shows the various combinations of goods *X* and *Y* (points *A, B, C, D)* that can be produced *efficiently* with given resources and technology. Point *E* is less desirable than points *B* or *C*, because less output is produced at this point. But because of unemployment or inefficiency, society may wind up at point *E.* Point outside the frontier, such as point *F*, are unattainable.

1.3. The problem of scarce resources allocation can be solved by comparison of income received after realization of concrete alternative and its opportunity cost, i.e. income obtained after realization of the best alternative. The central principle of microeconomics is that decision makers - households and firms - *"optimize"* - they do the best they can given their objectives and the constraints they face. Another principle is that decision makers optimizing their behavior take into account all possible alternatives of resources utilization - *opportunity cost principle*. These two principles found the basis of modern **microeconomics**.

Microeconomics - the study of public choices, business choices, and personal choices to understand how the economy functions.

Or: *Microeconomics* - the study of the decisions of people and business, the interactions of those decisions in markets, and the effect of government regulation and taxes on the prices and quantities of good and services.

1.4. In any large economy there are millions of products, households and firms.

The *firm* is the economic unit responsible for decisions concerning what to produce, how it is produced, and how much is produced. Firms operate on the principle of maximizing profits.

In economic theory, *households* are the consuming elements in the economy. They allocate their limited incomes to purchase of goods and services in order to satisfy their needs. Households operate on the principle of maximizing utility.

In a market system households and firms make their own decisions; and we have to understand how these decisions are made and how they fit together. We can analyze these problems using circular flow and supply and demand models.

2. Economic model and its main elements.

2.1.We study how economies work using **models**, which are descriptions of phenomena that abstract from the details of reality. By "abstracting" from details we mean ignoring those details that are not directly essential for understanding the phenomenon. All economic models express relationships among *economic variables*. Models have two kinds of variables: *exogenous* variables and *endogenous* variables. Exogenous variables come from outside the model - they are inputs into the model. Endogenous variables come from inside the model - they are model's output. In other words, exogenous variables are fixed at the moment they enter the model, whereas endogenous variables are determined within the model. The objective of model *construction* is to describe exactly how exogenous variables determine endogenous variables.

2.2. It is useful to think of the economy as consisting of two sectors: *households* and *firms*. Households own various productive resources - labor, capital, and land. Firms use these resources as inputs in the production of goods and services. Households receive their incomes by supplying input to firms, and purchase goods and services from business. In effect, then, economic activity is circular. The money that households spend on goods and services comes back around to them in the form of income from the sales of inputs.

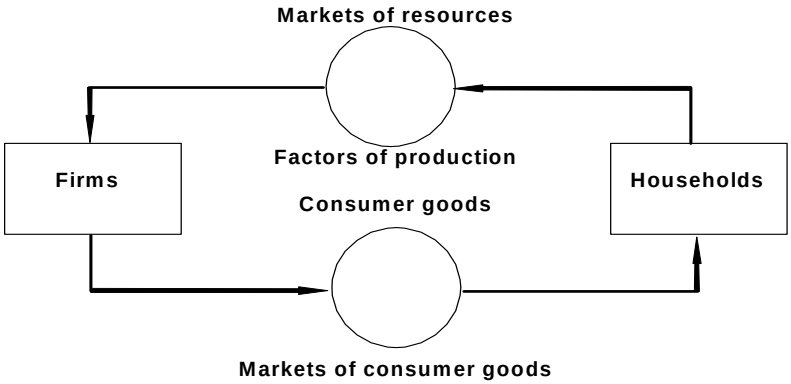

Fig. 1.2 Market mechanism of coordination. Circular flow model.

This is households sector who decides *what to consume*. These decisions would form business sector plans *what to produce*. Business firms must *coordinate* their decisions about scarce resources utilization. Finally, households should get the goods they planned to consume, i.e. coordinate their consumption activity. *Resource markets* (input markets) and *good markets* (output markets) coordinate these activities in a market society.

The *circular flow model* (Fig.1.2) indicates that markets somehow regulate the flows between the two sectors. Households and businesses "meet" in the goods market; the outcome determines what goods are produced. They "meet" again in the factor market; the outcome determines how the things are produced (that is, what inputs are used). The supply and demand model describes how prices guide the behavior of both producers and consumers. Supply-and-demand model defines goods (resources) quantity and their prices when households and business interact at goods (resources) market.

There are two kinds of economic agents in both resource and goods markets: *sellers and buyers*. Supply-and-demand model represents different needs of these economic agents. A *demand curve* is the relationship between the market price of a good and the quantity demanded of that good during a given time period, other things being the same. The *supply curve* is the relationship between the market price and the amount of goods producers are willing to supply during a given period of time, ceteris paribus. We want to find the *price* and *output* at which there is an *equilibrium* - a situation that will continue to persist because no one has any incentive to change his or her behavior.

Prices are signals that contain all the information needed to ensure consistency in the decisions of households and firms. For example, if flour becomes more expensive, no central directive is needed that people consume less and firms produce more bread. As a result, an equilibrium situation at bread market is restored.

2.3. Prices also ration scarce resources. Everyone who is willing to pay the equilibrium price gets the good, and everyone who is not, does not. Finally, prices determine incomes: in a market system, money income depends on the prices of the inputs supplied to the market.

The *coordination problem* in *market* system is resolved by market. Some behavior rules help to coordinate economic activities in *traditional* societies. Under *planned* society state administration coordinates economic activities. **All** coordination systems coexist at **every** moment of time. Every coordination system has its positive and negative features. One of these features is costs needed for coordination activity - so called *transaction costs.* There are many different *kinds* of transaction costs and this fact creates different coordination systems. In some circumstances - in large economies where the amount of information needed to coordinate different activities is enormous - market system is the most efficient coordination system because it minimizes the cost of collecting and transferring information through price mechanism.

Alongside with the problem of coordination, markets also solve the problem of synchronizing decisions about consumption and production of different goods. This function is performed through "futures markets", where future goods are bought and sold by *speculators* (from Latin word meaning reasoning about future). The economic justification for speculative actions is their product - information about scarcity of goods in future periods. It is important not to mix speculation with economically different activity - *arbitrage*. Arbitrages are buying and selling a good which has at the moment different prices in different location. Thus they perform a function of equalizing current prices for one particular good, providing the unambiguity of price signal. The role of speculators is somehow different. Through their actions economic agents get information about relative scarcity of goods in future. based on that information, they adjust their consumption and production plans towards more coherent, synchronized path.

Key Terms

Scarcity. The imbalance between desires for goods and services and the means of satisfying those desires.

Economics. The study of how scarce resources are allocated among alternative uses.

Microeconomics. The study of public choices, business choices, and personal choices to understand how the economy functions.

Opportunity cost of a choice. The next best alternative use of resources sacrificed by making a choice.

Production possibility frontier (PPF). Shows the maximum amounts of production that can be obtained by an economy, given the technological knowledge and quantity of inputs available. The *PPF* represents the menu of choices available to society.

Economic model. A simplified way of expressing how some sector of the economy functions; consists of assumptions that establish relationships among economic variables.

Circular flow model. A model that demonstrates how households and business firms are linked through input and output markets and how expenditure on products generates revenue that business firms use to pay for productive services.

Transaction costs. The value of the resources used in locating trading partners, negotiating terms of trade, drawing up contracts, and enforcing the property rights acquired in a transaction.

Productive resources (*inputs). Goods for consumption (outputs).*

Allocation of resources

Economic goods. *Free goods*

Households. Firms

Exogenous variables. Endogenous variables

Price

Market. Input markets. Output markets

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Lecture 2. **Supply and Demand. Functions and Graphs in Microeconomics.**

1. Market of a good.
   1.1. Sellers and buyers.
   1.2. Prices and quantities. Total revenues of sellers or spending of consumers on a market.
2. Market demand.
   2.1. Demand schedule and demand curve. Demand function. Inverse demand function.
   2.2. Sketching graphs and investigating functions.
   2.3. Different types of demand function. Linear and non-linear demand functions.
   2.4. Change in demand and changes in quantity demanded. The ceteris paribus assumption.
   2.5. Individual and market demand.
3. Supply.
   3.1. Supply schedule and supply curve. Supply function.
   3.2. Change in supply vs. change in quantity supplied.

1. Market of a good

1.1. In the circular flows model (fig.1.1) two types of markets were presented - of consumer goods and production recourses. Two groups of participants interact at each market: *sellers* and *buyers*. At the consumer goods market the role of buyers is played by households and the role of sellers - by firms. At the production recourses markets they switch roles. Households are sellers of recourses (production factors) whose owners they are. These recourses are bought by firms.

1.2. *Price* (*P*) of a good expresses a value of a good with the help of money. Prices are the measure which is used by sellers and buyers to exchange various goods voluntarily. Prices function as a signal for sellers and buyers in a sense that a price change forces participants to change their market behavior - to buy or sell more or less. In this sense prices coordinate decisions of producers and consumers.

Quantity of good (*Q*) is one more indicator which is defined at the market as a result of interaction of participants. As a result the market balances volume of goods which sellers are ready to sell and buyers are ready to buy at each specific price.

The result of *PxQ* defines the *total revenue* (*TR*) of sellers which they receive after selling of *Q* number of goods at a price of *P* per unit. Simultaneously the same number *PxQ* defines total expenditures of consumers at the market.

2. Market demand

Modern economists are trying to expose their thoughts in a mostly formal and exact way, that is in mathematical form. Thus, all assumptions and all steps in reasoning are explicitly stated. Usually such strict form is preventing any logical error and "opens" a theory for development and new contributions by other economists. The form in which economists are developing their ideas is called economic models.

Economic models express relationships of economic variables. These relationships are often expressed as functions. A function is mathematical concept that shows the dependence of variables. It is said that the *function of one variable* f_x is defined, if a unique element *y* from set B *corresponds* to every element x from set A according to a given rule.

An element (number) y corresponding to an element (number) x is denoted as $f(x)$. It is called *partial value* (or simply value) of function *f*, i.e. $y = f(x)$. The variable x is called *independent variable* (or *argument*), the variable y is called *dependent* variable.

2.1. For example, the functional dependence of demand for some commodity *Q* on its price *P* can be defined by the following table:

P, \$	9	5	3
Q, units	1	5	7

This table shows that there is negative dependence between variables Q and P: when Q goes down, P rises. The same dependence of Q on P can be represented by the diagram (Fig.2.1).

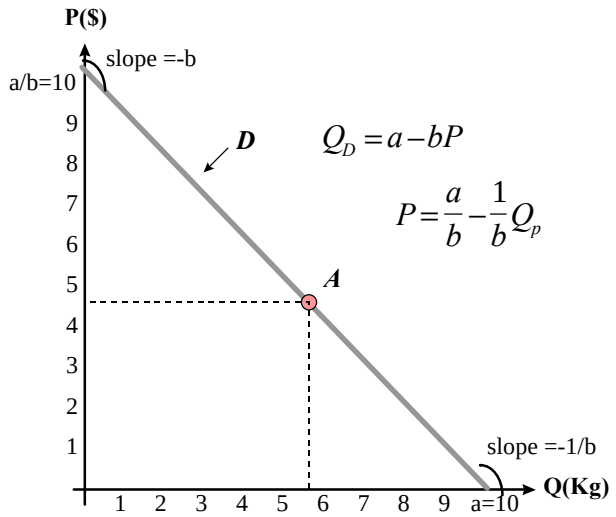

Fig. 2.1 The Demand Curve.

The functional dependence of variables P and Q can also be defined *analytically*, i.e. by the formula ***P* = *f*(Q)** (1) or by the formula ***Q*= *g*(*P*) (2).** One of this functions (1) is called *inverse* to another. In the example above the dependence of Q on P can be expressed by the following formulas:

Q = 10-P or ***P = 10-Q*** 1

***Demand (D)*:** The relationship between the price of an item and the quantity buyers are willing and the able to purchase.

***Law of demand*:** The lower the price of an item, the greater is the quantity demanded, other things (non-price determinants) being equal.

Forms of the Functional dependence: a) schedule (table); b) graph (coordinate system, horizontal axis - abscissa, vertical axis - ordinate, origin - zero point); c) analytical form (formula).

***Demand schedule*:** A table showing how the quantity demanded of an item varies with the price of the item.

***Demand curve*:** A graph of the relationship between price and quantity demanded. The negative (downward) slope of the demand curve illustrates the law of demand.

***Demand function*:** A representation of how quantity demanded depends on price; a mathematical way of expressing the law of demand

Q_D = f(P).

***Inverse demand function*:** A representation of how price depends on quantity demanded

P = h(Q_D).

2.2. How can the graph of linear function be plotted according to the formula? Let us consider the demand function $Q_D = 200 - 5P$ (P is the commodity's price, Q_D is the quantity demanded). This function is decreasing (the price P goes down as the quantity Q_D rises). Consumers would buy 200 units of commodity proposed under the price P=0. *The inverse demand function* is the dependence of *quantity on price*: $P = 40 - 0.2Q_D$. The *function's zero point* is P=40: it is the price of commodity when consumers ever buy it (Q_D=0). As a result, the graph crosses the coordinate axes in the following points (0, 200) and (40, 0). The function considered is a linear function, so in order to sketch its graph we should connect these two points by a straight line.

2.3. Different types of demand function:

a) ***Linear demand function***

Q_D = a - bP,

a > 0, b > 0; a - Q*-**intercept; ***(-b) - slope.

P = c - dQ_D,

c > 0, d > 0; c - P*-**intercept, ***(-d) - slope.

Slope: The direction of a line on a graph. Shows the change in ***Q*** that results from a unit change in ***P (=-b).***

Q-intercept: The value of ***Q_D*** when ***P*** equals zero ***(= a).***

P-intercept: The value of ***P*** when ***Q_D*** equals zero ***(= b/a).***

b) ***Nonlinear demand function***

$Q_D = aP^b$ => Log Q_D = a - b log P.

2.4. The changes in commodity's price (*changes in quantity demanded*) are presented by moving along the demand curve (Fig.2.2).

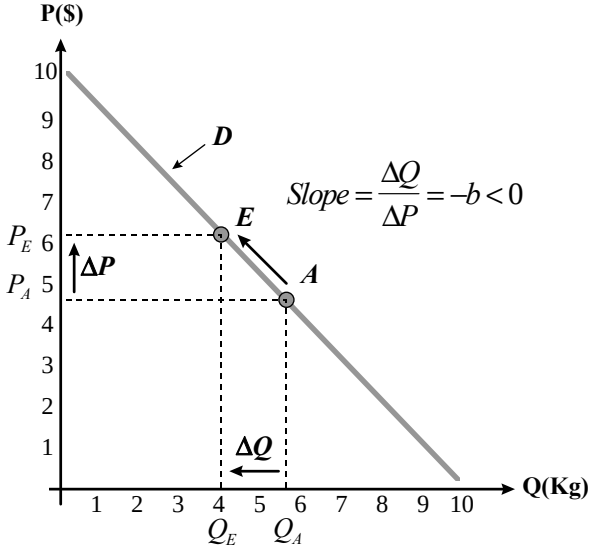

Fig. 2.2 Change in Quantity Demanded.

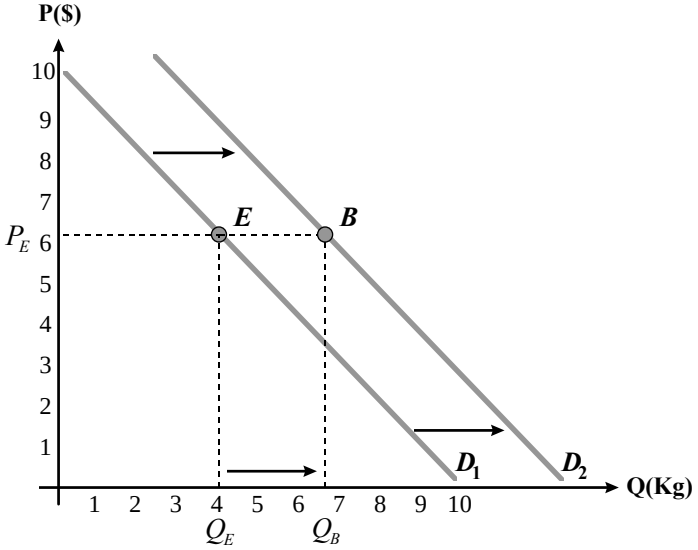

Fig. 2.3 Change in Demand.

Quantity demanded (Q_D): The amount of an item that would be purchased at a certain price given all of the other influences on demand.

Change in quantity demanded: A change in the amount of an item buyers are willing and able to buy in response to a change in its price (price changes).

Change in any factor except the price for the given good (in a price of another commodity, .aggregate income, consumer's taste, etc.) induces a shift of demand curve (Fig.2.3). It is important to distinguish moving along the demand curve (Fig.2.2) and the demand curve's shifts.

Change in demand: A change in the relationship between the price of an item and the quantity demanded caused by a change in something other than the price of an item (non-price determinants changes).

Non-price determinants:

- average income of buyers ***(I);***
- population (the size of the market) - only for market demand;
- prices of related goods - substitutes ***(P_s)*** and complements ***(P_c);***
- tastes or preferences ***(T);***
- expectations of changes in future prices ***(E);***
- special influences.

There is a *single* independent variable in a one-variable function. But as far as a function of *two* variables is concerned, it contains *two* independent variables: $y = f(x_1, x_2)$ is a function of two variables - x_1 and x_2. If number of independent variables $x_1, \ldots, x_n$ is equal to n ($n > 1$), we have a function of n variables $y = f(x_1, \ldots, x_n)$. It is often assumed in economic research that variables are non-negative, i.e. that $x_1 \geq 0, \ldots, x_n \geq 0$. We fix all but one variables (the assumption "other things being the same", or Latin "ceteris paribus") to analyze the influence of the *rest* variable.

Ceteris paribus assumption: other things (non-price determinants) being equal.

*Multivariate demand function***:** A relationship among amounts of a good consumers will buy, its price, and all other influences on the demand for the good:

$Q = f(P, I, T, P_s, P_c, E,$ special influences).

2.5. In the beginning, we use comparative static analysis to derive the *individual's demand curves*. This analysis examines the change in consumer behavior induced by a change in price of the *given* good, ceteris paribus. The *market demand* - this is the total demand of a good or service by everyone in the population. It is illustrated by the *market demand curve.* The market demand curve (*D)* is derived by horizontal summation of individual demand curves - d_1 and d_2 (Fig.2.4): if the price $P=P_E$ than the market quantity demanded Q_E is defines as $Q_E = Q_1 + Q_2$, $Q_1=d_1(P_E)$, $Q_2 = d_2(P_2)$.

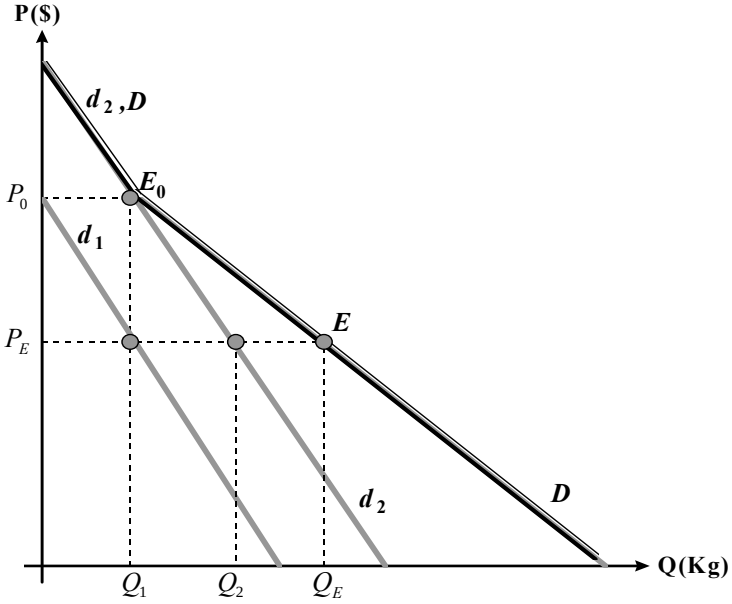

Fig. 2.4 Market Demand (D) derived from individual demands (d_1 and d_2).

3. Supply.

Supply (S): A relationship between price and the quantity sellers are willing and able to sell.

Quantity supplied *(Q_S)**:*** The amount of an item that would be supplied at a certain price given all of the other influences on supply.

The supply of commodity Q_S depends not only on the commodity's price P, but on many other factors ***(Non-price determinants)**:*

- the technology used (***T***): the rise of technology level shifts supply curve outward, because producer can propose higher quantity of commodity produced under the same price but lower costs;
- the inputs' prices ***(P_i):*** the rise of an input price shifts the supply curve inward, because producer can propose lower quantity of commodity produced under the same price but higher costs);
- expectations of future changes in price ***(E),***
- number of sellers (only for market supply): the growth of producers number shifts the supply curve outward if producers do not diminish their supply when new producers occur;
- market organization (taxes and subsidies): the growth of taxes level decreases a good's supply and thus shifts commodity's supply curve inward, the subsidies move it outward;
- special influences.

The Law of Supply says that as the price P goes up, the quantity supplied Q_S also goes up, ceteris paribus (i.e. if the other factors considered above are constant).

3.1. *Supply schedule:* A table showing how the quantity supplied of an item varies with the price of that item.

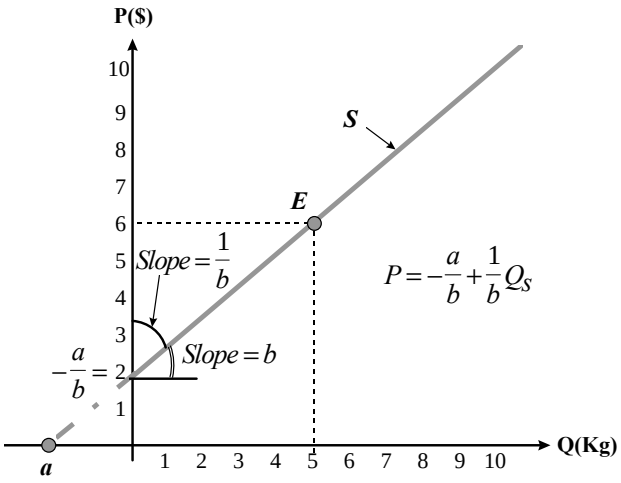

Fig. 2.5 The Supply Curve.

*Supply curve***:** A graph of the relationship between price and quantity supplied (Fig.2.5). The positive (upward) slope of the supply curve reflects the law of supply.

***Supply function*:** A representation of how quantity supplied depends on price; a mathematical way of expressing the law of supply

$$Q_S = f(P).$$

The supply function shows the maximum quantity of the commodity producer is willing to sell at any given price of the commodity P.

*Inverse supply function***:** A representation of how price depends on quantity supplied

$$P = h(Q_S).$$

Multivariate supply function: A relationship among amounts of a good sellers will sell, its price, and all other influences on the supply for the good:

$Q_S = f(P, T, P_i, E, special\ influences)$.

Examples of supply functions.

a) Linear supply function

$Q_S = a + bP$,

$a > 0, b > 0$; a - Q-intercept; b - positive slope.

$P = c + dQ_S$,

$c > 0, d > 0$; c - P-intercept, d - slope.

b) Nonlinear supply functions:

$Q_S = aP^b$, $a > 0, b > 0 \Rightarrow Log\ Q_S = a + b\ log\ P$;

$P = 0.3\ Q_S^2 - 4\ Q_S + 15,\ Q_S > 10$.

3.2. Changes in quantity supplied. Changes in supply.

Moving along the supply curve S is called *change in quantity supplied* (Fig.2.6). ***Change in quantity supply***: A change in the amount of an item offered for sale in response to a change in its price, other things being equal. In this situation a *change* in price p is accompanied in general by a change in quantity q.

A shift of supply curve (it may be not a parallel shift) is called a *change of supply* (Fig.2.7). ***Change in supply:*** A change in the relationship between the price of a good and the quantity supplied that results from a change in something other than the price of the good (non-price determinants changes).

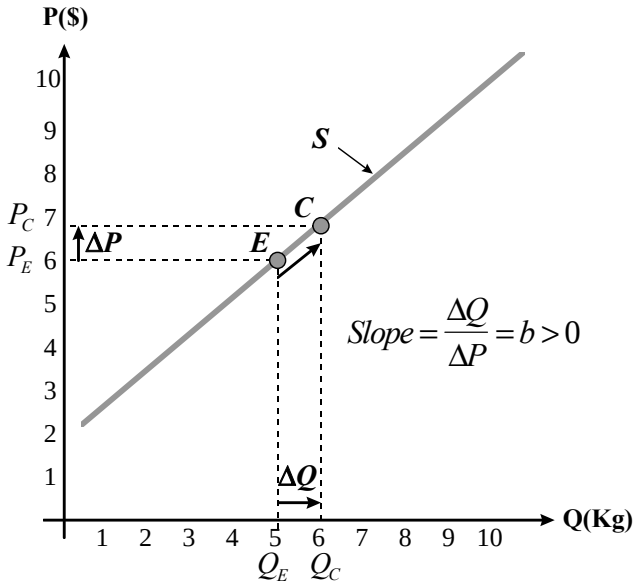

Fig. 2.6 Change in Quantity Supplied.

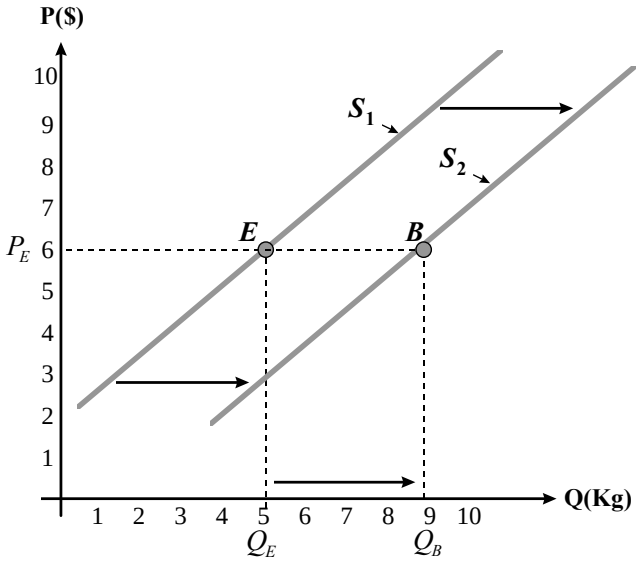

Fig. 2.7 Change in Supply.

Key Terms

Sellers
Buyers
Total revenue (TR)
Demand (D)
Quantity demanded (Q_D)
Law of demand
Demand schedule
Demand curve
Slope of the demand curve
Demand function
Inverse demand function
Change in quantity demanded
Change in demand
Non-price determinants
Ceteris paribus assumption
individual's demand curve
market demand
Supply (S)
Quantity supplied (Q_S)
Law of Supply
Supply schedule
Supply curve
Supply function
Changes in quantity supplied
Changes in supply

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Lecture 3. **Market Equilibrium Analysis**

1. Market equilibrium. Equilibrium price and market clearing.
   1.1.Competition between sellers and buyers. Law of uniform price.
   1.2.Excess demand and excess supply.
   1.3.Market equilibrium on a diagram. Algebra of supply-demand equilibrium in a linear case.
2. Demand, supply and equilibrium in a simple cobweb model.
3. Price controls and market mechanism.
   3.1.Price ceilings and shortage.
   3.2. Price floors and surplus.

1. Market equilibrium. Equilibrium price and market clearing.

1.1. The point where the demand curve and the supply curve cross each other at the demand-and-supply diagram is the equilibrium point. *Market equilibrium* is the characteristic of market conditions - commodities quantities and prices, when quantity demanded is equal to quantity supplied. They are reflected in information provided by market - commodities prices. Economic agents - both sellers and buyers - use this information for decision making about their behavior. If initial market conditions are equilibrium conditions, they would not be changed (would be the same) at the next step, *ceteris paribus*. As a result, the equilibrium situation can be characterized as a realization of all decisions made.

The value P_E is called *equilibrium price*, if the quantity of commodity demanded under this price is equal to the quantity of commodity supplied. As figure 3.1 shows, the equilibrium point **exists** and it is **unique** for demand-and-supply diagram. The demand curve DD and the supply curve SS at the figure 1 cross each other at point E with coordinates (Q_E, P_E).

Law of uniform (one) price: A homogeneous good trades at the same price no matter who buys it or which firm sells it.

1.2. When a market price P deviates from equilibrium price P_E (or a quantity of a good Q deviates from equilibrium quantity Q_E) an excessive supply or excessive demand is formed at a market.

Shortage (or an excess demand): The difference between quantity demanded and quantity supplied in a market when quantity demanded is greater than quantity supplied (Fig. 3.2, $P_2<P_E$).

Surplus (or an excess supply): The difference between quantity supplied and quantity demanded in a market when quantity supplied is greater than quantity demanded (Fig.3.2, $P_1>P_E$).

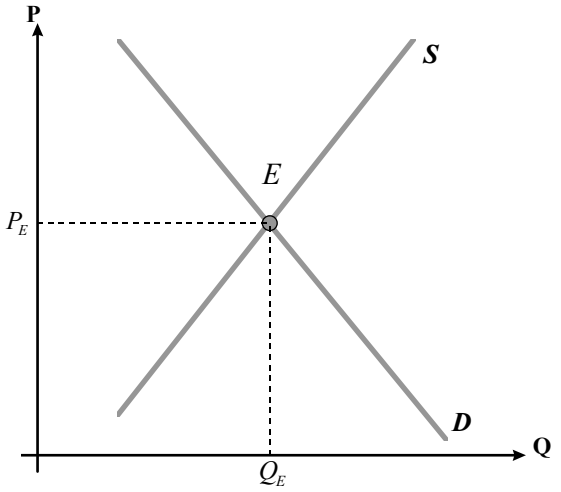

Fig. 3.1 Market Equilibrium.

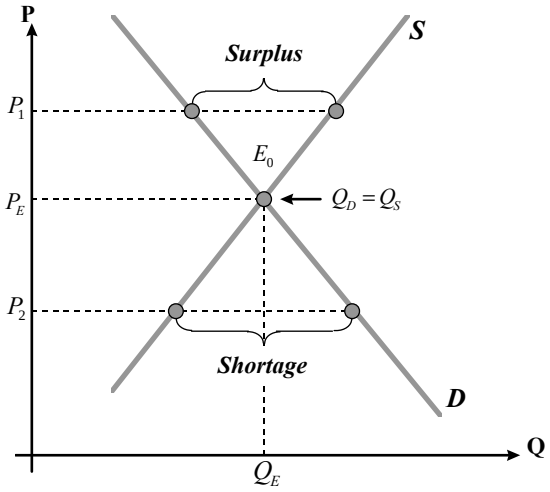

Fig. 3.2 Surplus and Storage.

Changes in demand and supply in the market generate changes in equilibrium situation.

a) An increase in market demand (represented by an outward shift in the demand curve D_0D_0) increases both the equilibrium price P_E and equilibrium quantity Q_E. (Fig.3.3a)
b) If market demand falls (this is represented by inward shift in the demand curve D_0D_0), both equilibrium price and equilibrium quantity fall. (Fig.3.3b)
c) If the market demand rises (the demand curve S_0S_0 moves outward), the equilibrium price falls and the equilibrium quantity rises. (Fig.3.3c)

d) Decrease in market supply (represented by inward shift in the supply curve) moves the equilibrium price up and equilibrium quantity down. (Fig.3.3d)
e) The simultaneous changes in demand and supply can move equilibrium price and quantity in various directions, as figures above show.

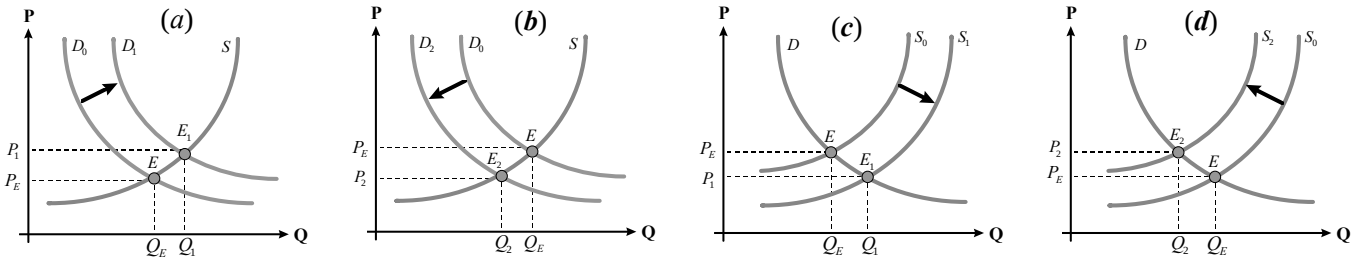

Fig. 3.3 Shifts in supply or demand change equilibrium price and quantity:
a) increase in demand; *b*) decrease in demand; *c*) increase in supply; *d*) decrease in supply.

1.3. Market equilibrium on a diagram (Fig.3.1-3.3).
Model of supply-demand equilibrium in a linear case:

$$Q_D = a - bP,$$
$$Q_S = c + fP,$$
$$Q_D = Q_S$$

Q_D - quantity demanded, Q_S - quantity supplied; **a,b,f>0** - parameters**.**
A state of equilibrium **(Q_E, P_E)** on fig.3.1 is a result of solving a system of equations:

$$Q_E = Q_D = Q_S = a - bP = c + fP;$$
$$P_E = (a-c) / (b + f),$$
$$Q_E = (af + bc) / (b + f),$$
$$a>c,\ af>bc.$$

2.Demand, supply and equilibrium in a simple cobweb model.

The demand and supply model is *static model*, because the values of all variables are fixed in time and they represent economy's state at some fixed moment - i.e. at some year, month or day. We can introduce a new variable in this simple model - the *time variable* - in order to design *dynamic model*.

Let us introduce in the demand and supply model the discrete time variable. (Time variable can also be presented as continuous variable.) Let us assume that market price of commodity A at period of time t is equal to P_t and it does not change during this period. The value of P_t can be equal (or not equal) to the equilibrium price P_E. Market price P_t describes *model's state* at time t, a set P_1, P_2,..., P_t describes *a trajectory* of a dynamic model in time.

This dynamic model is called "*cobweb*" because its trajectories for the first and second alternatives look like "web*". Cobweb model:* A model of price adjustment in which some trading takes place at nonequilibrium prices.

For example, consider a dynamic version of the supply and demand model for one commodity. Let us propose that supply and demand curves are fixed and that market demand Q_{Dt} at time t is a function of price at the same period t, but the market supply Q_{St} depends on market price at previous period of time $(t-1)$:

$$Q_{Dt} = Q_{St},$$
$$Q_{Dt} = a - bP_t,\ a,b>0,$$
$$Q_{St} = c + fP_{t-1},\ f>0.$$

Cobweb theorem: A simple dynamic model of price and output where the quantity supplied depends on price in the previous period, and the quantity demanded depends on price in the current period:

$$P_t = (P_0 - P_E)(-f/b)^{-1} + P_E\ ,$$
$$P_E = (a-c) / (b+f)\ ,$$

$P_0 >0$ - the initial price.

Three alternative trajectories of market price P_t for this model are possible:

1) the value of market price moves towards its equilibrium value: The first alternative is possible if the slope of supply curve SS is greater than the slope of demand curve DD ($1/f > 1/b$, $f/b < 1$).

Damped cobweb: This depicts a market that moves over a number of periods towards the equilibrium price and quantity (**converging cobweb):** $f < b$.

2) The value of market price moves from its equilibrium value, and model "explodes": the second alternative is possible in the inverse situation $(1/f < 1/b, f/b > 1)$.

Explosive cobweb: This depicts a market that moves over a number of periods away from the equilibrium price and quantity (**diverging cobweb): $f > b$.**

3) market price trajectory turns around its equilibrium point, and market price P_t never achieves its equilibrium value; the third alternative is possible if the slope of supply curve SS is equal to the slope of demand curve DD $(1/f = 1/b, f/b = 1)$.

*Uniform (***perfect cobweb): $f = b$.**

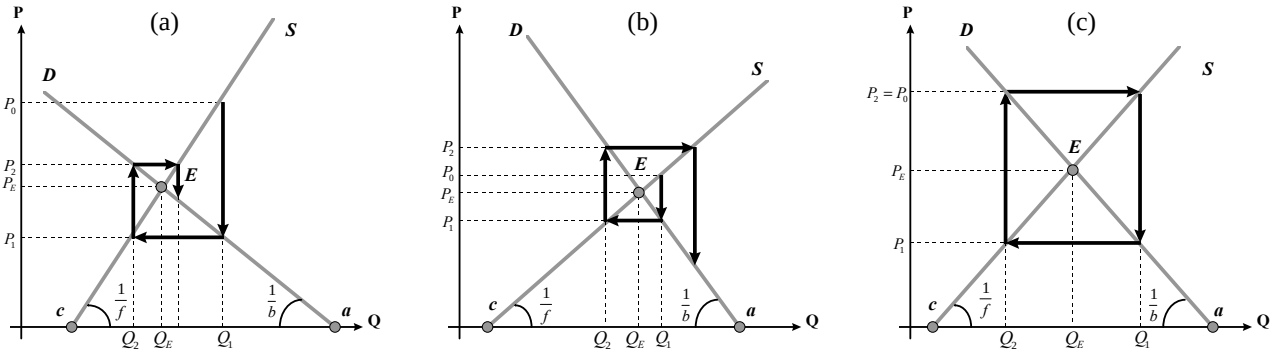

Fig. 3.4 Cobweb model: *a*) covering cobweb; *b*) diverging cobweb; *c*) perfect cobweb.

The foreign currency exchange or the commodity exchange can be described by this dynamic model: the demand is defined immediately by the exchange price, but the supply reacts on the price value with some lag. We can forecast future prices' trajectories for some commodity or currency exchange analyzing their past dynamic.

3. Price controls and market mechanism.

We can investigate consequences of various governmental prices regulation programs using the supply and demand model.

3.1. Sometimes market prices are regulated by the government. For example, the government can introduce the *price ceiling* for some commodity in order to support low-income consumers of this product. The price P_{MAX} is called the *ceiling* (or *maximum*) price if it is lower than equilibrium price P_E and it is prohibited to sell commodity by higher price. After introduction of maximum price the *shortage* of commodity usually occurs. The government can equilibrate market demand and supply using its reserves (see point B (P_{MAX}, Q_D), Fig.3.5). Point A corresponds to the situation of the black market. The black market price P_D equilibrate demand and supply and it is greater than equilibrium price pP_E. The equilibrium price in situation like this is usually called "*shadow price*".

Scarcity of land and housing often is a reason for excessive growth of housing rent in towns. In response authorities sometimes introduce housing rent control. The maximum rent at a level R_{MAX} which is lower than equilibrium price R_E (fig. 3.6) leads to a situation when some portion of dwellers in the amount of (Q_D - Q_S) can not find housing. They are forced to bribe landlords or pay high advanced payments to get an apartment. New construction is also hampered. Increase of maximum housing rent reduces excessive demand.

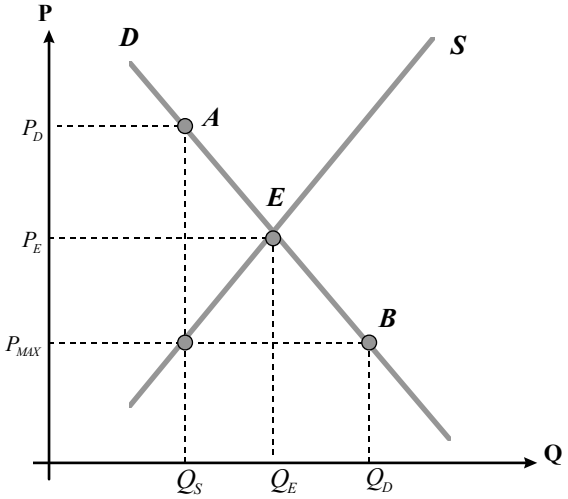

Fig. 3.5 Maximum price P_{max}.

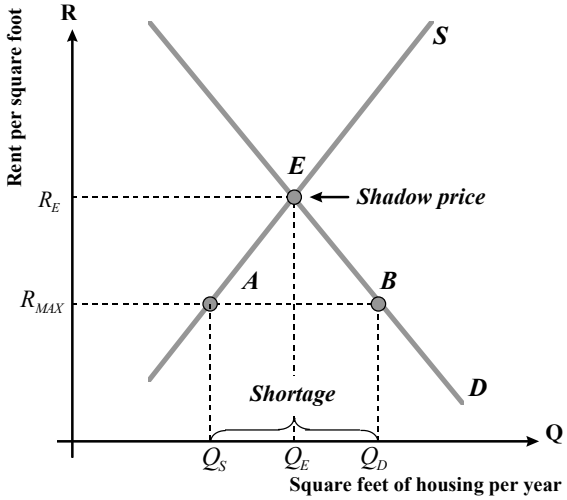

Fig. 3.6 Rent Control: An Example of a Price Ceiling.

3.2. The government can also introduce *price floor* for some commodity in order to support producers of this commodity. The price P_{MIN} is called *floor* (or *minimum*) *price* if it is higher than equilibrium price P_E (see Fig.3.7) and it is prohibited to buy commodity for lower price. After introduction of minimum price commodity *surplus* usually occur. The government tries to diminish supply in this situation by subsidizing producers' output cuts. This situation is presented by the point *A*. The point C corresponds to the situation of illegal sales of surplus at price P_S , which is lower than shadow equilibrium price P_E.

Sometimes authorities set up at a legislative level the minimum wage which is the minimum level of payment for any work. Minimum wage at a level W_{MIN} under condition of equilibrium wage W_E leads to an equilibrium in point *A* (fig. 3.8.) Too high wages lead to unemployment of a (L_S - L_D) size. Reduce of W_{MIN} increases employment.

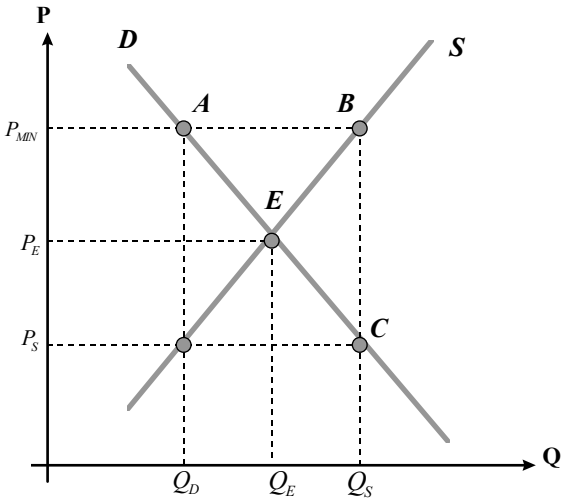

Fig. 3.7 Minimum price P_{min}.

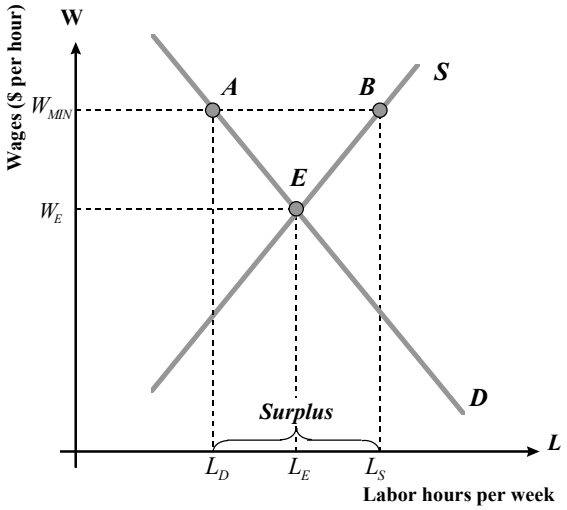

Fig. 3.8 Minimum Wages:
An Example of a Price Floor.

Key Terms

market equilibrium E (P_E, Q_E)
equilibrium price P_E
equilibrium quantity Q_E
law of uniform (one) price
shortage (or an excess demand)
surplus (or an excess supply)
cobweb model
damped cobweb (converging cobweb)
explosive cobweb (diverging cobweb)
uniform (perfect cobweb)
can introduce the
price ceiling (or *maximum* price)
shadow price
price floor (or *minimum price)*

Reading

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Lecture 4. **Elasticity Concept. Elasticity of Demand and Supply.**

1. Marginal analysis in Economics.
   1.1.Increments and rates approaches to changes in Economics. Definition of derivative and its geometrical interpretation.
   1.2.The use of derivatives: introduction to optimization theory and its applications to economics.
2. Price elasticity in market equilibrium model.
   2.1.Price elasticity of demand. Elastic and inelastic demand. Unit elasticity.
   2.2.Linear demand curve and its price elasticity. Constant elasticity demand curve.
   2.3.Elastic and inelastic supply.
   2.4.Concept of cross-price elasticity.
3. Income elasticity.
   3.1.Income elasticity of demand.
   3.2.Engel curve and income elasticity.

1. Marginal analysis in Economics.

The main objective of modeling is to describe the relationship of economic variables in order to predict an impact of a change in an economic variable on the others. To do it we develop a measure of the *responsiveness* of one economic variable to the changes in the factors determining its value.

1.1.There are two approaches to measure the responsiveness of relationship $y = f(x)$.
a) Increment approach: What is the effect of unit change of *independent* variable *x* on the value of function *y*. This approach analyzes the following dependencies:

factor increment (Δx) $\Rightarrow$ the change of analyzed variable (Δy).

Such a measure of "absolute" responsiveness can be called the rate of function's change. The value of this responsiveness at a particular point ("instant speed") is called the derivative of the function.
b) Rate approach: What is a *percent* change of the function due to *one percent* change of independent variable. This approach analyzes the following dependencies:

growth rate of a factor ($\%\Delta x$) $\Rightarrow$ growth rate of analyzed variable ($\%\Delta y$)

Remind that the growth rate (a percent change) of the variable is its absolute change multiplied by 100 and divided by the initial value:

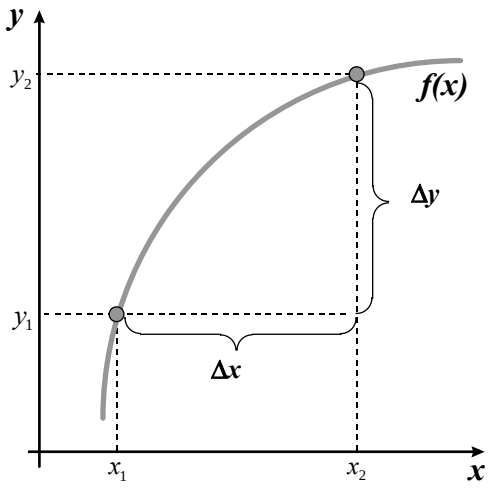

Fig. 4.1 The geometrical interpretation of derivative.

$$\%\Delta x = \frac{\Delta x}{x} \cdot 100\% = \frac{x_2 - x_1}{x_1} \cdot 100\%.$$

The measure of "relative" responsiveness in called *elasticity* of function.

Derivative is a more general concept than the elasticity, that is why we are dealing first with the derivatives. Let the value of z change from a z_1 (initial value) to z_2 (final value). The difference $\Delta z = z_2 - z_1$ is called the *increment of value z*.

Let us take the function $y = f(x)$ and consider two values of argument: x_1 and x_2. Corresponding values of the function are $y_1 = f(x_1)$ and $y_2 = f(x_2)$. The difference $\Delta x = x_2 - x_1$ is called an increment of argument, and $\Delta y = y_2 - y_1 = \Delta f = f(x_2) - f(x_1)$ - increment of the function. The geometrical interpretation is given in the figure 4.1.

We can measure the responsiveness of variable *y* to changes in variable x by the ratio $\Delta y/\Delta x$. The disadvantage of such a measure is that the value of responsiveness depends not only on the initial point x_0, but also on the length of interval Δx. To avoid this ambiguity, the concept of derivative (the "local" rate of change at the certain point) is introduced. To find this rate of change of the function, we bring the points x and x_0 together, reducing the interval Δx to zero. The rate of change of function $f(x)$ at the point x_0 is called *the value of derivative of* $f(x)$ *at the point* x_0. Geometrically, this value is represented by the slope of tangent line to the graph of function at the point x_0.

The derivative of function $y=f(x)$ at point x is denoted as $\boldsymbol{f'(x)}$, y'_x , $\frac{df(x)}{dx}$ 2 , $\frac{dy}{dx}$ 3 . All these designations are correct. We find this value *by taking the derivative* of the function.

1.2. Economic agents are often trying to find an optimal way of using scarce (limited) resources. It could be a firm or a household - in any case the *rules* of finding the best use of resources are basically the same and these rules cam be reduced to the simple logical problem: find one variant among *feasible* outcomes, at which the value of objective function is as big as possible (at which the objective function has a maximum). The problem could be formulated in an opposite way: achieve a certain goal with minimum expenses. The idea that these kinds of problems can be reduced to a sequence of basic steps made an epoch in the development of economics. Such standard steps are described by optimization theory.

The point x^0 is a *point of local maximum* (*minimum*) of the function $y = f(x)$, if the value of function at all points close to x^0 is less (or bigger), than the value of function at point x^0. The value of function at that point $f(x^0)$ is called *local maximum* (*local minimum*) of the function $y = f(x)$. If the point x^0 - is a local maximum (minimum) of function $y = f(x)$, then the graph G of function $y = f(x)$ looks like a hat (reversed hat) in the neighborhood of this point.

Instead of two words - maximum and minimum - the single term is used - *extremum*. The *necessary condition* that a certain point is local extremum for function $y = f(x)$ is the following: *the derivative of this function at the point of extremum is equal to zero* (we assume that the derivative at such point exists).[1]

Let us use this techniques to solve a problem of defining the optimal consumption of the good distributed for free. Evidently, a consumer will not have any benefit by increasing consumption of such a good beyond the point where it reaches the maximum utility: additional units would only reduce his or her welfare.

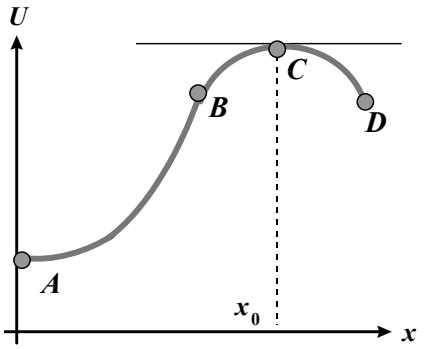

Fig. 4.2 Local maximum point C of the utility function.

Marginal utility is the derivative of utility function; where marginal utility is equal to zero (or the tangent line to utility graph is horizontal, see Fig.4.2), the total utility would be maximized: at point C the amount of good is equal to x_0 at the graph, and $MU = U'(x) = 0$.

For a function $f(x_1, x_2)$ of *two* variables x_1 and x_2 a point (x_1^0, x_2^1) of *local extremum* has the similar definition as for the function of one variable. By analogy with a function of one variable the *necessary condition* of local extremum of a function of several variables is that the *derivatives* of this function with respect to each variable at that point are zero. These derivatives of a function of several variables are called *partial derivatives* and are denoted as $\partial f(x_1,...x_n)/\partial x_i$.

In the basic theory of local extremum there are no *additional conditions (constraints)* on the values of independent variables. In practice the decision-making economic agent always encounters several constraints. These are technological, financial, resource, ecological and other constraints. For example, a consumer maximizes utility within his or her budget, a producer is constrained by given production capacity, an exporter - by foreign market capacity and so on. Economic variables (output, consumption, prices and others) are often required to be non-negative. It is formalized by inequalities $x_i \geq 0$. There are special methods to solve various classes of conditional extremum problems: of the problems with inequality constraints, with linear and non-linear objective functions and so on. They are based on the methods of search for unconditional extremum. Although they are more complicated because an objective function is maximized (minimized) under additional constraints which are not present in a problem of unconditional extremum. The problems with equality constraints are easier to solve in comparison with the problems with inequality constraints. For example, a variable in an equality constraint can be detached with respect to the rest ones. Then it can be substituted into an objective function. It brings the problem to an ordinary problem of

[1] Points where the derivative of an objective function turns to zero are called critical points of the function (by definition x^0 is a *critical* point of function $y = f(x)$ if $f'(x^0) = 0$ (either if $f'(x^0) = \infty$ or $f'(x^0)$ does not exist). Local extremum are always critical points, but the opposite is not correct - critical points are not sure to be extremum. To take this into account the *sufficient conditions of local maximum* (*minimum*) are formulated: the critical point x^0 is a point of maximum if the first derivative $f'(x)$ is changing its sign from plus to minus by crossing this point from left to right (the opposite is true for minimum); the same could be written by using the second derivative (derivative of a derivative) in a point x^0: if $f''(x^0) > 0$ ($f''(x^0) < 0$), then x^0 is a local minimum (maximum).

unconditional extremum. A number of more complicated methods are necessary to solve problems with inequality constraints. These methods are called methods of *mathematical programming*.

2. Price elasticity in market equilibrium model.

In economics the derivative as a measure of responsiveness in a relationship is not convenient, since its magnitude depends also on the units of measuring. For example, let us take a demand function for sugar $Q=f(P)$. The derivative of this function with respect to price P (measured in Rubles) depends on whether the quantity demanded is measured in kilograms or centners. In the first case its value is measured in *kg/R*, in the second - in *c/R*. As well, in economics not absolute but relative (in per cent) change of the variables is usually important, but the derivative links absolute changes of independent and dependent variables. To avoid this ambiguity in economics one often takes the changes of variables not in absolute terms but in *relative* terms as percentage change.

The elasticity of function $y=f(x)$ shows the relative change of the dependent variable y due to unit relative change of the argument x.

The elasticity is dimensionless value which does not depend on the units in which prices or quantities are measured. If we denote the elasticity of change in y with respect to the change in x as $E_x(y)$, then using the definition of elasticity we get

$$E_x(y) = \frac{\Delta y}{y} : \frac{\Delta x}{x} = \frac{\Delta y}{\Delta x} \cdot \frac{x}{y} . \quad 4$$

Since under $\Delta x \to 0 \quad \lim \frac{\Delta y}{\Delta x} = \frac{\partial y}{\partial x}$, 5 (i.e. under small increments of the argument the increments' Δy and Δx ratio converges to the derivative of y by x), we have:

$$E_x(y) = \frac{\partial y}{\partial x} \cdot \frac{x}{y} = f'(x) \cdot \frac{x}{y} = \frac{f'(x)}{\frac{y}{x}} = \frac{f'(x)}{\frac{f(x)}{x}} = \frac{Mf}{Af} .$$

6 If we consider $f(x)$ as total value (for example, total revenue), then $Mf = f'(x)$ is the corresponding marginal value (marginal revenue, or the revenue for additional unit of x), and Af is the average value of the function (average revenue, or the revenue for the unit of x in average). So, the elasticity equals to the ratio of the marginal and average values.

While using the real data to compute the elasticity we get an approximate elasticity value, and the possible result is not unique as in exact formula. Let the value of x change from x_1 to x_2, and the value of y change from y_1 to y_2. In such a case the following elasticities can be estimated:

$$\textit{point elasticity} \quad E_x(y) = \frac{\frac{y_2 - y_1}{y_1}}{\frac{x_2 - x_1}{x_1}} , \qquad \textit{arc elasticity} \quad E_x(y) = \frac{\frac{(y_2 - y_1)}{(y_1 + y_2)/2}}{\frac{(x_2 - x_1)}{(x_1 + x_2)/2}} .$$

The calculation of point elasticity is based on the initial values of x and y, and in arc elasticity formula the means of the initial and final values of x and y are used.

2.1. *The price elasticity of demand* shows the per cent change of the demanded quantity due to one percent price change. So the coefficient of price elasticity is the relative (percentage) change in quantity divided by the relative (percentage) change in price:

$E_D = (\Delta Q_D / Q_D)/(\Delta P/P)$, where Q_D is the quantity demanded, P is the price. Usually the price elasticity of demand in negative: under the increase in price the quantity demanded decreases. For convenience the negative sign is often omitted, so the elasticity is taken in absolute terms. Demand is classified as *inelastic*, *elastic* or *unit elastic* depending on whether price elasticity's module is less than, greater than, or equal to 1.

Figure 4.3 illustrates the five cases of elasticities;

a) elastic demand (fig.4.3a): $E_D < -1, \ \%\Delta Q_D > \%\Delta P, \ P_1Q_1 < P_2Q_2;$
b) inelastic demand (fig.4.3b): $0 > E_D > -1, \ \%\Delta Q_D < \%\Delta P, \ P_1Q_1 > P_2Q_2;$
c) unit elastic demand (fig.4.3c): $E_D = -1, \ \%\Delta Q_D = \%\Delta P, \ P_1Q_1 = P_2Q_2;$
d) perfectly elastic demand (fig.4.3d): $E_D = -\infty;$
e) perfectly inelastic demand (fig.4.3e): $E_D = 0.$

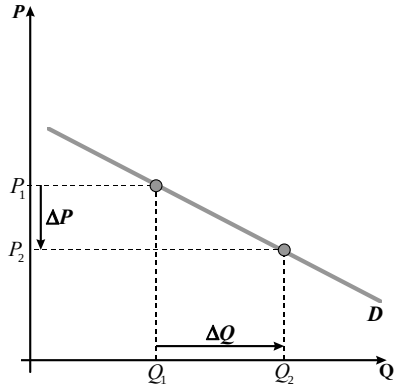

Fig. 4.3a Elastic demand |Ed|>1: %ΔQ>%ΔP.

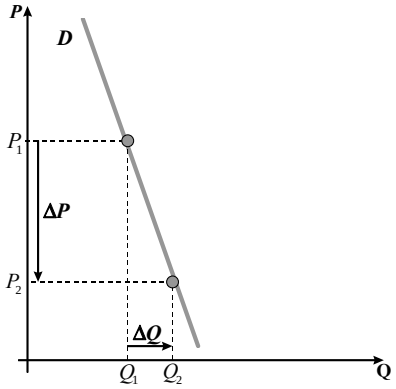

Fig. 4.3b Inelastic demand |Ed|<1: %ΔQ<%ΔP.

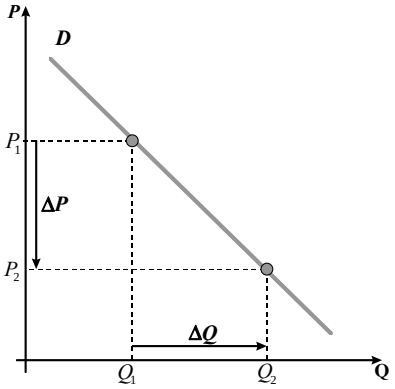

Fig. 4.3c Unit-elastic demand |Ed|=1: %ΔQ=%ΔP

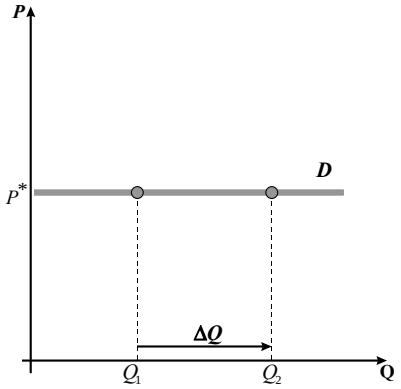

Fig. 4.3d Perfectly elastic demand |Ed|= ∞.

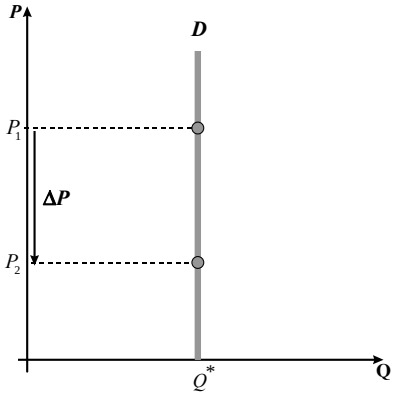

Fig. 4.3e Perfectly inelastic demand |Ed|= 0.

2.2. Slope and elasticity are not the same thing. All points on the straight-line demand curve *D* (Q_D=*a-bP)* have the same slope *-b.* But above the midpoint, demand is elastic; below it, demand is inelastic; at the midpoint, demand is unit-elastic (fig.4.4).

Figure 4.5 illustrates the demand curve for a good whose price elasticity of demand is unitary at all possible prices. This means that no matter what the price, total expenditure (*PQ)* by consumers is always the same: $P_1Q_1 = P_2Q_2 = k$, *k=const. The equation of the curve is* $PQ_D = k$, *or* $Q_D = kP^{-1}$

The more general case is $Q_D = kP^{-a}$, *a>0,* this is the *constant elasticity demand curve:* $E_D = -a$ at all prices.

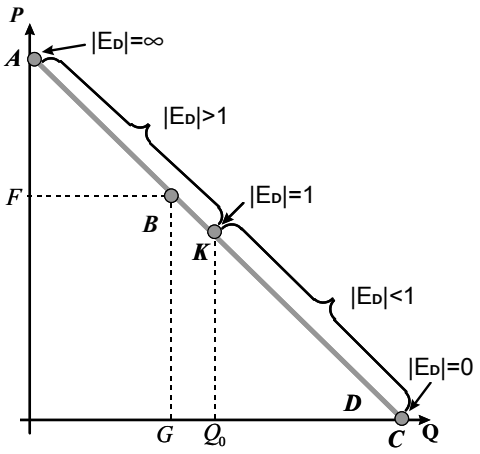

Fig. 4.4 Elasticity of straight line.

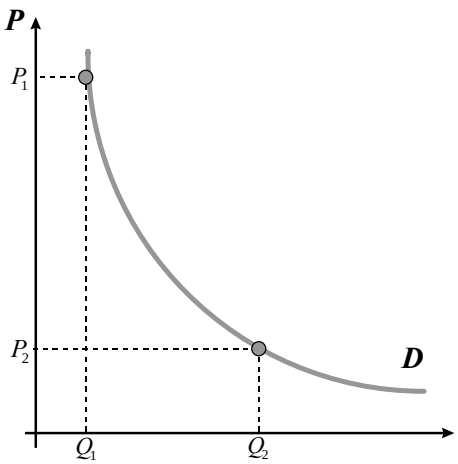

Fig. 4.5 Constant elasticity demand curve.

2.3. *Price elasticity of supply* (E_S) measures the sensitivity of changes in quantity *supplied* (ΔQ_D) to changes in price (ΔP) as the percentage change in quantity supplied resulting from each 1 percent change in market price: $E_S = (\Delta Q_S/Q_S)/(\Delta P/P)$, or $E_S = \%\Delta Q_S / \%\Delta P$.

The price elasticity of supply ranges from zero to infinity:

a) E_S =0 - supply is perfectly inelastic,
b) $0 < E_S < 1$ - supply is inelastic,
c) $E_S = 1$ - supply is unit elastic,
d) $E_S > 1$ - supply is elastic,
e) E_S = *infinity* - supply is perfectly elastic.

A linear supply curve S_1 that intercepts the price axis is elastic at all prices (fig. 4.6a). A linear supply curve S_2 that intercepts the quantity axis is inelastic at all prices (fig. 4.6b). A linear supply curve S_3 that goes through the origin is unit elastic at all prices (fig. 4.6c). The vertical supply curve S_4 showing perfectly inelastic supply (fig. 4.6c). The horizontal supply curve S_5 displaying perfectly elastic supply (fig. 4.6c).

The major factor influencing supply elasticity is the extent to which production in the industry can be increased. Another important factor in supply elasticities is the time period under consideration.

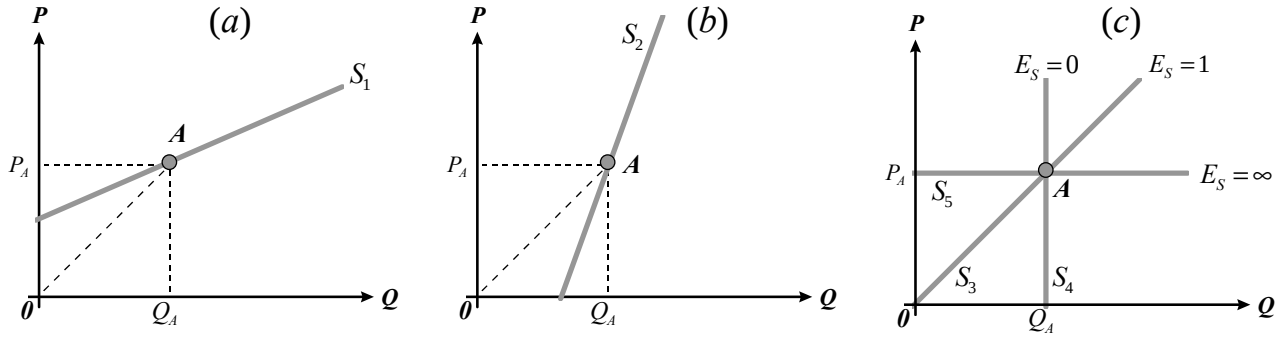

Fig. 4.6 Price elasticity of supply:
a) S_1 is elastic at all prices; b) S_2 is inelastic at all prices; a) S_3 is unit elastic at all prices.

2.4. Goods are related to other goods as either *substitutes* or *complements*. The relationship is measured by the *cross price elasticity*, which is defined as the percentage change in quantity of one good divided by the percentage change in the price of the other good. When goods are substitutes, the cross price elasticity between them is positive. When goods as complements, the cross price elasticity between them is negative. If the cross price elasticity between two goods is 0, the goods are said to be unrelated.

3. Income elasticity.

3.1.The effect of changes in income on quantity demanded is measured by the *income elasticity of demand*. Like all elasticities it is the ratio of two percentage changes. In this case it is the percentage change in quantity demanded divided by the percentage change in income. Goods are classified as normal, inferior, or luxury depending on the value of their income elasticity of demand. *Normal goods* have a positive income elasticity. *Inferior goods* have negative income elasticity and *luxury goods* have income elasticities greater than 1.

3.2. *Engel curve* relate the quantity of a good consumed to income. Figure 4.7a shows an upward-sloping Engel curve applies to all *normal goods:* if income increases from $10 to $20 to $30 per month, the consumption of good Q increases from 4 10 to 16 units.

In figure 4.7b good Q is a normal good for income less than $20 per month and an *inferior good* for income greater than $20 per month.

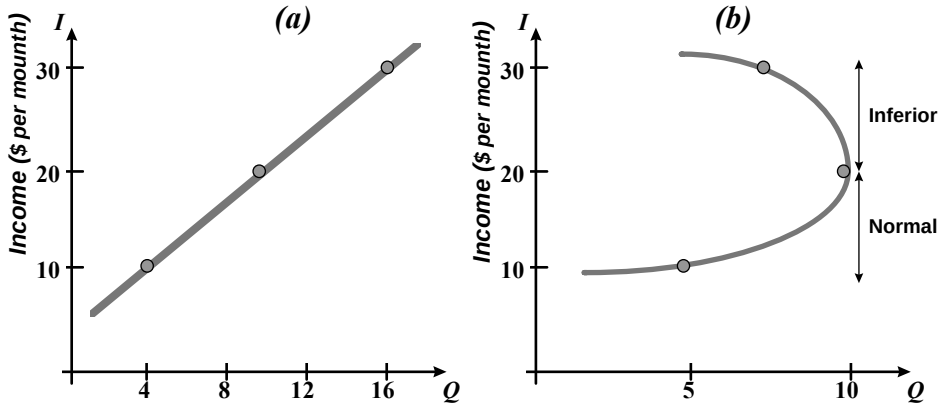

Fig. 4.7 Engel Curves: *a)* normal good; *b)* normal good if I<$20, inferior good, if I>$20.

Key Terms

constant elasticity demand curve
derivative of the function
elasticity
point elasticity
arc elasticity
price elasticity of demand
elastic demand
inelastic demand
unit elastic demand
price elasticity of supply
substitutes
complements
cross price elasticity
income elasticity of demand
normal goods
inferior goods
luxury goods
Engel curve

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Lecture 5. **Elasticity of Demand and Supply: Applications.**

1. Application of price elasticity.
   1.1.Maximizing the sales revenue for a seller.
   1.2.Elasticity and economic policy: example of revenues from sales taxes.
2. Application of income elasticity.
   2.1.Forecasting demand for a good.
   2.2.Demand for food: income elasticity and the share of food spending. Cross-countries comparisons.

1. Application of price elasticity.

1.1. The coefficient of the price elasticity of demand could be used to predict the changes in *sellers revenue* with changes in prices. This relationship is presented by a linear demand function $q=a-bp$ (see the graph).

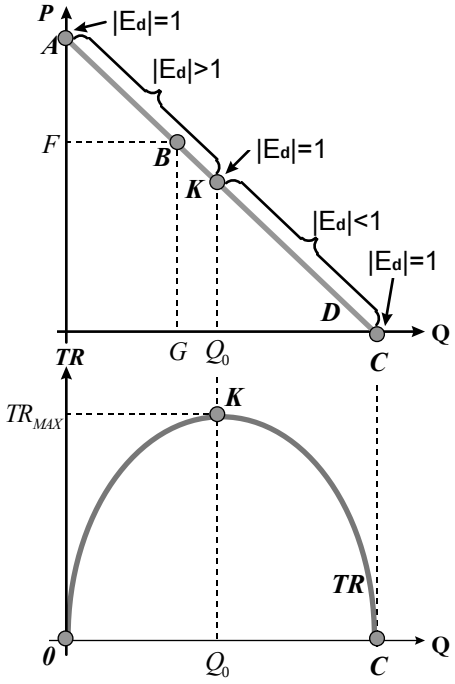


Fig. 5.1 Maximizing the sales revenue for a seller (TR_{max}).

To investigate this relationship, we have to introduce the theory of optimization.[2]

By the definition of elasticity,

$$E_q(p)=\frac{q'_p\,p}{q}=\frac{-bp}{a-bp}=\frac{p}{\frac{a}{b}-p}=-\frac{BG}{AF}=-\frac{BC}{AB}.7$$

So, if the point B moves along the straight demand line from the point A to the point C, the elasticity of demand decreases. It is negative, its module equals in each point to the ratio of the lengths of BC and AB, and equals to one in the middle point of AC. In the lower part of the figure the dependence of revenue on price is shown: $TR = q \cdot p(q)$. This is quadratic function having maximum in the middle point of the interval OC. On the elastic segment of the demand curve (to the left of the middle point) the revenue from sales is increasing with increasing quantity and price cuts, on the inelastic part - increases with an increase in price and fall in the quantity bought.

1.2. So, if the demand is inelastic, the price change causes the revenue change in the same direction, and the price rising is profitable for sellers. Under elastic demand the revenue changes in the reverse direction to the price change, and sellers should decrease price to rise revenue.

For example, the farmers' revenue would decrease under good harvest since the elasticity of demand for agricultural products is rather low. The price rising by state enterprises aiming at the increase of budget revenue (for example, railway tickets prices) can cause the fall of budget revenues if the demand for corresponding good or service is elastic. Similarly, the tax increase for the good with elastic demand leads to the fall of the revenue from taxation.

Tax incidence in competitive markets.

We begin our analysis by considering a competitive market. The basic principles may be illustrated by the demand-and-supply diagram for beer shown in Figure 5.2. The equilibrium before the imposition of taxes is depicted by point E_0. .

The tax shifts the supply curve up by the amount of tax ***t*** per unit. This lowers the quantity consumed and raises the price paid by consumers. The new equilibrium price $\boldsymbol{P_b}$ is increased, but it does not increase by ***t :*** $P_b < P_0 + t$. The price received by the producer is thus $\boldsymbol{P_S = P_b - t,}$ $P_S > P_0 - t$.

In spite of the fact that the tax was nominally imposed on producers, consumers are forced to pay a part of the increased cost resulting from increased taxes, through higher prices. The amount by which the price rises depends on the shape of the demand and supply curves.

[2] See appendix.

1) The more elastic the demand curve and the less elastic the supply curve, the more the tax is borne by producers (Fig.5.2a).

2) The less elastic the demand curve and the more elastic the supply curve, the more of the tax will be borne by consumers (Fig.5.2b).

The horizontal demand curve is infinitely elastic; and has zero elasticity. A vertical supply curve has zero elasticity, while a horizontal supply curve has infinite elasticity.

3) Tax borne by consumers:

a) Perfectly inelastic demand (the vertical demand curve), the price rises by the full amount of the tax; the entire burden of the tax is on the consumers (Fig.5.3a).

b) Perfectly elastic supply (horizontal supply curve), the price rises by the full amount of the tax; the entire burden of the tax is on consumers (Fig.5.3b).

4) Tax borne by producers:

a) Perfectly elastic demand with a perfectly elastic (horizontal) demand curve, the price does not rise at all; the entire burden of the tax is on producers (Fig.5.4a).

b) Perfectly inelastic supply curve with a perfectly inelastic (vertical) supply curve, the price does not rise at all; the full burden of the tax is on producers (Fig.5.4b).

2.2

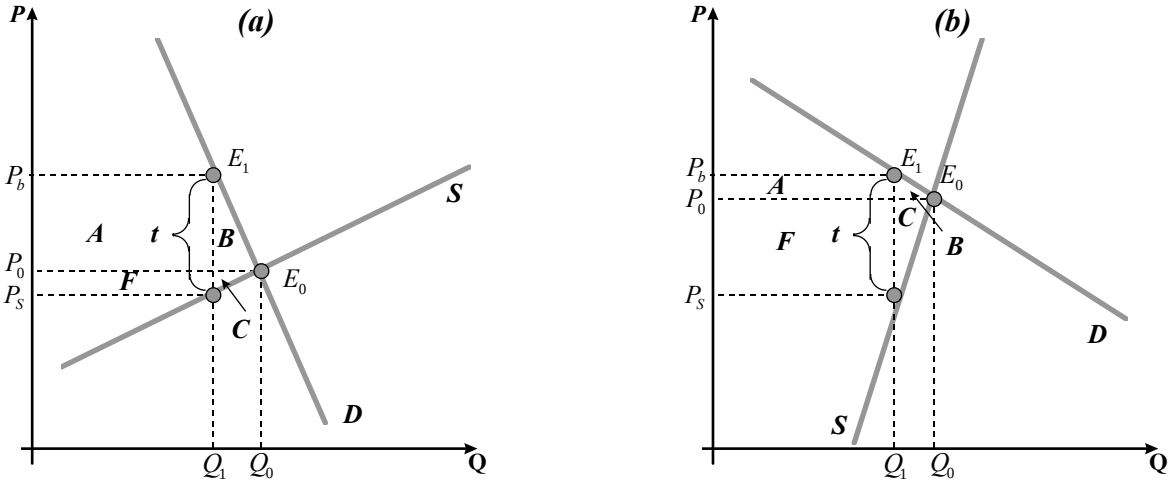


Fig. 5.2 Impact of a tax depends on elasticies of demand:
a) demand is very inelastic; b) demand is very elastic.

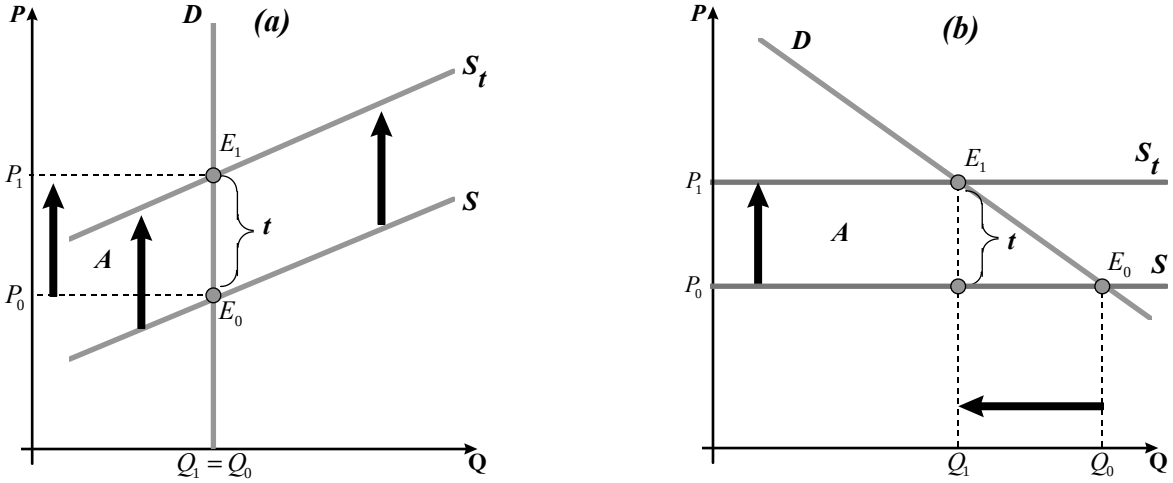


Fig. 5.3 Tax born by consumers: a) perfectly inelastic demand; d) perfectly elastic supply.

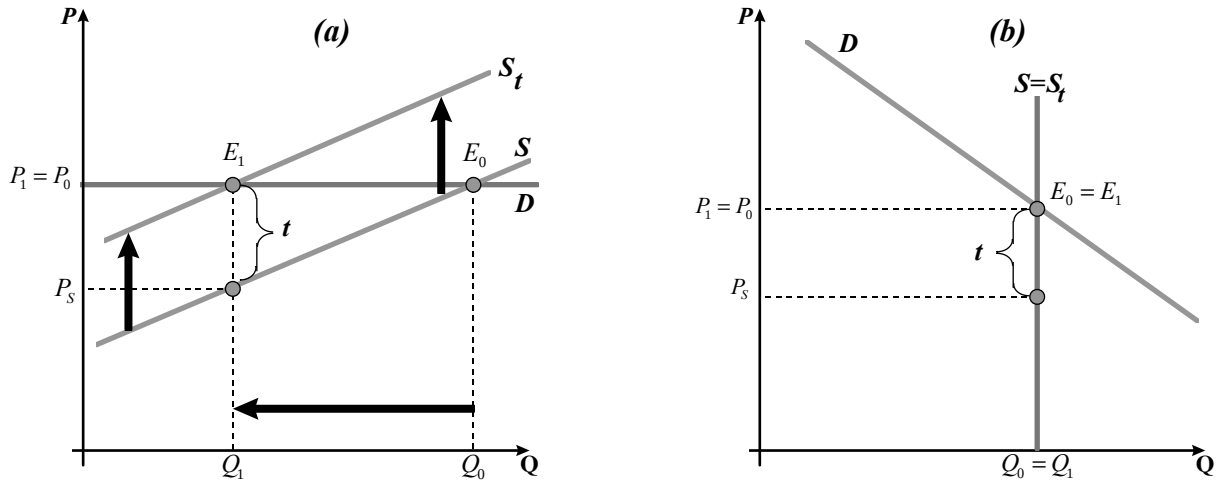


Fig. 5.4 Tax born by producers: a) perfectly elastic demand; b) perfectly inelastic supply.

2. Application of income elasticity.

2.1. Market experiments and consumer surveys are typically used by business firms to obtain information on the responsiveness of quantities purchased to changes in price and other demand determinants.

Information obtained by asking existing customers questions about their income could be used to concentrate advertising campaigns in the media watched, listened to, or read by the customers most likely to buy particular goods.

A problem with the consumer survey is that there is no guarantee that the way consumers will actually behave is correlated with the way they respond to a questionnaire. There are also problems in obtaining a representative sample of consumers. If the sample is not representative of the consumers who actually buy a good, the results will be of little use.

The most sophisticated techniques for estimating demand functions involve the use of statistical methods.

The first step required to statistically estimate a demand function is to specify the variables and the hypothesized relationships of cause and effect. For example, the researcher might specify that the quantity of some good purchased, *X,* depends on its own price, *P,* the price of a complementary good, P_C , the price of a substitute, P_S and average consumer income, /. After this has been done, it is necessary to hypothesize the way the quantity of *X* purchased per person per year, *Qx,* depends on its price and the other variables. The researcher may, for example, hypothesize a linear relationship. This means that the demand function may be expressed as the following linear equation:

$$Q_X = a + bP + cP_C + dP_S + eI$$

The small letters *b, c, d,* and *e* are called the *demand coefficients***.** They represent the amounts by which the dependent variable *Qx* will change for each unit change of an independent variable. For example, the coefficient of the variable *I* says that for each $1 change in the income*,* the quantity purchased will change by *e* units.

When the coefficients have been estimated, hypotheses about their signs (positive or negative) can be accepted or rejected.

2.2. Table 5.2 shows estimates of some income elasticities of demand in the United States. Necessities such as food and clothing are income inelaistic, while luxuries such as airline and foreign travel are income elastic.

Income elasticity of demand has three ranges of values. In part (a), income elasticity of demand is greater than 1. In this case, as income increases, the quantity demanded increases but by a bigger percentage than the increase in income. In part (b), income elasticity of demand is between zero and 1. In this case, as income increases, the quantity demanded increases but by a smaller percentage than the increase in income. In pare (c), the income elasticity of demand is positive at low incomes but becomes negative as income increases above level m. Maximum consumption of this good occurs at the income m.

Table 5.1 Some Real-World Income Elasticities of Demand

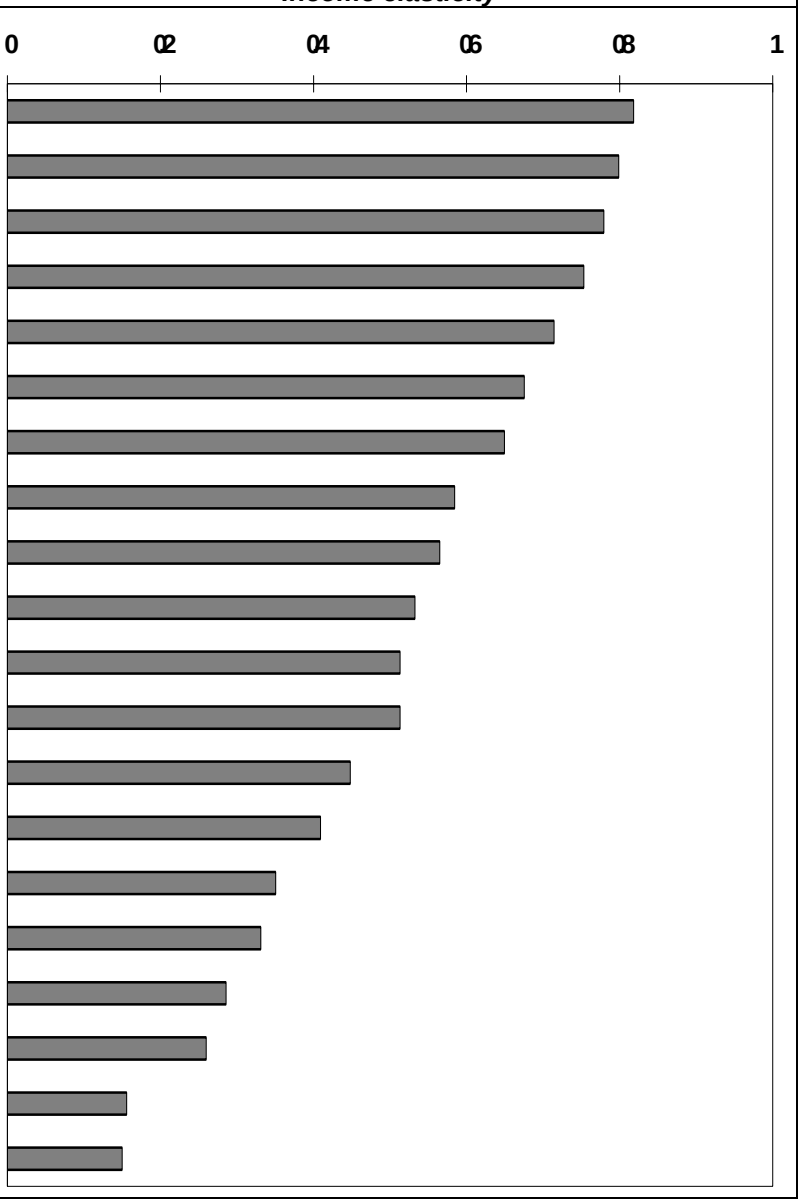
Good or Service	*Elasticity*
Elastic Demand	
Airline travel	5.82
Movies	3.41
Foreign travel	3.08
Housing services	2.45
Electricity	1.94
Restaurant meals	1.61
Local buses and trains	1.38
Gasoline and oil	1.36
Haircutting	1.36
Cars	1.07
Unit Elastic Demand	
Dentists' services	1.00
Inelastic Demand	
Shoes and other footwear	0.94
Tobacco	0.86
Shoe repairs	0.72
Alcoholic beverages	0.62
Furniture	0.53
Clothing	0.51
Newspapers and magazines	0.38
Telephone	0.32
Food	0.14

Sources: H.S. Houthakker and Lester D. Taylor, *Consumer Demand in the United States* (Cambridge, Mass.: Harvard University Press, 1970), and Henri Theil, Chins-Fan Chung, and James L.Scale, Jr., *Advances in Econometrics, Supplement* /, 1989*), International Evidence on Consumption Patterns* (Greenwich, Conn: JAI Press Inc., 1989).

What is a necessity and what is a luxury depend on the level of income. For people with a low income, food and clothing can be luxuries. So the *level* of income has a big effect on income elasticities of demand. Figure 5.5 shows this effect on the income elasticity of demand for food in 20 countries. In countries with low incomes, such as Tanzania and India, the income elasticity of demand for food is high while in countries with high incomes, such as the United States, it is low. A 10 percent increase in income leads to an increase in the demand for food of 7.5 percent in India and only 1.5 percent in the United States. These numbers confirm that necessities have a lower income elasticity of demand than luxuries.

Figure 5.5 Income Elasticities in 20 Countries[3]

Country	*Income (% of USA)*	*Income elasticity*
Tanzania	3.3	
India	5.2	
Nigeria	6.7	
Indonesia	7.2	
Bolivia	14.4	
Korea	20.4	
Peru	23.1	
Chile	32.4	
Brasil	36.8	
Greece	41.3	
Ireland	45.4	
Israel	45.6	
Spain	55.9	
Japan	61.6	
Italy	69.7	
United Kingdom	71.7	
France	81.1	
Germany	85.0	
Canada	99.2	
United States	100	



Key Terms

sellers revenue
tax incidence

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[3] Source: Henri Theil, Ching-Fan Chung, and James L.Seale, Jr., *Advances in Econometrics, Supplement 1, 1989, International Evidence on Consumption Patterns* (Greenwich, Conn: JAI Press Inc., 1989).

Lecture 6. **Consumer Choice and Demand Function. Individual and Market Demand.**

1. Basics of utility theory: Tastes, preferences and utility. Goods and bundles of goods. Utility function.
2. Introduction to consumer choice theory.
   2.1.Indifference curves. Indifference map.
   2.2.Budget constraint. Slope of budget constraint line.
   2.3.Problem of consumer choice. Concept of consumer optimum (equilibrium). Geometrical interpretation.
3. Demand function.
   3.1. Price and income changes and budget constraint.
   3.2.Dependence of demand on prices. "Price-consumption" curve and individual demand.
   3.3. "Income-consumption" curve.
4. Price change and quantity demanded: substitution and income effects.
5. Consumer surplus
   5.1.Concept of consumer welfare.
   5.2.Taxation and consumer surplus. Deadweight losses.

1. Basics of utility theory

In the origin of the market demand we find decisions of individual consumers. This decisions are the result of their desire to obtain maximum gain from their means. And the benefit for the consumer is the effect that he/she achieves from various goods. This effect (increase in welfare or satisfaction of his/her needs) is *utility*.

The good in consumption theory is any consumption object bringing *definite (stable, predictable)* satisfaction to a consumer (rising his/her level of welfare). Usually goods are consumed in definite sets (or bundles or baskets).

This lecture develops the standard theory of consumer choice. This theory assumes: consumers have individual tastes and preferences; consumers are limited in satisfying their tastes and preferences by their budget constraints; and consumers, given their budget constraints and their tastes and preferences, choose bundles that make them as much satisfied as possible.

The analysis of consumer behavior needs strict description of his/her purposes, just dependence of the utility level on the consumed goods bundle composition. This strict dependence is represented by *utility function*. *Utility function* is the relationship between quantities of consumed goods and utility level achieved in this case for consumer: $U=f(x_1;x_2;...x_n)$, when U is utility level, $x_1;x_2;...x_n$ are the amounts of goods consumed. The utility function is a form of *consumer preferences ranking*. We have two hypotheses about typical consumer preferences character:

Ordinal utility *function* delineates only order (arrangement, ranking) of the well-being degrees. The consumer in this case always can say what bundle he/she prefers, but can not define how much is the utility difference between two bundles.

Cardinal utility *function* shows the ranking of consumer satisfaction levels as well as valuation of differences between these levels. It means that utility is measured in particular units.

Total utility (***TU***) is the satisfaction obtained from a given amount of good or bundle. When the consumption of any one good is increasing (and the quantities of all other goods are *the same - ceteris paribus*), the total utility is first rising, then achieving its maximum and afterwards decreasing. Using cardinal utility function we can characterize not only total utility, but the marginal utility too. The *marginal utility* (***MU***) is the additional amount of satisfaction from the consumption of one additional unit of good. So marginal utility is a *partial derivative* of utility function. If we would generalize real situations of consumption, we reveal that additional amounts of the good (ceteris paribus) shall give decreasing increments of welfare. This property is named *diminishing marginal utility*.

2. Introduction to consumer choice theory.

Let us consider the problem of *choosing the best consumption bundle*. We reduce the number of goods in the bundle to 2. It is not the strong simplification of the reality: we may represent each consumer choice as a choice between given good and all other goods.

2.1. The graph 6.1 of utility function with two variables usually is like the hill getting more and more flat (diminishing marginal utility). And it is more comfortable to work with level lines or isoquants of a function (Fig.6.2):

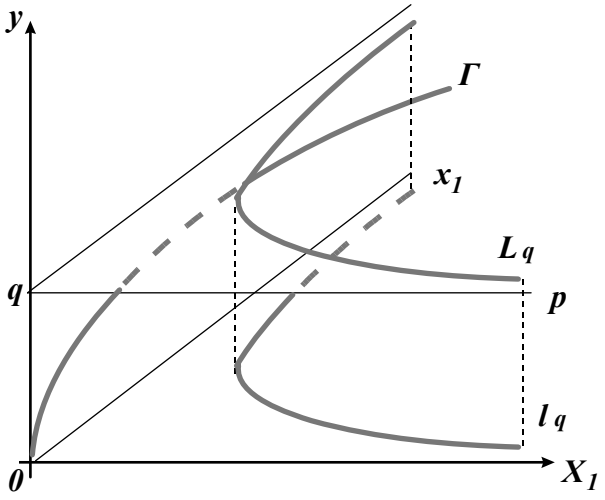

Fig. 6.1 The graph of utility function with two variables.

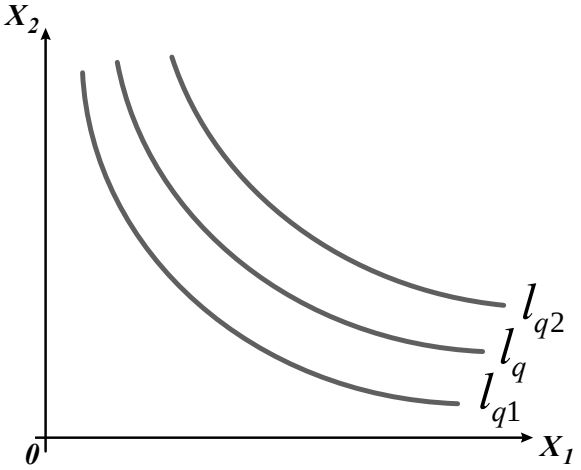

Fig. 6.2 Indifference curves and indifference map.

The isoquants l_q of utility function $U = f(X_1, X_2)$ are named *indifference curves.*

Thus tastes and preferences are represented by *indifference curves* and *indifference maps*. An indifference curve is the locus of points expressing consumption bundles giving the consumer the same satisfaction. The consumer is indifferent to any pair of bundles on a particular indifference curve.

The negative slope of an indifference curve is the consumer's *marginal rate of substitution* of good 2 for good 1 ($\boldsymbol{MRS_{X1X2}}$)

$$\boldsymbol{MRS_{x1x2} = -\Delta X_2/\Delta X_1 .}$$

Its value shows the number of units of the good plotted on the vertical axis that the consumer is willing to give up when compensated by one unit of the good plotted on the horizontal axis. For example, if hot dogs are plotted on the vertical axis and books are plotted on the horizontal axis, then MRS of 3 means the consumer is willing to give up three hot dogs in exchange for one book.

Standard indifference curves are convex. That is, they bow toward the origin reflecting the fact that *MRS* diminishes. Perfect substitutes have straight-line indifference curves. Perfect complements have right-angled indifference curves.

2.2. The next step is to introduce goods prices and consumer budget into the analysis. The prices of goods (for example p_1 and p_2) reflect market conditions (demand and supply relation) and do not depend on single consumer decisions, while consumer income (I) constraints his/her total purchases. *The budget constraint* shows all of the combinations of goods that can be purchased with given income at given prices. It is often written as

$$\boldsymbol{p_1X_1 + p_2X_2 \le I}$$

meaning that the sum of expenditures for goods cannot be greater than income. Adding nonnegativity conditions for X_1 and X_2 one obtains feasible area for consumer choice.

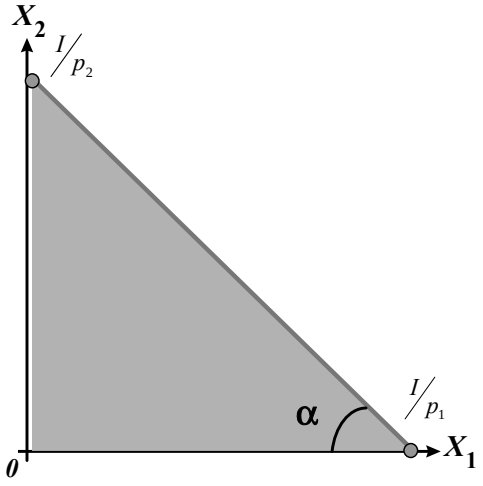

Fig. 6.3 The budget constrain line.

Budget constraint line is the straight line $p_1X_1 + p_2X_2 = I$ reflecting situations when income is spent completely (Fig.6.3). In other case some money remains unspent and utility does not reach its highest level. Budget line intersects axes in points $X_1=I/p_1$ *and* $X_2=I/p_2$ showing maximums of goods X_1 *and* X_2 which can be bought under this income and these prices.

The negative slope of budget constraint is the price ratio p_1/p_2 ($=tg\alpha$). It shows the number of units of the good plotted on the vertical axis a consumer must give up in order to afford a purchase of one additional unit of the good plotted on the horizontal axis. When the consumer is a price taker, the budget constraint is a strait line.

But, in other cases, it may be kinked, or curved, or there may be more than one constraint (e.g. when the consumer must satisfy both time constraint and budget constraint).

2.3. Analyzing the features of consumer choice problem and its solution, we build the ways to look at the origins of the demand function. Thus we show how the market demand curves are formed and how the consumer behavior model allows to describe demand fluctuations related to different economic shocks. We will assume that what is correct for <u>two</u> goods is correct for any number of goods. So the consumer with the given budget and given market prices of goods is trying to find an optimal combination of these two goods.

Let us present a geometrical interpretation of the problem's solution (Fig.6.4):

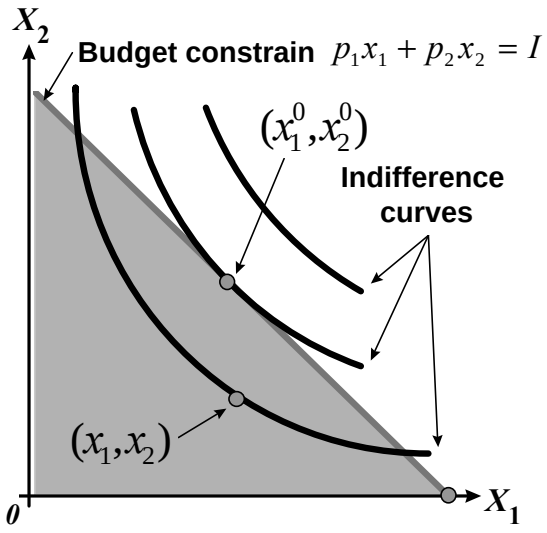

Fig. 6.4 Consumer choise problem and it solution.

The triangle shows all feasible consumption baskets (X_1,X_2), but only one of these baskets (X_1^0,X_2^0) maximizes the utility $u(X_1,X_2)$. The point (X_1^0,X_2^0) is a point of tangency between budget constraint $p_1X_1+p_2X_2=I$ and indifference curve. So we are picking up the basket which gives the highest utility level (the consumer is on the highest indifference curve achievable with the given budget and prices). The solution is thus the tangency point between the line representing the constraint and the isoutility line of the objective function.

At the point of *consumer optimum* (*equilibrium)* one of the indifference curves (the highest at the given budget) is *tangent* to the budget constraint, therefore:

$$MRS_{x_1 x_2} = \frac{p_1}{p_2}.$$

It means that the slope (derivative) of indifference curve (MRS) equals to the slope (derivative) of budget constraint line (p_1/p_2).

It can be shown that the marginal rate of substitution equals to the ratio of marginal utilities of goods:

$$MRS_{x_1,x_2} = \frac{MU_1}{MU_2}.$$

Then the condition of consumer equilibrium may be expressed as:

$$MRS_{x_1,x_2} = \frac{MU_1}{MU_2} = \frac{p_1}{p_2}.$$

Rearranging the last ratio, for n goods we obtain:

$$\frac{MU_i}{p_i} = \frac{MU_j}{p_j}.$$

In the point of consumer equilibrium the ratio of marginal utilities must be equal to the ratio of prices. Expanding this condition at any amount of goods we get *equimarginal principle*: *marginal utility generated by the last monetary unit spent on each good must be the same.* Otherwise the consumer can redistribute money to the good with higher utility of last monetary unit spent for it.

In the two goods case, the consumer maximizes utility at an interior equilibrium by satisfying two conditions simultaneously. <u>The first condition</u> is that the *MRS* between the goods equals the ratio of their prices. <u>The second condition</u> is spending all the income. When *MRS* is everywhere greater or everywhere less than the price ratio, the consumer maximizes utility by acquiring only one good. This is called *a corner solution*. If the budget constraint is kinked, utility maximization may also occur at the kink.

3. Demand function.

The analytical solution of the consumer choice problem allows us to get the demand functions basing on utility function, prices and equimarginal principle. Let us consider simple consumer choice problem with two

goods. The utility function is: $U(x,y) = x_1 \cdot x_2$. As we have revealed, the budget constraint in optimum point is an equality.

Quantities of both goods should be non-negative because of zero utility in the case if one of them is not consumed. Writing the optimum conditions (the equimarginal principle that the ratio of goods' marginal utilities must be equal to the ratio of their prices, and the budget constraint as an equality), we get the system of equations:

$$\frac{x_2}{x_1} = \frac{p_1}{p_2}; \quad p_1 x_1 + p_2 x_2 = I. \quad 8$$

It follows that *spendings for both goods must be equal*, i.e. $x_2 \cdot p_2 = x_1 \cdot p_1$, and the demand functions are:

$$x_1 = \frac{I}{2 \cdot p_1}; \quad x_2 = \frac{I}{2 \cdot p_2}. \quad 9.$$

The expenditure on each good is the *half* of total consumer income. This relationship is not accidental: it is determined by the parameters of utility function.[4]

3.1. A change in income (with price unchanged) causes the budget line to shift parallel to the original line *MN* (Fig.6.5a). When the income is increased, the budget line shifts outward to M_1N_1. If the income falls, the line shifts inward to M_2N_2.

A change in the price of one good (with income unchanged) causes the budget line to rotate about one intercept M (Fig.6.5b) or N (Fig.6.5c). When the price of good 1 falls, the budget line rotates outward from *MN* to MN_1 (Fig.6.5b). When the price of good 2 falls, the budget line rotates outward from *MN* to M_1N (Fig.6.5c).

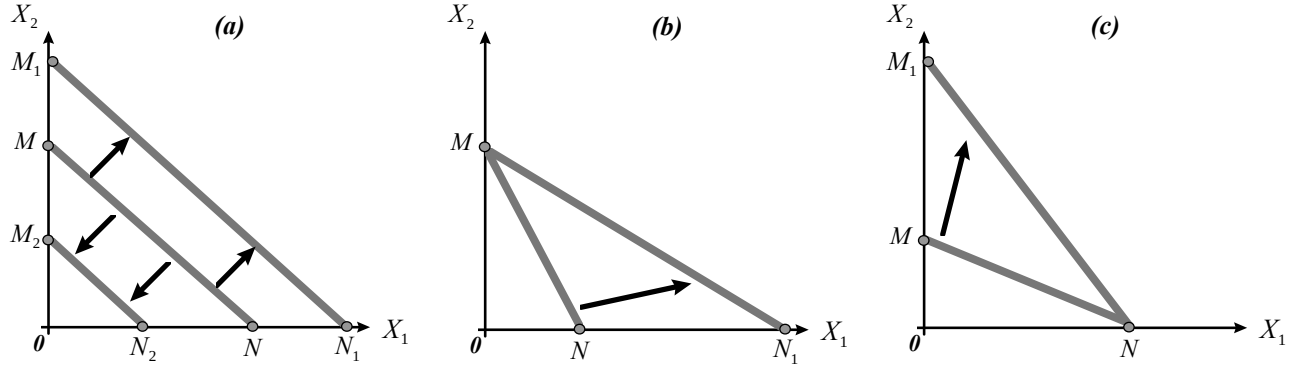

Fig. 6.5 The budget and prices: a) changes in income; b) a change in the price X_1; c) a change in the price X_2 .

[4] More general utility function has the form: $u(x) = \prod_{i=1}^{n} (x_i)^{\alpha_i} \rightarrow \max$. **Ошибка! Только основной документ.**

Coefficients $\alpha_i > 0$ characterize here relative "valuabilities" of goods for the consumer and at the same time they are optimal shares of spending on each good in the consumer's budget. This implies constant elasticity of demand with respect to prices and income.

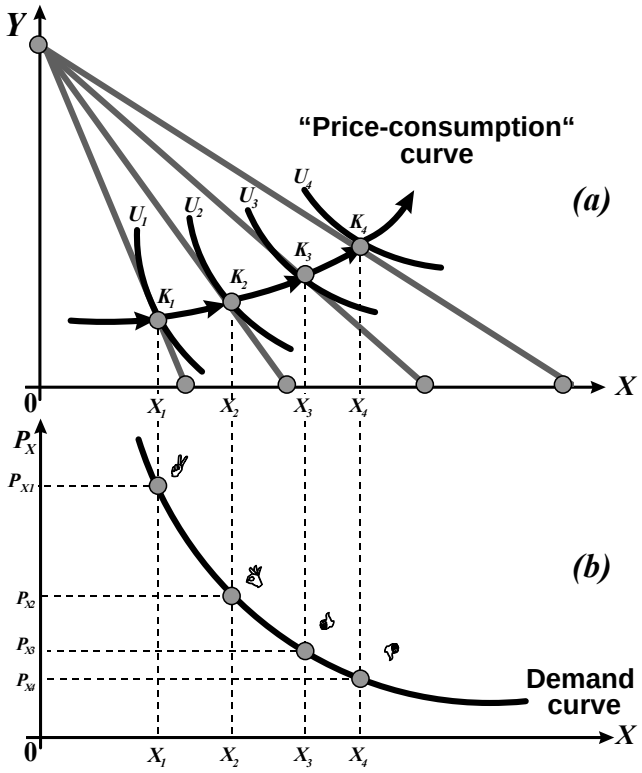

Fig. 6.6 Effect of price changes: a) the price-consumption curve; b) the individual demand curve.

3.2 This section shows how the demand curve of an individual consumer follows from the consumption choices that a person makes when faced with a budget constraint.

A reduction in the price of good *X,* with income and the price of good Y fixed, causes this consumer to choose a different market basket. In Fig.6.6a the market basket that maximize utility for various prices of good *X* (point K_1, price P_{X1}; K_2,P_{X2}; K_3,P_{X3}; K_4,P_{X4}) trace out the *price-consumption curve*

Figure 6.6b. gives the *individual demand curve*, which relates the price of goo *X* to the quantity demanded: (P_{X1},X_1), (P_{X2},X_2), (P_{X3},X_3), (P_{X4},X_4). Points *A,B,C,D* correspond to points K_1,K_2,K_3,K_4.

The *demand curve* relates the quantity od good *X* that the consumer will buy to the price P_X of good *X.*

3.3.

The effects of a change in income can be analyzed in much the same way as a price change . Figure 6.7 shows the consumption choices that a consumer would make when allocating a fixed income to good *X* and good *Y* , when the price of good *X* is P_X, and the price of good *Y* is P_Y.

Initially the consumer's income is I_1. The utility-maximization consumption choice is then at *A*, at which consumer buys X_1 units of good *X* and Y_1 units of good *Y*.

An increase in their income, with the prices of all goods fixed, causes consumers to alter their choice of market basket. In figure 6.7 the market baskets that maximize consumer satisfaction for various incomes (point *A*, income I_1, B,I_2, C,I_3) trace out the *income-consumption curve.*

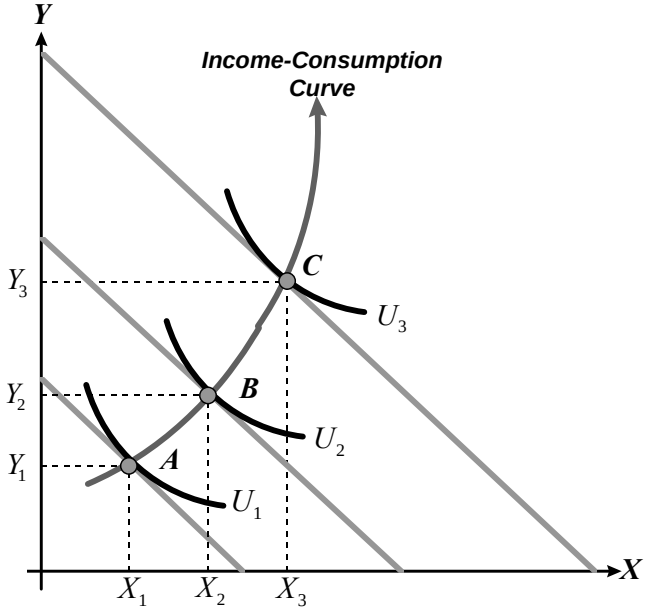

Fig. 6.7 Income-Consumption Curve.

4. Price change and quantity demanded: substitution and income effects.

To see what forces are set in motion when the price of a good changes, notice that two different things happen to some consumer budget constraint when the price of the good *A* plotted on the horizontal axis (say apples) decreases while holding constant the price of the good *B* plotted on the vertical axis (say oranges).

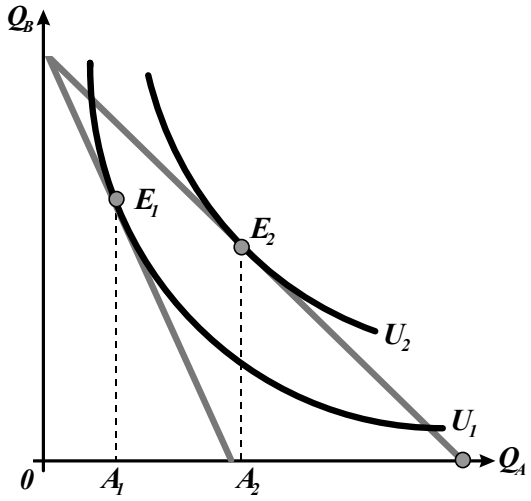

Fig. 6.8 Consumer choise, when the price of a good A changes.

First, as his/her budget constraint swings out along the good A axis some combinations of goods A and B that were unaffordable before the price reduction are now affordable. In essence, the price reduction has increased his/her *real income*. With any given money income he/she can now buy more good A and more good B than he/she could before the tall in price of good A.

Second, his/her budget constraint is flatter. The consumer must now give up fewer good B to afford each additional unit B. The market trade-off between goods A and B has changed. In essence, the price reduction makes it easier for him/her to *substitute* now cheaper good A for good B (Fig.6.8).

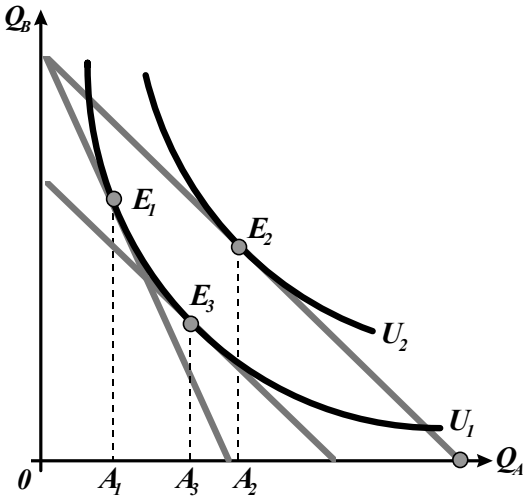

Fig. 6.9 Income and sudstitution effects.

These two changes - in real income and relative prices - are the heart of the *income effect* and the *substitution effect*. Every price change produces both effects because every change in price changes both affordable choices and the slope of the budget constraint.

For measuring the substitution effect we draw additional budget line on the graph 6.9. Its slope is defined by new price ratio, and its position on the graph - by constraint that it has to be tangent to the initial indifference curve (U_1). After the price reduction consumer welfare rises, then to hold it at the previous utility level it is necessary to cut his/her income:

The shift of optimal amount of consumption from A_1 to A_2 is the sum of shifts $A_1 \to A_3$ (substitution effect) and $A_3 \to A_2$ (income effect). In algebraic form this joint influence of substitution effect and income effect is described by the *Slutsky equation*:

$$\frac{\partial x_i}{\partial p_j} = \left(\frac{\partial x_i}{\partial p_j}\right)_{comp} - \left(\frac{\partial x_i}{\partial I}\right) x_j \quad 17$$

The first component in the right hand side describes the substitution effect, and the second - the income effect expressed in the same units of measuring (by multiplying at x_j). The left hand side describes the total influence of price change on the quantity demanded including changes in the demand structure a general change in the level of real income.

The result of joint influence of substitution effect and income effect depends on their direction and magnitudes. At the increase of this good price substitution effect is always negative. Income effect may have negative or positive sign for a given good. If consumer decides that a good is *inferior,* and absolute value of income effect exceeds substitution effect, this good is a *Giffen good*, and demand curve for that good is positively sloped.

To isolate the substitution effect of a price change, we need to remove the income effect. That is, we need to calculate the change in money income just necessary to *offset* the change in real income induced by the price change. This amount is called the *"compensating variation"*. To compensate means "to restore" or "to reimburse", so the compensating variation is the change in money income necessary to restore the

consumer utility level he/she experienced before the price changed. The compensating variation measures the change in utility at the new prices. Compensating variation is exact measure of changes in the cost of living due to rise (or fall) of prices.

The concept of changes in quantity demanded produced by pure substitution effects leads to the theoretical notion of the compensated demand curve. *A compensated demand curve* plots the relationship between price and quantity demanded, net of the income effect. Whenever price changes along a compensated demand curve, the consumer is provided with the appropriate compensating variation necessary to restore the pre-price-change level of satisfaction. Thus, movements along a compensated demand curve only reflect the substitution effect caused by the change in relative prices. They leave unchanged the consumer's *real income* as measured by his/her level of utility. While a compensated demand curve is an extremely useful theoretical construct, ordinary (or Marshallian) demand curves are the demand curves observed in the real world.

In contrast to the compensated demand curve, movements along an uncompensated or ordinary demand curve reflect the net result of both the income and the substitution effects as consumer respond to price changes. While utility remains constant along a compensated demand curve, along an uncompensated demand curve price decreases are associated with increases in utility and price increases are associated with decreases in utility.

If to look at the whole economy the influence of price changes on the quantity demanded at every particular market should usually be compensated by price changes on other markets. For example, if the price of one good increases and as a result its quantity produced is reduced, resources earlier used in this market should move to other industries, and relative prices of other goods should decrease, leading to corresponding gains in welfare. These negative and positive influences at the real income could be equal, and then the consumer could move along *compensated* demand curve.

5. Consumer surplus

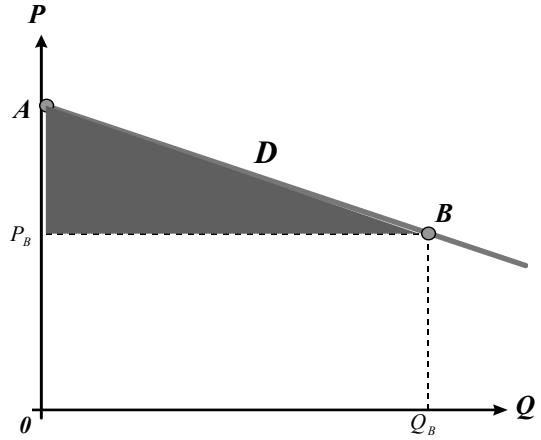

Fig. 6.10 Consumer surplus.

5.1. The decision about optimal quantity of good consumed is the result of cost-benefit comparison. The cost of given quantity of this good is one unit's price P_B multiplied by quantity of units Q_B (the area OP_BBQ_B). Area under marginal utility curve is equal to total *value* (utility expressed in money) of the amount of good (the area $OABQ_B$). The effect exceeds cost since the consumer was ready to pay more for the first units of good. The maximum excess of the *effect over cost is* achieved at the point when *marginal utility is equal to the price* (point B).

As noted above, an important purpose of careful analysis of price changes is to derive a measure that can be used to provide an economic evaluation of different public policies. Consumer surplus is such a measure, and changes in consumer surplus reflect the effect of changes in prices induced by policies such as taxes, tariffs, or trade barriers.

Consumer surplus is net addition to a consumer's welfare when consuming a good. It is the difference between the maximum he/she would pay and what actually has to be paid. *Consumer surplus (CS)* is the difference between what a consumer is willing to pay for a good and what the consumer actually pays when buying it.

In geometric terms (Fig.5.10), consumer surplus is the area under the compensated demand curve above *AB* the price P_B (line BP_B) paid for the good. Consumer surplus (or *net benefit, NB)* is the *total benefit (TB)* from the consumption of product (the area $OABQ_B$) net the *total cost* of purchasing it ($TC= P_B \times Q_B$, or the area OP_BBQ_B)

$$CS = NB = TB\text{-}TC.$$

The demand curve *D* is marginal benefit curve (*marginal benefit, MB,* is the extra benefit of one more unit of good). In equlibrium consumers purchase goods up to the point *B* at which the marginal benefit just equals the price P_B*:*

$$MB=P_B.$$

The *change in welfare* produced by a *change in price* is just equal to the change in consumer surplus produced by the price change. This change in consumer surplus is what economists typically try to measure when evaluating the welfare effects of alternative public policies.

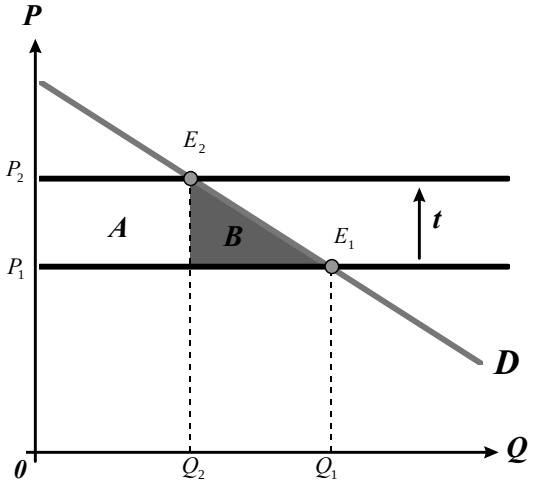

Fig. 6.11 Taxation and consumer welfare.

5.2. The unit tax ***t*** increasing the price from P_1 to P_2, decreases its consumption from Q_1 to Q_2.

The loss of consumer welfare are equal the area A plus the area B. The area A are equal to the consumer surplus loss transfered to government revenues (=$Q_2 \times t$). Net loss of consumer welfare is the *"deadweight loss*" - since nobody gets that part of wealth. By economic meaning, deadweight loss is the price paid by society for intervining in the market mechanism (area B on the Figure 6.11).

Key Terms

utility
utility function
consumer preferences
ordinal utility function
cardinal utility function
total utility (TU)
marginal utility (MU)
diminishing marginal utility
indifference curves
indifference maps
marginal rate of substitution (***MRS***)
budget constrain
consumer
equilibrium
equimarginal principle
demand function
"price-consumption" curve
"income-consumption" curve
income effect
substitution effect
Slutsky equation
Giffen good
"compensating variation"
a compensated demand curve
consumer surplus (CS)
total benefit (TB)
marginal benefit (MB)
consumer's welfare
"deadweight loss"

Reading

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Lecture 7. **Production and Cost in Market Economy.**

1. Firm in a market economy.
   1.1. Firm: economic meaning. Types of firms in market economy.
   1.2. Objectives of the firm. The problem of governance. The f0irm and the entrepreneur.
   1.3. Production process. Inputs and outputs. Factors of production.
2. Production Function.
   2.1. Output and factors: some empirical relationships.
   2.2. The properties and types of production functions. Cobb-Douglas production function and Leontieff production function.
   2.3. Concept of returns to scale.
3. Cost.
   3.1. Economic cost and accounting cost.
   3.2. Fixed and variable costs. Total, marginal and average costs.
   3.3. Typical cost functions and their graphs.

1. Firm in a market economy.

1.1. *Firm* is an institution of market economy aimed at coordination of the decisions made by the production factors' owners. Oppositely to the market, the firm represents a planned or hierarchical system, where all key decisions are made by the owner(s). The private and state owned firms should be distinguished; there are few different types of ownership in private firms.

Entrepreneurial firm is the individual private enterprise, where owner buys in the market all the factors of production. Evidently the objective of such a firm is to maximize the *residual income* (or economic profit) - the revenue minus all payments for the factors of production. *Capitalist firm* is owned by proprietors of capital. Their aim thus is to maximize residual income per unit of capital after all other factors (except their capital) are paid on current market rates. Very often such firms have a corporate form and the role of entrepreneur belongs to *managers*. *Labor managed firm* ("self-managed" enterprise) is maximizing the revenue of labor.

Corporation (joint stock company), individually owned enterprise and partnership are the main types of business organization in market economy. Corporation is the major type judging by its economic role; it belongs to stockholders who bought a part of its capital in the form of *shares.* Stockholders are the claimants for corporate incomes. Part of profit distributed between stockholders is called *dividend.* Other part of profits are retained earnings. Ownership and management of the firm are clearly separated. Managers are hired by corporation on behalf of stockholders.

1.2. Every firm must solve a number of problems: What and how much to produce? How to promote its products? What price to charge? The answers to these and other questions can be found by assuming that the goal of the firm is to maximize its profit.

Profit is the difference between the total revenue the firm receives from selling its products and the total economic cost of the firm's production.

Other objectives of the firm: sales maximization; maximization of the revenue of labor.

The assumption of profit maximization provides the basis of the *theory of firm* development. However, the divorce of ownership from control in the modern corporation opens the possibility that managers may not seek to maximize profits on behalf of stockholders.

Stockholders (principals) may want their firms to maximize profits, but managers (agents) may find it in their personal interest not to maximize profits. As in all *"principle-agent" situations*, the principal must take care of structuring the situation to encourage the appropriate behavior on the part of the agent. In modern corporation stockholders use both *internal* (corporate governance scheme, proxy fights, and performance-based compensation schemes) and *external* (the market for corporate control, product market competition, discipline form capital suppliers) mechanisms to encourage managers to maximize profits. This system of control allows to use the profit maximizing hypothesis in most of the cases.

1.3. *Production* is a process through which resources and/or other products (*inputs)* are transformed into different products either for final use or use in another production process (*output).*

Inputs are commodities or services used by firms in their production processes. An economy uses its existing *technology* to combine inputs to produce outputs. *Outputs (or total product, **TP**)* are the various useful goods or services that are either consumed or employed in futher production.

We classify inputs, or *factors of production*, into three broad categories: land, labor, and capital.

*Land (*or *natural resources)* - represents the gift of nature to our productive processes. *Labor* consists of the human time spent in production. Land and labor are often *called primary factors of production*. *Capital* (or *capital goods*) form the durable goods of an economy, produced in order to produce yet other goods.

Production process characterizes by following indicators:

The short run for the firm is a time period when at least one of the production resources (factors) of the firm is fixed. Usually this is fixed capital of the firm. In the short run a firm can change the intensity of using fixed factor by varying the quantities of other, variable factors (in particular, labor).

The long run for the firm is a period when it can vary quantities of all resources it uses, including fixed capital.

*Total product of a variable input (**TP**)* is the amount of output (*Q*) produced when a given amount of that input is used along with fixed inputs.

Average product of a variable input (for example, labor - AP_L) is the total product of the variable input divided by the amount of that input used:

$$AP_L = TP_L/L,\ AP_K = TP_K/K.$$

*Marginal product of a variable input (*for example, labor - MP_L) is the change in the total product of that input corresponding to a 1-unit change in its use:

$$MP_L = \Delta TP / \Delta L,\ MP_K = \Delta TP / \Delta K;$$
$$MP_L = \partial f(L,K)/ \partial L,\ MP_K = \partial f(L,K)/ \partial K.$$

2. Production Function.

2.1. Production can be described in terms of production function.

Production function relates the quantities of inputs used in a production process to the output. Usually the two-factor production functions are being used: $Q = f(L,K)$, Q - is output, L and K labor and capital (respectively) used in production. The flows and stocks of the resources used should be distinguished: the whole capital stock used by firm is the factor of production function, but only its depreciation is included in the output value. In the same time the labor is usually included in production function not as stock but as flow. Symbol *f* is a characteristic of production system transforming resources into products. Here Q is the maximum level of output that can be produced by using (L,K) units of input.

Production function describing input-output relationship at the firm (annual flows of inputs and output) as a single productive system is a microeconomic production function. We may apply production function concept to productive systems such as branch of economy, sector, horizontally and vertically integrated complexes, and, finally, national economy. In the latter case we have a macroeconomic production function.

2.2. *Isoquant* $I(Q)$ of the production function $Q = f(L,K)$ connects the points where the output $Q = f(L,K)$ can be produced using different combinations of inputs (or different technologies). Different sets $(L_1,,K_1)$ and $(L_2,,K_2)$ of the resources used belonging to the same isoquant $I(Q)$ provide the same output Q. *Isoquant map* is a set of isoquants that shows the maximum output attainable from any given combination of inputs (Fig.7.1).

`The slope of isoquant, or marginal rate of substitution, similarly to the slope of indifference curve, shows the technical ability to substitute one input for another. *Marginal rate of technical substitution (of labor for capital)* is a measure of the amount of capital that each unit of labor can replace without increasing or decreasing production:

$$MRTS_{LK} = -\Delta K / \Delta L,$$
$$MRTS_{LK} = MP_L/MP_K$$

In the two figures (7.1. and 7.2) isoquants of two main types of production functions are shown. First (7.1), the *Cobb-Douglas production function* is non-linear (degree) function characterized by zero output in case where one of the inputs is not used. Its formula is: $y = a_0 L^{\alpha} K^{\beta}$ (usually $\alpha+\beta=1$). Isoquant $I(Q_2)$ located to "north west" from isoquant $I(Q_1)$ corresponds to higher output level ($Q_2>Q_1$). The degrees α and β in Cobb-Douglas production function are the labor and capital elasticities of output. Hence in any starting point the 1% increase of factor L leads to increase of output by α%, and 1% increase of factor K leads to increase of output by β%.

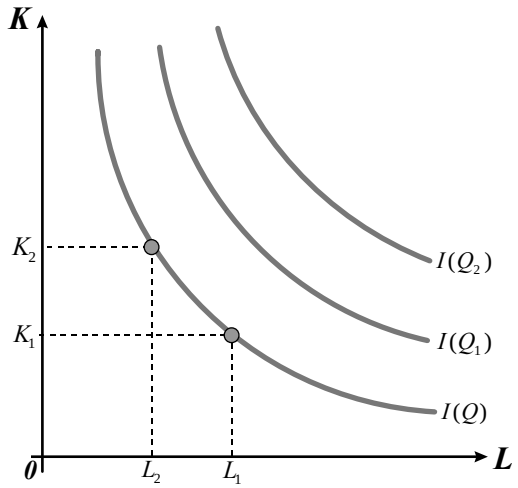

Fig. 7.1 Isoquant map
(Cobb-Douglas production function).

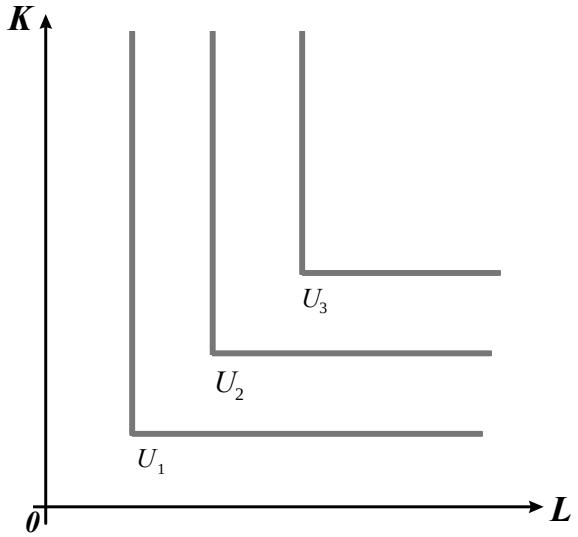

Fig. 7.2 Isoquant map
(Leontieff production function).

The second figure (7.2) represents isoquants of a typical linear production function for fixed proportion technology. It is called *Leontieff production function*, its formula is: $Q = min(\alpha L, \beta K)$. Under sufficient quantity of one resource the output here is proportional to the quantity of another (limiting) resource, and the coefficients α and β are the resources' productivities. The using of factors in fixed proportion at microlevel is often caused by the technology.

2.3. Concept of returns to scale.

Law of diminishing marginal returns: States that as more of variable input is used while other inputs and technology are fixed, the marginal product of the variable input will eventually decline.

The measure of increased output associated with increases in all inputs is fundamental to the long-run nature of the firm's production process. How does the output of the firm change as its inputs are proportionately increased?

If output more than doubles when inputs are doubled, there are *increasing returns to scale.* This might arise because the larger scale of operation allows managers and workers to specialize in their tasks and make use of more sophisticated, large-scale factories and equipment.

A second possibility with respect to the scale of production is that output may double when inputs are doubled. In this case, we say there are *constant returns to scale.* With constant returns to scale, the size of the firm's operation does not affect the productivity of its factors. The average and marginal productivity of the firm's inputs remains constant whether the plant is small or large.

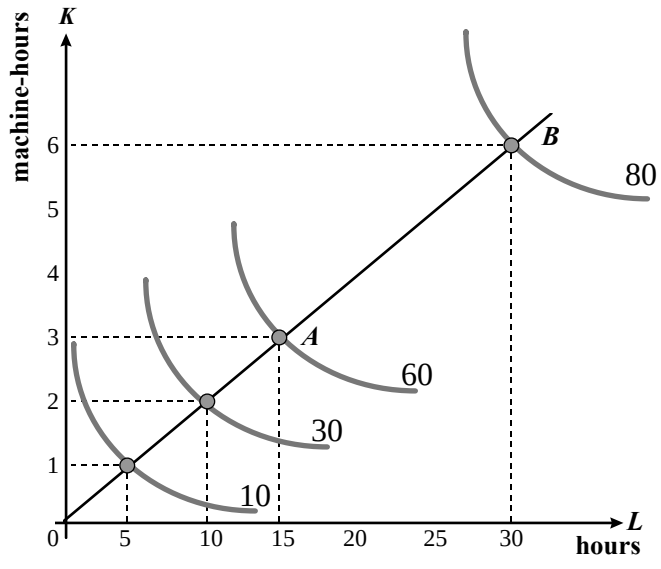

Fig. 7.3 Returns to scale.

Finally, output may less than double when all inputs double. This case of *decreasing returns to scale'* is likely to apply to any firm with large-scale operations. Eventually, difficulties of management associated with the complexities *of* organizing and running a large-scale operation may lead to decreased productivity of both labor and capital.

The presence or absence of returns to scale is seen graphically in Figure 7.3. The ray *OB* from the origin describes the various combinations of labor and capital that can be used to produce output when the input proportions are kept constant. Increasing returns to scale are shown by a movement from 0 to *A* along ray OB. Decreasing returns to scale are shown by a move from *A to B*.

The returns to scale are determined by production function that describes the physical relationship between inputs and outputs. It shows the per cent change of output corresponding to one per cent growth of all factors and is connected with the *degree of homogeneity* p $(p>0)$ of the production function. If $p>1$ with the increase in the scale of production process t times $(t>1)$, output increases t^p $(>t)$ times, and we have an *increasing returns to* scale. At $p<1$ an increase in scale leads to decreasing total productivity. At $p=1$ we have a constant returns to scale.

The presence of returns to scale is an important issue from a public policy perspective. If there are increasing returns, then it is economically advantageous to have one large firm producing (at relatively low cost) than to have many small firms (at relatively high cost). Because this large firm can control the price that it sets, it may need to be regulated. For example, increasing returns in the provision of electricity is one reason why we have large, regulated power companies.

3. Cost.

3.1. *Total economic cost* evaluate all the inputs to the production process at their opportunity cost. The market price paid for inputs is often a good measure of opportunity cost. But when the inputs are not purchased in the market, an *imputed cost* (at the appropriate opportunity cost) must be assigned. Examples are the time of the owner, or when the building used by the business belongs to the owner.

Accounting costs include only *explicit costs*, representing payments for purchased input services.

Sunk cost represent the part of input's cost that has a zero opportunity cost; it should be omitted when calculating an economic cost.

3.2. In the short run there are variable resources and fixed resources and there are two types of costs - *variable costs and fixed costs.*

Variable cost (VC) is the cost of inputs that change with output.

Fixed cost (FC) is the cost of inputs that are independent of output (The common business term for FC is *overhead cost).*

Total cost (TC) is the sum of the cost of all inputs used to produce a good. Total cost in the short run are equal to the sum of variable and fixed costs at the given volume of output. All types of costs (excluding fixed costs) depend on the output *Q:*

$$VC=g(Q),\ TC = c(Q) = FC + g(Q).$$

The typical graphs of the fixed, variable and total costs as functions of the output *y* are shown in the graph 7.4:

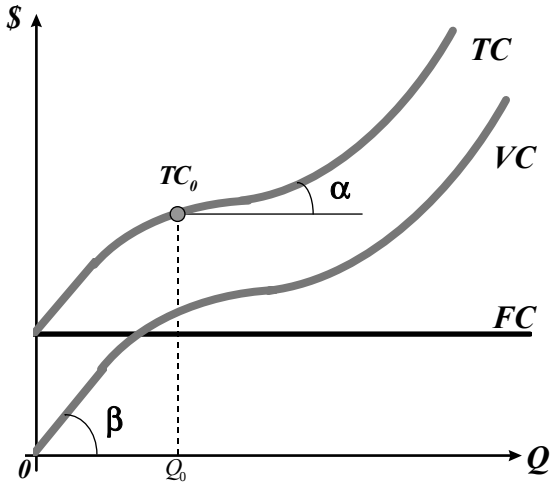

Fig. 7.4 The fixed, variable and total cost curves.

Besides the total figures, the costs per unit of production can be considered (in particular, *average* and *marginal* costs).

Average cost (AC, ATC) is the total cost per unit of output

$$AC = TC / Q.$$

Average variable cost (AVC) is the variable cost per unit of output

$$AVC = VC / Q.$$

Average fixed cost (AFC) is the fixed cost per unit of output

$$AFC = FC / Q.$$

$$AC = AFC + AVC.$$

Average costs are evidently functions of output Q,

$$AFC=r(Q),$$

$$AVC=s(Q),$$

$$AC=t(Q).$$

Marginal cost (MC) is the change in total cost (**ΔTC**) that results from a change in output (**ΔTC**); the extra cost incurred to produce another unit of output

$$MC = \Delta TC / \Delta Q;$$

The marginal fixed costs *(MFC)* and marginal variable costs *(MVC)* can be defined in a similar way, and it is clear that $MFC=0;\ MVC=MC$. MC is the derivative of total cost function $TC=c(Q)$ with respect to Q:

$$Q=Q_0,\ MC=MC(Q_0) = dc(Q_0) / dQ.$$

In the long run for the firm all expenditures could be varied and so all costs are variable costs.

Hence the marginal costs can be interpreted graphically as a slope of the line tangent to the graph of total (TC) or variable (VC) costs ($tg\ \alpha$). In the same figure the variable costs TC_0/Q_0 can be interpreted as a slope β of the crossing line which passes through the origin.

The typical cost curve has the following properties. If the output grows from zero, the marginal costs first decrease (the positive returns to scale, fixed cost economy and approaching to the optimal technology take place). Further the marginal costs start to grow when less effective resources and technologies should be used to increase output.

The typical view and joint location of the graphs of average and marginal costs are shown in the figure 7.5.

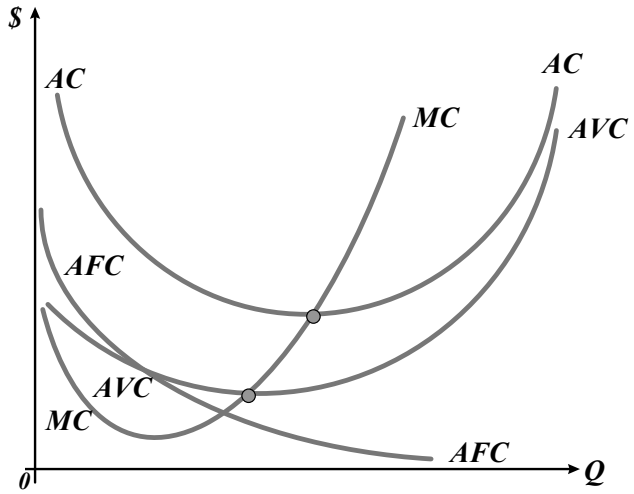

Fig. 7.5 The average and marginal cost curves.

The distance between average total and average variable costs curves equals to average fixed costs. If $MC<AC$ $(MC<AVC)$ then AC (AVC) increase; if $MC>AC$ $(MC>AVC)$ then AC (AVC) increase (the reverse statement is also true). These statements mean that if the cost of increasing output by unit is less than average cost of output then adding of this unit will increase the average costs (or increase it under $MC>AC$ respectively). It follows from these statements that MC curve intersects AC and AVC curves at their minimum points.

This rule reflects a general property: graphs of average and marginal values always have an intersection at the extremal (minimum or maximum) point of the average value function.

3.3. A business that is expanding or contracting its operation needs to predict how costs will change as output changes, estimates of future costs can be obtained from a *cost function,* which relates the cost of production to the level of output and either variables that the firm can control.

To predict cost accurately, we need to determine the underlying relationship between variable cost and output. Then, if a company expands its production, we can calculate what the associated cost is likely to be.

One cost function that might be chosen is

$$TC = a + bQ.$$

This linear relationship between cost *and* output is easy to use but is applicable only if marginal cost is constant (*MC=b)*.

If we wish to allow for a U-shaped average cost curve and a marginal cost that is not constant, we must use *a* more complex cost function. One possibility, shown in Figure 7.6, is the quadratic cost function:

$$TC = a + bQ + cQ^2.$$

This implies *a* straight-line marginal cost curve of the form

$$MC = b + 2cQ,$$

Average cost, given by

$$AC = a/Q + b + cQ.$$

is U-shaped when c is positive.

If the marginal cost curve is not linear, we might use a cubic cost function:

$$TC = a + bQ + cQ^2 + dQ^3.$$

Figure 7.7 shows this cubic cost function. It implies U-shaped marginal as well *as* average cost curves:

$$MC = b + 2cQ + 3cQ^2,$$
$$AC=a/Q + b + cQ + dQ^2.$$

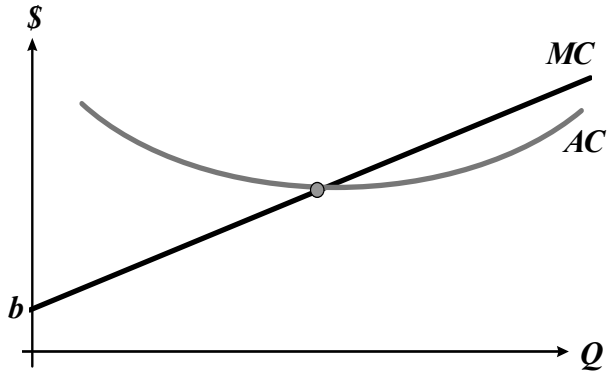

Fig. 7.6 Quadratic cost function.

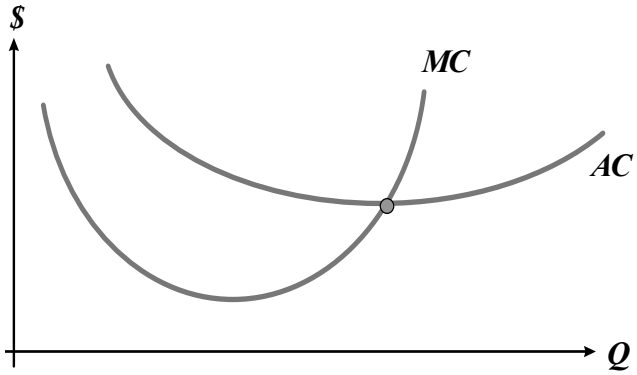

Fig. 7.7 Cubic cost function.

Key Terms

firm
profit
"principle-agent" problem
production
Inputs, or factors of production
land (or natural resources)
labor
capital (or capital goods)
technology
short run
long run
average product ***AP***
marginal product ***MP***
outputs (or total product, ***TP****)*
production function
isoquant
isoquant map
marginal rate of technical substitution (of labor for capital) $\boldsymbol{MRTS_{LK}}$
Cobb-Douglas production function
Leontieff production function
law of diminishing marginal returns
increasing returns to scale
constant returns to scale
decreasing returns to scale
economic cost
imputed cost
accounting costs
explicit costs
sunk cost
variable cost (VC)
fixed cost (FC)
total cost (TC)
average cost (AC, ATC)
average variable cost (AVC)
average fixed cost (AFC)
marginal cost (MC)

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Lecture 8. **Competitive Firm Supply. Firm and Industry in the Long Run.**

1. Firms and markets.
   1.1.Concept of market structure. The ideal of perfect competition.
   1.2.Output, price, revenue and profit of a firm. Total, average and marginal revenue of a competitive firm.
2. Competitive firm and market supply.
   2.1.Profit maximization and output level. Marginal Output Rule. Break-even point.
   2.2.Firm supply in the short run and shut-down decision.
   2.3.Market supply in the short run
3. Firm and industry in the long run.
   3.1.Long run average costs function.
   3.2. Returns to scale in the long run.
   3.3.Market equilibrium in the long run. Entry and exit of firms.
   3.4.Industry long run supply. Factor prices changes and market supply.
4. Competitive market efficiency
   4.1.Producer surplus.
   4.2.Total (social) surplus and economic welfare. Market efficiency
   4.3.Taxes and subsidies. Their influence on competitive firm supply.

1. Firms and markets.

1.1. In the theory of consumer choice we may assume that individual decisions are independent. In the theory of firm we must take into account the firm's ability to influence the price and other market parameters. For analyzing the economic processes in the industrial market an assumption on how firms are interacting is necessary. This framework is called *market structure*. The simplest market structure for the analysis is *perfect competition* - a situation where all decision-makers are independent and their behavior consists in adjustment to competitive market equilibrium. *Perfect competition* is the model of market structure that relies on some fundamental assumptions:

1) sellers are price takers;
2) entry into the market is free;
3) sellers do not behave strategically;
4) buyers are price takers;
5) each agent has perfect information on market variables.

In such a market all prices are set equal to marginal costs and producers earn zero economic profit in the long run. If some market meets only four first assumptions then the market structure is called *pure competition*. *Imperfect competition* is the structure where at least one of the major assumptions is not met.

The basic behavioral consequence of perfect competition is that firm cannot influence market price. *Price taker firm (competitive firm)* is a firm that sells its output in a perfectly competitive market and thus cannot influence the price of what it sells. Cases of imperfect competition are always the situations where firm can determine or influence market price, i.e. act as a price maker.

The demand for the output of a competitive firm: It is infinitely elastic at the market price (horizontal line).

1.2. *Total revenue (TR)* is the price (***P***) of the good sold multiplied by the amount sold (***Q***):

$$TR = PQ.$$

Profit is the difference between the total revenue the firm receives from selling its products and the total cost of the firm's production

$$\Pi = TR - TC.$$

Economic profit (= profit) is the total revenue minus economic cost *Accounting profit* is the total revenue minus accounting cost. *Normal profit* is the profit that the firm's owners forgo by employing their owner-supplied inputs within their own firm (opportunity cost of the of the owner-supplied inputs).

Accounting profit - Economic profit = normal profit.

Average revenue (AR) is the total revenue per unit of output

$$AR = TR/Q = P.$$

Marginal revenue (MR) is the change in revenue that results from selling an additional unit of output

$$MR = \Delta TR / \Delta Q;$$

$$TR = R(Q),\ MR = dR(Q)/ dQ = P.$$

$$MR = AR = P$$

2. Competitive firm supply.

2.1. In order to determine how a perfectly competitive firm will react to the changes in prices let us consider a *profit maximization problem П = Pr(Q)*

$$Pr(Q) = R(Q) - C(Q) = P_0Q - C(Q) \rightarrow max$$

where $Pr(Q)$ is the firm's profit, P_0 is market price of output, and $P_0Q=R(Q)$ is the firm's revenue. As we analyze perfect competition, firm is a price taker and price does not depend on the output Q.

Output level which maximizes firm's profit is $Q_0$18, such as

$$0 = d\,Pr(Q_0) / dQ = P_0 - C'(Q_0) = P_0 - MC(Q_0)$$

(the partial derivative of the profit function is equal to zero). This necessary condition has a clear economic interpretation: under perfect equilibrium optimal level of output is achieved when *marginal cost is equal to market price of output*. The necessary condition does not guarantee the profit maximization: it can be implemented as well in the point of minimum profit or in the point of maximum or minimum losses. The sufficient condition of maximum for profit function $Pr(Q)$ should be fulfilled, and this function should be positive in maximum point.

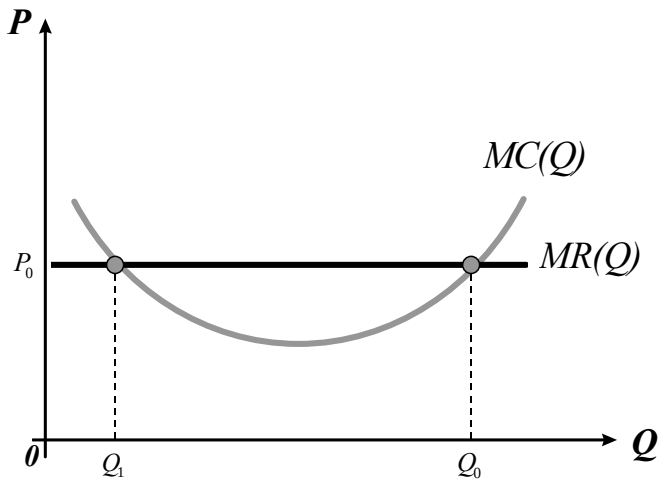

Fig. 8.1 Profit maximization.

Equation $P_0=MC(Q_0)$19 is a special case of a more general rule: $MR(Q_0) = MC(Q_0)$ (Fig.8.1). 20Regardless of the type of market structure in which the firm operates, the marginal output rule requires it to produce that level of output where marginal cost equals marginal revenue. Under perfect competition the maximum of profit is achieved at the output level where MC curve intersects the horizontal price line $P=P_0$. The sufficient condition of maximum means here that $MC(Q)$ function increases.

Putting together benefit and cost, a firm whose goal is to maximize profit should follow the marginal output rule and the shut down rule.

The marginal output rule means that the firm should produce with equal marginal output and marginal costs.

The shut-down rule tells the firm to shut down (go out of business) whenever economic profit is less that zero at all levels of output.

These two rules are of universal character for the firm, they are correct for operating in the market of any structure.

In the short run to make a shut-down (or continuing production) decision, the firm compares the revenue with variable costs, not with the total ones. It is regarded that the fixed expenditures has been already done and cannot be reduced even in the case of immediate stopping production. Hence the firm continues production for some time if the revenue exceeds variable costs, even if the production is in total unprofitable.

2.2. Knowing firm's costs we may find its supply under different prices, and we may find the output and price corresponding to break-even (zero economic profit) and shut-down.

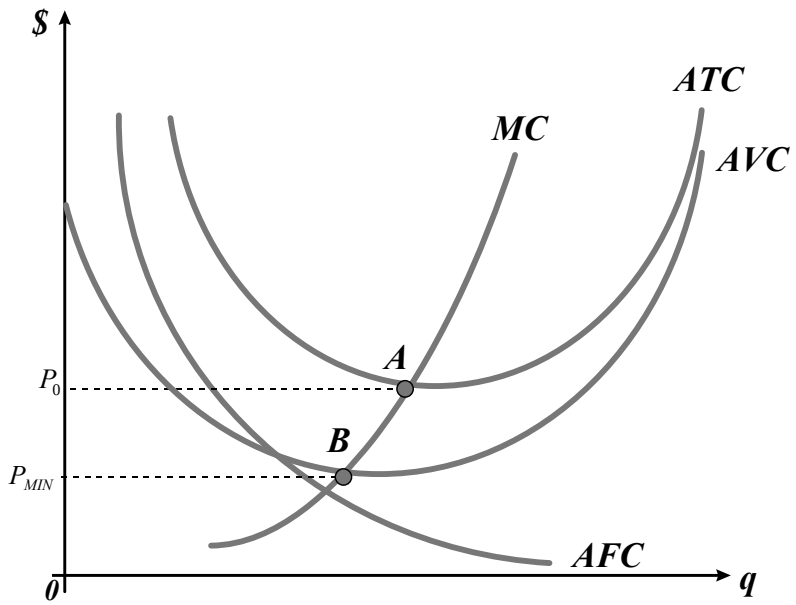

Fig. 8.2 The Break-even point (B) and shutdown point (A).

Break-even point (point B, Fig.8.2)*:*

$$P_{MIN} = MC = min\ AC.$$

Shut-down point: The point A (Fig.8.2) reached when price falls to a level P_0 that just allows a firm to cover the minimum possible average variable cost of its output.

$$P_0 = MC = min\ AVC.$$

The supply curve in the short run is the line showing the quantity which firm is willing and able to supply at each price. This curve coincides with the portion of the short run marginal cost *(MC)* curve of a competitive firm laying above the short run average variable cost *(AVC)* curve.

2.3. From firm's equilibrium we can move easily to market equilibrium in the short run. Perfectly competitive market has a *market supply curve* ***S*** (Fig.8.4) which is the horizontal sum of all individual supply curves ***s*** (Fig.8.3) (if all the decisions on how much to produce are independent).

Intersection of ***D*** and ***S*** curves gives us the *market equilibrium price* P_E and corresponding *quantity supplied* Q_E (see the fig. 8.4). As within the framework of perfect competition no firm can influence market price, the demand curve ***d*** for an individual firm's output is horizontal. In the figure 8.3 the situation of positive economic profit got by a typical firm is presented. Under the optimal output q_E *the profit is positive* since $P_E > AC(q_E)$, and hence

$$R(q_E)=q_E P_E > q_E AC(q_E)=C(q_E).$$

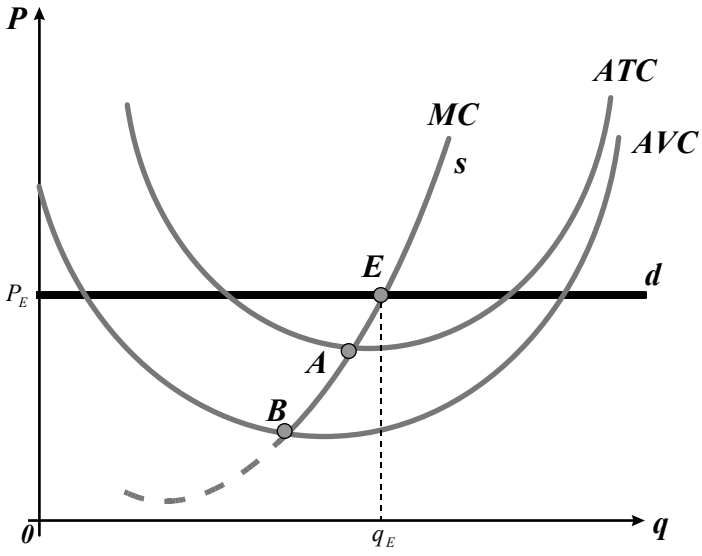

Fig. 8.3 The firm supply curve (s) in the short run.

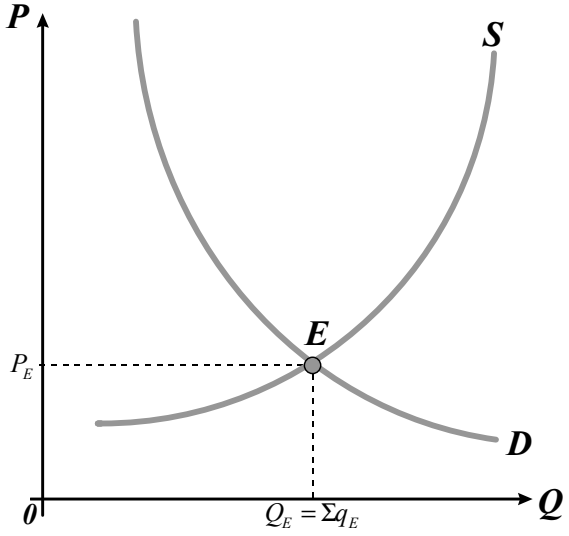

Fig. 8.4 Market supply curve (S) end market equilibrium.

If there would be such an equilibrium price P_E that the curve ***d*** would cross the curve ***s*** in the point between the lines ***AC*** and ***AVC*** then the loss minimization would be done. It would take place if the inequality $P_E < AC(q)$ would be fulfilled under any output ***q***. For even lower equilibrium price P_E (if $P_E < AVC(q)$ under any output ***q***) the firm should minimize losses through immediate stopping production and exit from the market.

The market share of each firm is thus determined by its marginal cost - the more output the firm can produce until its marginal cost will be equal to price, the higher would its market share and economic profit be. The theory of market supply is built on the assumption of constant marginal cost curves of all firms in the market. This assumption is true if and only if the resource prices and technology of production are constant.

3. Firm and industry in the long run.

In the *long run* the average cost value is of special importance (as it will be shown below). We shall demonstrate first the process of the long-term average costs function formation.

3.1. Let the firm have the different short run cost curves $AC_1, AC_2, AC_3, AC_4, AC_5$ corresponding to different plant sizes. In the long run all the resources and hence all the costs are variable. The plant size is chosen to maximize the profit, and it requires to minimize the total and average costs under given output. Hence the graph of long-run average costs ($LRAC$) shows the minimal average costs of production of any given quantity. In the figure 8.5 the bold line consisting of the connected segments of short-run average costs curves $SRAC$ ($AC_1, AC_2, AC_3, AC_4, AC_5$) represents the long-run average costs curve AC.

In principle, a firm can change much more smoothly its capital, which signifies that even small changes in the output demanded in the market lead firm to adjust its production possibilities. Thus average costs in the long run would be an *envelope* of short run cost curve with a usual U shape (figure 8.6).

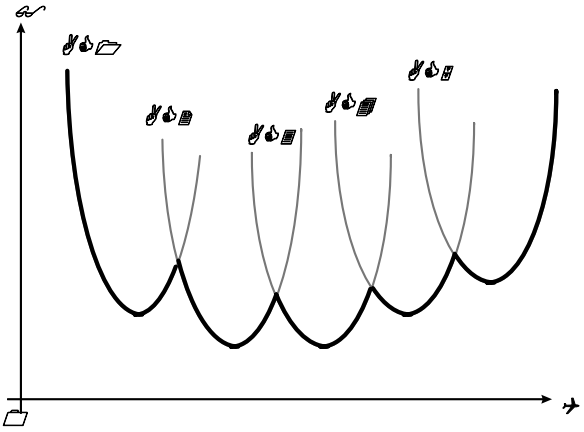

Fig. 8.5 Short run cost curves corresponding to different plant sizes.

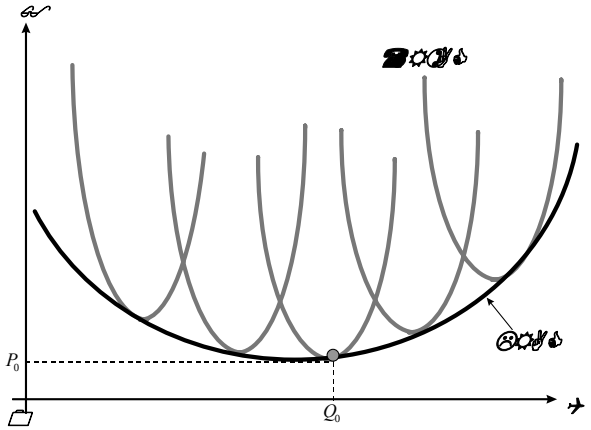

Fig. 8.6 Long run average cost curve LRAC as an envelope curve.

3.2. The optimal size of a firm in a long run equilibrium is determined by the shape of long-run average cost curve (AC). Usually U-shaped AC curve is considered: the average cost decrease till some point y_0, and then start to grow. There are *positive returns to scale* to the left from the point y_0 and *negative returns to scale* to the right from it.

Under the output expansion the *positive returns to scale* are observed if the output increases greater number of times than the factors' inputs (and the average cost increase).

The positive returns to scale is the long-run decrease of average costs caused by firm's output increase. It is also called the *economies of scale*.

Economies of scale: When a firm's costs less than double in response to a doubling of output.

The *negative returns to scale* is the long-run increase of average costs caused by firm's output increase. It is also called the *diseconomies of scale*.

Diseconomies of scale: When a firm's costs more than double in response to a doubling of output.

The *constant returns to scale* mean the unchanged long-run average costs under firm's output increase.

Long-run causes of positive returns to scale are labor and management specialization, more effective use of capital equipment and technologies, use of by-products. The diminishing returns to scale are determined by difficulties of management and control of large enterprise, coordination failures etc.

The *minimum efficient scale* is the smallest volume of firm's output that could be produced at the minimum long run average costs.

3.3. In the long-run equilibrium of industry the product price P_0 equals to the minimum average costs of the typical firm in industry. We consider that the average costs include some normal profit, and economic profit equals zero since the alternative activities of the firm provide the same profit rate.

Suppose that the industry is in the long-run equilibrium, i.e.

$$\boldsymbol{P = P_0 = AC(q_0) = min\ AC(q) = MC(q_0),}$$

and the typical firm produces the output q_0 (see Fig.8.7). In such a state the economic profit of typical firm $Pr(q)$ equals zero. The market price P_0 is determined in industry as equilibrium price, when the demand and supply are equal (Fig.8.8). The summation of the short-run supply curves of separate firms gives the market supply curve $\boldsymbol{S}$, and with the market demand curve $\boldsymbol{D}$ it determines the equilibrium price of industry market.

Each separate firm adjusts to this price (by setting such a production volume when the price equals to marginal costs).

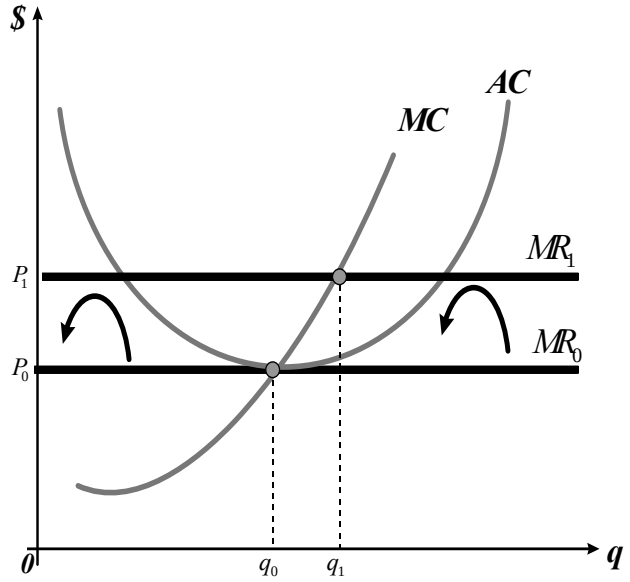

Fig. 8.7

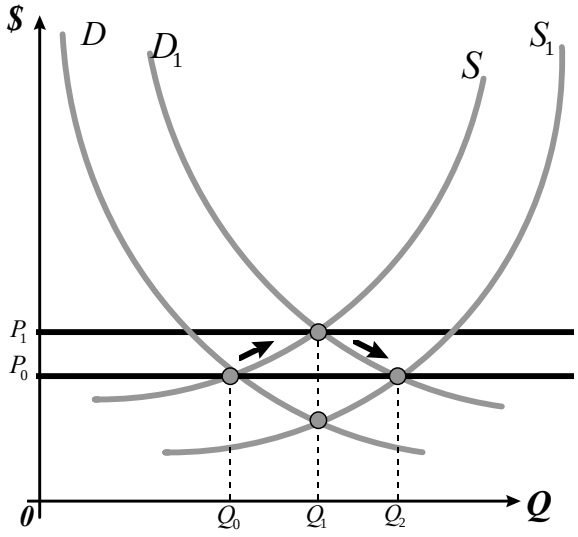

Fig. 8.8

If the market demand is increasing from ***D*** to ***D1,*** new short-run equilibrium will be achieved at the price P_1 and firm's demand curve is shifting up from position MR_0 to position MR_1. The firm will get positive economic profit, and it will get an incentive to increase its output till q_1. But such increase can be done only in the short run (and it will rise the industry output till Q_1). Then the positive economic profit will attract new firms to that market, which will shift the market supply curve to the right, from ***S*** to ***S1***. As a result price will fall P_1 to the initial level p_0, economic profit will be reduced back to zero and the entry of new firms discontinued. The increase of the industrial output from Q_0 to Q_2 means that there are21 $(Q_2 - Q_0)/ q_0$ new firms in the industry.

The entry of new firms or the exit of existing firms is the mechanism that moves an industry to a *long run equilibrium*. Entry occurs when firms perceive they can make an economic profit. Exit occurs when existing firms are unable to cover their long run average cost of production. Entry or exit continues until the marginal firm is just making zero economic profit (breaking even). In long run equilibrium, firms maximize profits (that is, they are in short run equilibrium), and there is no incentive for any firm to leave the industry or to enter the industry.

3.4. So the changes in the output lead to the changes in the number of firms, but do not alter the equilibrium price, that gravitates around minimum average cost AC of a typical firm. *The long-run market supply curve* is horizontal and thus perfectly elastic with respect to price. This condition is true if the change of firm's output does not influence the prices of resources the firm uses *(the constant cost industry*). *Increasing cost industries* are characterized by upward sloping long run market supply curve and increasing prices of inputs with the expansion of the industrial production. *Decreasing cost industries* are benefiting from the large economies of scale since the inputs' prices decrease with output expansion, so the long run market supply curve is downward sloping.

In the long run equilibrium firm is earning zero economic profit and produces at the minimal cost, i.e. the most efficient technological combination is achieved. The condition $P_0 = minLRAC$ also implies that consumers are getting the demanded quantity at the lowest price possible in the long run. Thus, under perfect competition the efficiency is guaranteed.

4. Competitive market efficiency

4.1. *Producer surplus* (*PS)* is the difference between a producer's revenue and the opportunity cost of production. It is calculated as the sum of the differences between price and the marginal cost of production each unit of output. The area between the supply curve and price measures the producer surplus (Fig.8.9).

4.2. When we add consumer (CS) and producer (PS) surplus together, we obtain *total surplus (TS)*

TS = CS +PS = Value to buyers - Cost of sellers.

Total surplus (or social surplus) in a market is the total value to buyers of the goods, as measured by their willingness to pay, minus the costs to sellers of providing those goods.

If an allocation of resources maximizes total surplus, we say that the allocation exhibits efficiency. If an allocation is not efficient, then some of the gains from trade among buyers and sellers are not being realized.

Allocative efficiency occurs when no resources are wasted. To achieve allocative efficiency, three conditions must be satisfied. There are:

1.Producer efficiency

2.Consumer efficiency

3.Exchange efficiency.

Producer efficiency occurs when firms are on their supply curve (*P=MC)*. Consumer efficiency occurs when consumers are on their demand curve (*P=MB, marginal benefit)*. Exchange efficiency occurs, when

*P=MC=MB (*market equilibrium*).*

The market equilibrium maximizes the total surplus (Fig.8.10).

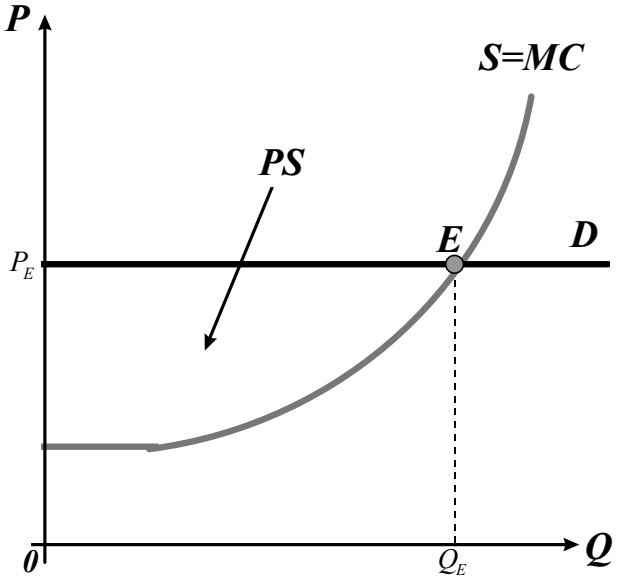

Fig. 8.9 Producer surplus.

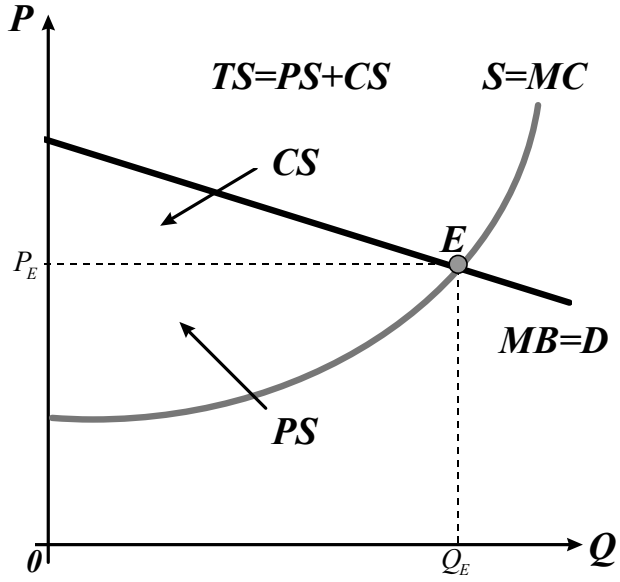

Fig. 8.10 Total surplus.

4.3. The introduction of tax or subsidy for the supplier influences the supply curve of the firm in the short run only if it changes the marginal costs curve. With an excise tax or value added tax the marginal cost curve shifts up by a distance equal to tax per unit. As a result all firms in the market decrease their output. So the industry supply curve *SS* will shift to the left, and equilibrium market price will increase. The measure of price increase is determined here by the elasticities of market demand and market supply.

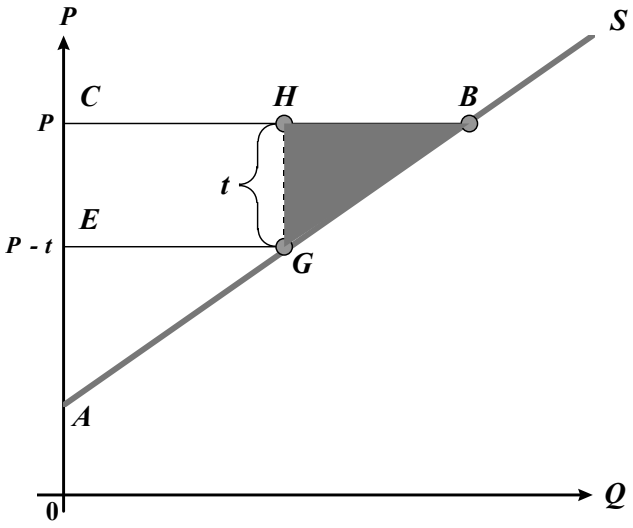

Fig.1.1 The deadweight loss of tax on production.

Consider the example illustrated in Figure 8.11. Assume initially the producer is receiving the price *P.* Then a tax is imposed that lowers the amount he receives to *P - t.* In the initial situation, his total profits (producer surplus) are given by the area *ABC.* Now, his profits are reduced to *AGE.* The change in his profits area is *ECBC.* But of this change, part accrues to the government as tax revenue—the rectangle *ECHG.* The tax on producers has resulted in producers' profits being reduced by more than government revenue has increased. The difference between the two is the deadweight loss associated with the tax. It is simply the shaded area *BGH.*

Key Terms

market structure
perfect competition
pure competition
price taker (competitive) firm
total revenue (TR)
economic profit (= profit)
accounting profit
normal profit
average revenue (AR)
marginal revenue (MR)
profit maximization problem
marginal output rule
shut-down rule
break-even point
shut-down point
supply curve in the short run
market supply curve
long-run average cost
positive returns to scale
economies of scale
negative returns to scale
diseconomies of scale
constant returns to scale
constant cost industry
increasing cost industry
decreasing cost industry
producer surplus (PS)
total surplus (or social surplus)
allocative efficiency

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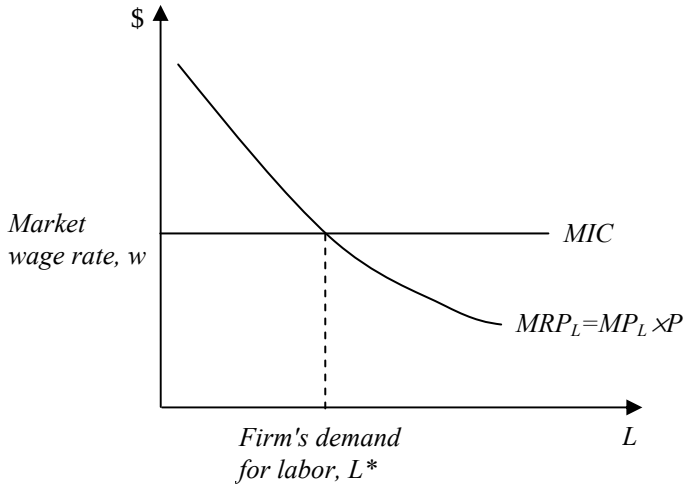
Fig. 1. Hiring rule



Lecture 11. **Inputs' Markets and Resources Allocation**

1. Demand for an input of firm and competitive industry.
1.1. Concept of derived demand.
1.2. Marginal factor productivity. Input cost for a competitive firm.
1.3. Hiring rule.
1.4. Inputs substitutability.
1.5. Demand for an input.
1.6. Example: demand for capital.

2. Factor supply
2.1. Opportunity cost of owner of an input. Rent.
2.2. Household supply of labor
2.3. Supply of capital.

3. Input's market equilibrium.
3.1. Price of an input. Wage rate. Interest rate.
3.2. Income on factors. Labor and capital shares in market economies.
3.3. Institutional structure of labor markets. Formal and informal sector: basic facts.

1. Demand for an input of firm and competitive industry

1.1. The markets of inputs (labor, capital, land) is an essential part of market economy as well as markets of the goods and services. As a rule, in the inputs' markets households are suppliers and firms act on the demand side.

Demand for factors of production is a derived one because it depends on demand for final goods. The larger input is used by firm in production the larger output it produces.

A situation of perfect competition in the market of the factors of production exists when there is a large number of sellers and buyers, and nobody has an opportunity to affect price. In this case firm is price-taker and price of an input does not depend on quantity which is used by the firm.

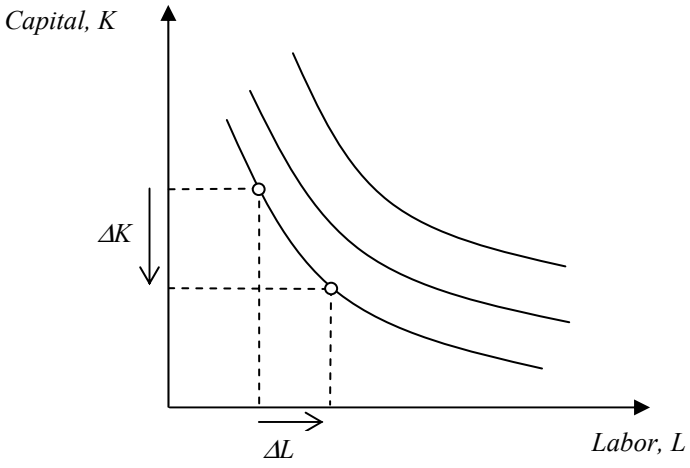
1.2. The *marginal product of an input* (*MP*) is the change in output when usage of input is increased by one unit. For example, firm's output grows by MP_L units if the firm uses additional working hour. Most technologies have the property of *diminishing marginal product*: if the amount of all other resources is constant, the smaller marginal product of an extra unit of resource corresponds to the greater amount of this resource. For example, each additional unit of labor in a bakery produces fewer additional loaves of bread than the preceding units of labor due to increasing lack of equipment and working space.

1.3. When profit-maximizing firm in competitive market is deciding whether to hire one more unit of labor, it considers how that decision affects profits. It therefore compares the extra revenue from the added labor with the extra costs. Benefits from hiring additional unit of the input is an additional revenue received by the firm (*marginal revenue product* or *MRP*):

$$MRP_L = (MP_L)(MR)$$

Where MP_L is *marginal* product of labor, *MR* is *marginal* revenue. At the competitive market the *marginal* revenue is equal to the market price of a good.

Fig. 2. Isoquant map



The cost of additional unit of the factor (*marginal input cost*) does not depend on quantity of a resource employed by firm and is equal to the market price of the input (in case of labor it is wage rate):

$$MIC = w$$

Profits are maximized by hiring an input up to the point at which its marginal revenue product equals marginal cost. This occurs when (see Fig. 1):

$$MRP = MIC,$$

If market is competitive,

$$(MP_L)\ (P) = w$$

We can write down it as:

$$MP_L = w/P\ .$$

*w/P i*s *real price of a resource,* (in our example – wage rate), i.e. price expressed in terms of production, instead of money terms.

The curve MP_L slopes downward because the *MP* diminishes as *L* increases. The firm hires labor up to the point at which the real wage *W*/*P* equals MP_L. Hence, the schedule is at the same time the *firm's labor demand curve*.

1.4. The firm's profit-maximizing decision can be formulated as optimization of an inputs quantity to be used in production process.

The solution of factors combination optimization problem looks graphically like the solution of consumer choice problem. The production function shows the highest level of output that can be produced by each combination of inputs *K* and *L*. It can be depicted by the isoquant map. An isoquant at the map shows the set of input combinations that yield the particular level of output. The slope of isoquant shows the substitution rate of one factor for another. The negative slope of the isoquant (that is derivative of the isoquant as a function *K* of *L*) equals the *marginal rate of technical substitution* (*MRTS*).

$$MTRS = -\frac{\Delta K}{\Delta L}\ .$$

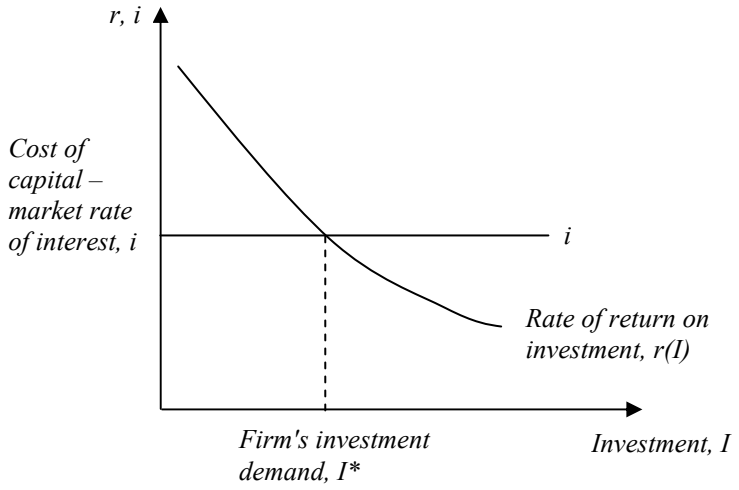
The substitution capability of resources or the marginal rate of substitution is equal to the ratio of the marginal productivities of inputs:

$$MTRS = \frac{MP_L}{MP_K}\ .$$

Isocost is a level line of cost function $C=p_LL+p_KK$. An *isocost map* shows the different input combinations that can be purchased at each fixed level of expenditure. The negative slope (the derivative) of an isocost is the ratio of the prices of inputs. By sketching the isocost map and the isoquant on the same diagram, it is possible to determine the least-cost combination of inputs required to produce each output.

Isoquant is tangent to isocost at the point of optimal input structure. The slope of isoquant at the point is equal to the slope of isocost. Hence, the marginal rate of substitution of the second input for the first one equals their price ratio:

Fig. 4. Investment demand



$$MTRS = \frac{MP_L}{MP_K} = \frac{p_L}{p_k}$$

We rearrange the proportion to get

$$\frac{MP_L}{p_L} = \frac{MP_K}{p_k}.$$

It implies equal "productivities" on additional currency units spent for each input. This is the necessary condition of optimum in problem of determination of firm's demand for factors. It is the consequence of condition which states that marginal productivity of a resource equals its real price

$$MP_K = \frac{p_k}{P}, \quad MP_L = \frac{p_L}{P}.$$

1.5. The factor hiring rule leads directly to the function of the firm's demand for a factor. Changes in factor price lead to both a substitution effect and an output effect. The *substitution effect* gives incentive for the firm to substitute relatively expensive inputs by relatively cheap ones. The *output effect* leads the firm to produce more output when the price of an input falls and to produce less when it rises.

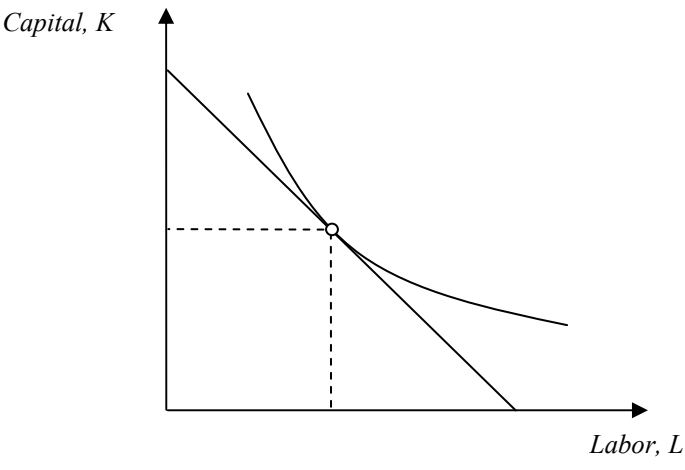
Analyzing the market of productive resources we sum the individual firms' demand functions. The conditions of consumer goods market, the *elasticity of demand* in particular, directly influence dynamics of demand for productive factors. The higher elasticity of demand for consumer goods corresponds to the higher elasticity of demand for productive factors. When factor's price changes, the firm's behavior depends on *possibilities of technological substitution of productive factors* as well. There is a difference between individual firm's demand and aggregate demand for productive factors. Shift in aggregate demand for a particular resource changes the resource's price. As a result, the magnitude of aggregate demand for resource also depends on *elasticities of the factor and its substitutes' supply*.

1.6. Capital is durable input created for the purpose of producing more goods and services. Examples of physical capital inputs include buildings, machines, equipment, industrial infrastructure etc. Human capital consists of knowledge, experience and skills of the worker.

Rate of return on the investment is the net increase in profit resulting from the investment expressed as a percentage of each dollar invested.

$$r = \frac{\text{Increase in profit - Investment}}{\text{Investment}}$$

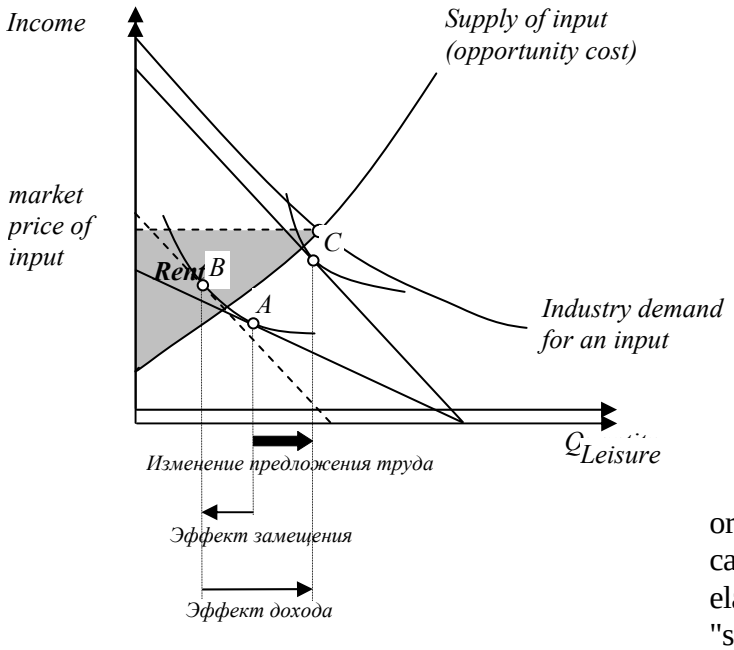
Fig. 3. Optimal combination of inputs



The investment opportunities of firm, as a rule, are limited, and the increase of volume of the investments results in decrease of the rate of return (the law of diminishing returns). The dependence of the rate of return on the amount of invested funds determines demand of firm for the financial resources for creation of the capital.

The cost of the investment is determined by the market interest rate, whether irrespective of the firm uses own financial resources (in this case interest rate reflects opportunity costs of investment) or borrowed funds. I.e. the market interest rate determines *the supply of* financial resources for separate firm. The firm chooses such volume of the investments, when the marginal benefits are equal to marginal cost (market interest rate *i* - see. Fig. 4).

Fig. 6. Work-leisure choice



2. Factor supply

2.1. The factors' (resources') **supply** is defined by their owners' decisions. If the market price of resource P_f is higher than opportunity incomes, the resource is sold in this market. The surplus of incomes received over opportunity costs (incomes) is known as *resource owner's rent*. The opportunity costs of resource sellers determine minimal resource's price in the market. If the price level is lower than the *minimal price of supply*, resource owners prefer either to supply it in other markets or not to sell it at all. - That is why this price is called "*reservation price*". The lower the elasticity of the resource supply is (i.e. the "steeper" the supply curve is), the greater is the share of rent in owner's incomes. The rent value does not directly affect decisions on recourse supply in the market - that is a rent's specific feature. If resource is quite *mobile*, its prices in different markets have a strong tendency to equality because the resource markets are interdependent. If there are different initial wage rates in two sectoral **labor markets** due to differences in demand for labor workers will leave the second sector trying to find a job in the first sector. As a result, the labor supply curve of second market will shift inward, the supply curve of first market will shift outward. Both supply curves' moving will stop when the wage rate in the first sector will be equal to the wage rate in the second sector (w').

In reality we do observe sufficient wage differentiation. Wage differentiation can be caused by several reasons, for example by *discrimination* and *compensation differences* in wage rates. Any constraint for new workers' entrance into branch is called discrimination.

Wage differences are often caused by diverse labor supply in various branch markets due to specifics of working process. For example, woodcutter's job is more risky than woodworker's one. As a result, the woodcutter's wage includes *risk premium* that is surplus to the woodworker's wage.

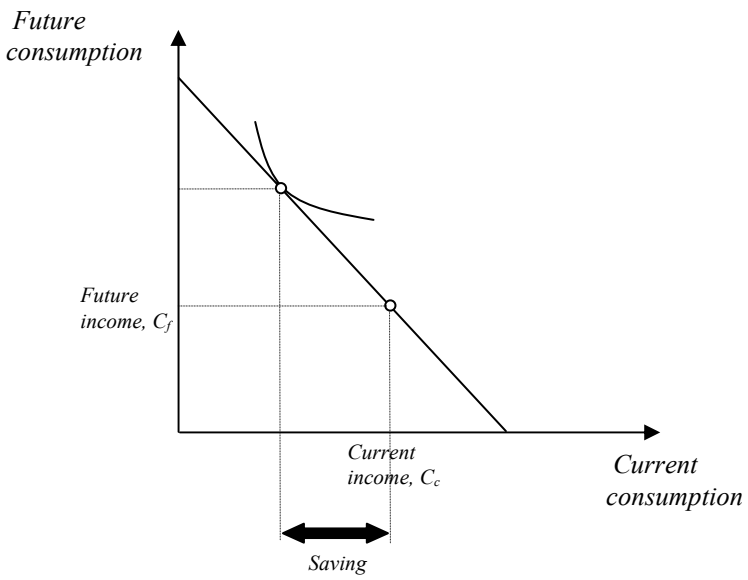
2.2. One can imagine that supply of productive factors in economy is fixed by their current stocks: country's population, territory, productive assets. But there is a difference between factor's *stock* and its market *supply*. Fundamental approach to labor and savings supply decisions applies the same analytical apparatus that was developed to analyze household's role as a demander in commodities markets.

The first problem is a household's labor supply under different wage levels. These decisions define a consumption level as well as labor supply in the economy. There is a choice between consumption which draws back to wage level and leisure. To solve this problem, household maximizes its utility function, making choice among various combinations of leisure and consumption that are available under some wage level. If leisure is a normal good the income effect and substitution effect work in opposite directions. Wage growth increases both real income and demand for leisure (income effect) though causes crowding out of some leisure by working time along welfare isoquant line (substitution effect). As a result, consumers may either decrease or increase their labor supply reacting on the wage rise. (see Fig. 6).

It should be noted that unemployment in this model is completely voluntary unemployment. Individuals who are not satisfied with the current wage rate do not sell their labor at all and prefer leisure. It is impossible to decrease the level of such unemployment. We can rise the wage level (for example, adopting the Law on the Minimal Wage Rise) - but this will decrease firms' labor demand and result in real unemployment. There will be people who try in vain to find a job under current wage rate.

The above model of labor supply skips time though the decisions on factors utilization yield long run consequences. This implies *intertemporal choice*. For example, expenditures on education can raise future

Fig. 7. Intertemporal choice



incomes. These costs are known as investment in *human capital*. Steady differences in wages draw back as a rule to diverse human capital - skills, education and experience. In this model individual decides how much to invest in human capital (for instance, in his education and professional training) and how much to consume. The capital market allows a household to separate the two components of the problem. Household can first determine the expenses on education and professional training to obtain the highest level of income throughout lifetime. Second, it can optimally distribute income, savings and borrowing over the lifetime. Such a *separation* of two decisions is made possible by the existence of *capital markets*.

2.3. The source of the investments in an economy is *savings* - part of the income which has been not consumed by households in the current period. Thus, the supply of saving in the capital markets is determined first of all by households. Quantity of goods the man postpones for the future consumption is determined by his preferences over the current and future consumption (indifference curves in Fig. 8) and the proportion in which he can exchange a part of the today's income for consumption in the future, i.e. *market interest rate* (the slope of a straight line in Fig. 7 which is equal to $(1 + i)$).

Rational consumer will choose a point, where MRS_{FC} (the marginal rate of time preference) is equal $(1 + i)$. The sum of the supply of the savings of all households forms the market supply of saving.

3. Input's market equilibrium

3.1. The price of the factor of production (wage rate in the labor market or interest rate in the capital market) in the competitive market is determined so that quantity demanded coincided with quantity supplied. Thus, *in the completely competitive market always there is a full employment of the inputs*, and any government intervention results in occurrence of an inefficiency.

3.2. If the production function is characterized by constant return to scale, the product is completely distributed between the owners of the inputs:

$$Y = f(K, L) = MP_L \times L + MP_K \times K \ .$$

For example, for the Cobb-Douglas production function

$$Y = f(K, L) = AK^{\alpha} L^{1-\alpha},$$

where α and $1-\alpha$ are the shares of the inputs in the final product

3.3. Labor markets are different from markets for commodities. The wages they set and the employment conditions they determine profoundly affect the quality of life of workers and society as a whole. Not surprisingly, societies, and the governments that represent them are heavily involved in labor market the world over.

Societies intervene when unregulated labor markets fail to deliver the most efficient outcomes. Four reasons are given for government interventions: ineven power of labor and firms in the labor contract, discrimination, insufficient information and inadequate protection (insurance) against risk.

When workers find themselves in a weaker position, it leads usually to efficiency losses, since workers who feel alienated and exploited become less likely to invest in firm-specific skills, which are crucial for the improvement of labor productivity and thus to increase in the standards of living. Discrimination leads to market outcomes that are not only inequitable, but inefficient: it limits the realization of potential contribution of minorities to the economy at the benefit of few privileged groups. Inefficiencies arises when workers and employers are poorly informed about health and safety standards, which could cost to society more in terms of medical care than the product produced in these poor conditions. Finally, as incomes of workers families depend on the steady employment, it is typically impossible to insure adequately the well-being of large parts of society against the temporary income loss (for example due to structural adjustment), disability or old age. The absence of such insurance may lead workers to demand higher wages than justified by production fundamental in order to compensate themselves for bearing such risks and thus impose a heavy weight on efficiency.

Government respond to these problems by setting standards. Near all governments set workplace standards. Standards differ in their objectives, but almost everywhere are present

- Establishment and protection of workers' rights
- Protection for vulnerable
- Establishment of minimum compensation for work
- Assurance of decent working conditions
- Provision of income security

But not all legislated standards achieve their objectives, however. Some end up protecting a group of relatively well-off workers at the cost of limiting employment in the modern "open" sector. Where standards set are too high for the level of economic development, or they actually hinder the labor market flexibility, the informal arrangements still present a dominant solution to labor market problems. The table shows the share of informal market (not regulated by labor standards) in different groups of countries.

Informal sector employment (% to total employment), by sector and country income group

Sector	Low-Income	Middle-Income	High-income
Agriculture	96.7	74.4	61.8
Industry	70.2	23.3	10.9
Services	53.6	31.8	14.4
All sectors	82.9	42.6	15.6

Source: Calculated form table 11.2, p. 72 of the World Bank 1995 World Development Report, "Workers in an integrating world".

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Lecture 12. **Market equilibrium and welfare**

1. Market equilibrium. Concept of efficiency.
1.1. Partial vs. general equilibrium.
1.2. Concept of efficiency of resources allocation (Pareto optimality).

2. Efficiency in the exchange economy.
2.1. The concept of economic efficiency of allocation of goods.
2.2. Competitive equilibrium.
2.3. Efficiency of the perfect competition.
2.4. Welfare economics.

3. Production efficiency.
3.1. Efficient distribution of resources.
3.2. Production possibilities frontier.

4. Equilibrium and welfare.
4.1. First welfare theorem.
4.2. Market imperfections.
4.3. Concept of the shadow prices.

1. Market equilibrium. Concept of efficiency.

1.1. The markets of the goods, services, inputs are interconnected among themselves. In opposite to the case *of analysis of partial equilibrium* studying laws of functioning of the separately taken markets, *the analysis of general equilibrium* assumes research of interrelation of the prices and quantities in all markets simultaneously taking into account *feedback effects*.

The purpose of this lecture is investigation how the market economy works as a whole, as far as the resources in the competitive markets are effectively allocated.

1.2. First of all it is necessary to define what efficiency is. *Allocative efficiency* is a situation that prevails when the resources are allocated among persons so that it is impossible to make any person better off without harming another person. Productive efficiency exists when it is impossible to reallocate the use of available input services to increase the output of one good without decreasing the output of any other goods.

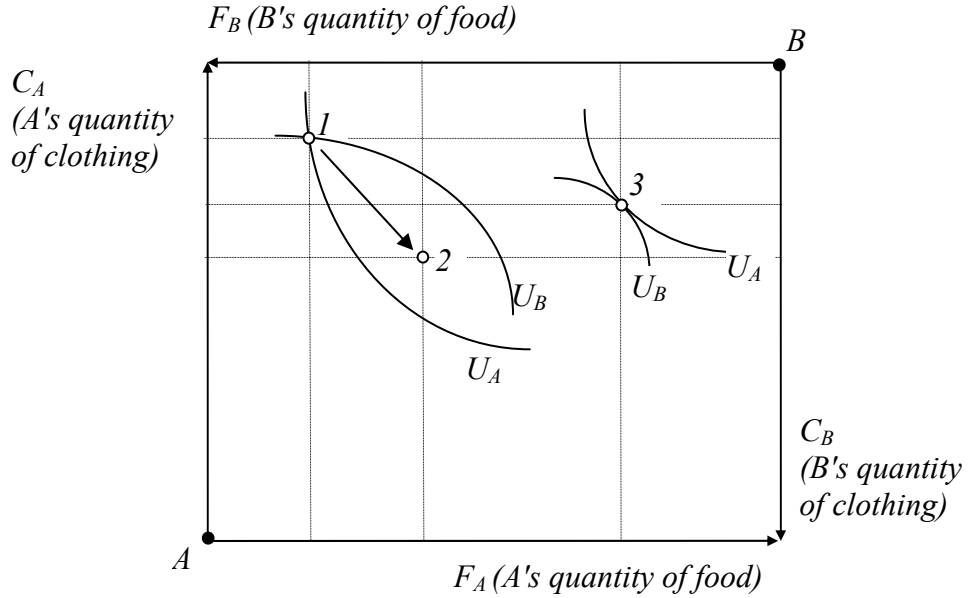
2. Efficiency in the exchange economy

2.1. Let's consider economy in which there is no production. The economic agents are allocated with some quantities of goods total amount of which is limited and try maximize the utility entering in exchange at the marketplace.

The distribution will be efficient (optimal) in the sense mentioned above if the marginal rates of substitution are equal for all consumers.

Convenient model for elementary exchange economy of *the Edgeworth diagram* (*Edgeworth box*) - Fig. 1, where two consumers, (*A* and *B*) and two goods (*F* and *C*, for example, meal and clothes) are considered. Total amount of one good *(F)* is equal to length of a rectangular, amount of another is height. Each point inside a rectangular determines one of possible *variants of distribution* of the goods between *A* and *B*. Distribution determined by a point ***1*** in a Fig. 1 is inefficient, since the redistribution (for example, transition to a point ***2***) is possible which will improve welfare of both consumers. The distribution ***3*** is efficient, since there is no opportunity to redistribute the goods without damage one of the from the consumers. The slope of a indifference curves of *A* is equal at this point to the slope of indifference curve of B, i.e.:

Fig. 1. Edgeworth box



$$MRS_{FC}^{A} = MRS_{FC}^{B}$$

The set of all possible efficient distributions is called <u>*contract curve*</u> (Fig. 2a).

If on the diagram with consumers' utility on the axes we show the points appropriate to all possible efficient distributions, we shall receive *utility possibility frontier* – a curve that shows the greatest possible utility level of one consumer given total amount of goods and utility levels of other consumers (a Fig. 2b).

2.2. *Competitive equilibrium* is the set of relative prices which balance demand and supply in *all* markets.

2.3. If the markets are competitive, i.e. any of participants can not affect prices, prices will be changing until equilibrium will be reached. If every consumer tries to maximize utility, i.e. to reach a rule

$$MRS_{FC} = \frac{p_C}{p_F},$$

The equilibrium distribution is efficient

$$MRS_{FC}^{A} = MRS_{FC}^{B} = \frac{p_C}{p_F}.$$

2.4. *The efficiency* of distribution of the goods is not connected to concept *of equity* of distribution in any way. In a Fig. 2b it is possible to consider distribution ***3*** as more fair than ***5***, however distribution ***3*** is efficient but ***5*** is not. Achievement of efficient distribution (for example transition from a point ***5*** in a point ***4***) can result in losses for separate groups in a society.

3. Production efficiency

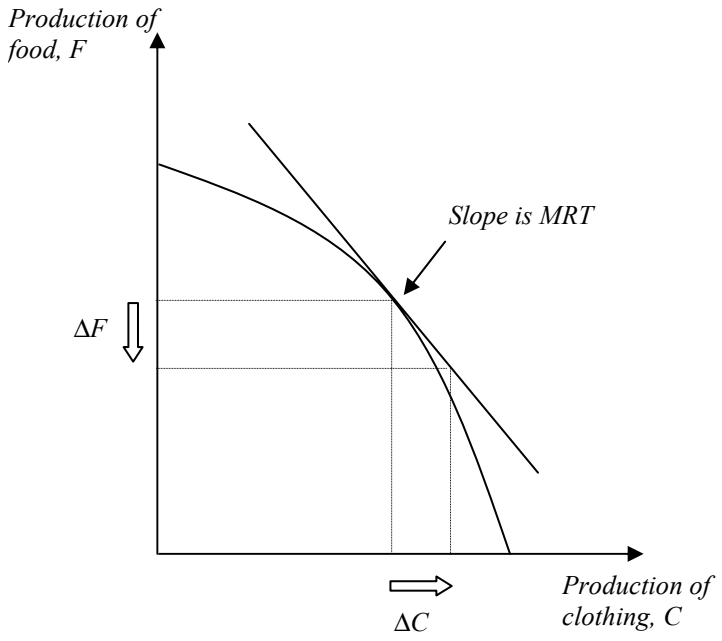
3.1. Total amount of the factors of production available in the economy is limited, i.e. always there is *a resource constraint*.

Production (distribution of the productive factors among industries) *is efficient* if the marginal rates of technical substitution are identical to all industries:

$$MRTS_{LK}^{F} = MRTS_{LK}^{C} = \frac{MP_K}{MP_L}.$$

3.2. *The production possibility curve* (Fig. 6) shows greatest possible volume of production of one goods at the given quantities of other goods, resource restrictions and technology.

Fig. 3. Production possibility frontier



The marginal rate of transformation (MRT) is a quantity of one good which is necessary to refuse when the resources used for its production are redistributed for production of additional unit of another good:

$$MRT_{FC} = -\frac{\Delta F}{\Delta C},$$

I.e. *MRT* represents the slope of the production possibility curve.

It is possible to tell that *MRT* represents the additional production cost of additional unit of clothes *(ΔC)*. I.e. quantity of food which it is necessary to refuse *(ΔF)* is *alternative cost* of increase of production of clothes.

If the markets of the factors of production are competitive, i.e. any separately taken participant of the market does not influence the prices, which are established only according to a supply and demand, and the firms maximizes profit, i.e.

$$MRTS_{LK}^{F} = \frac{p_K}{p_L}$$

$$MRTS_{LK}^{C} = \frac{p_K}{p_L}$$

then equilibrium at the markets of the productive factors gives efficient allocation of inputs:

$$MRTS_{LK}^{F} = MRTS_{LK}^{C} = \frac{p_K}{p_L}$$

4. Equilibrium and welfare

4.1. Under conditions of perfect competition the manufacturer which maximizes profit aspires the prices were equaled to marginal cost:

$$p_F = MC_F$$

$$p_C = MC_C$$

Hence:

$$\frac{p_C}{p_F} = \frac{MC_C}{MC_F} = MRT_{FC},$$

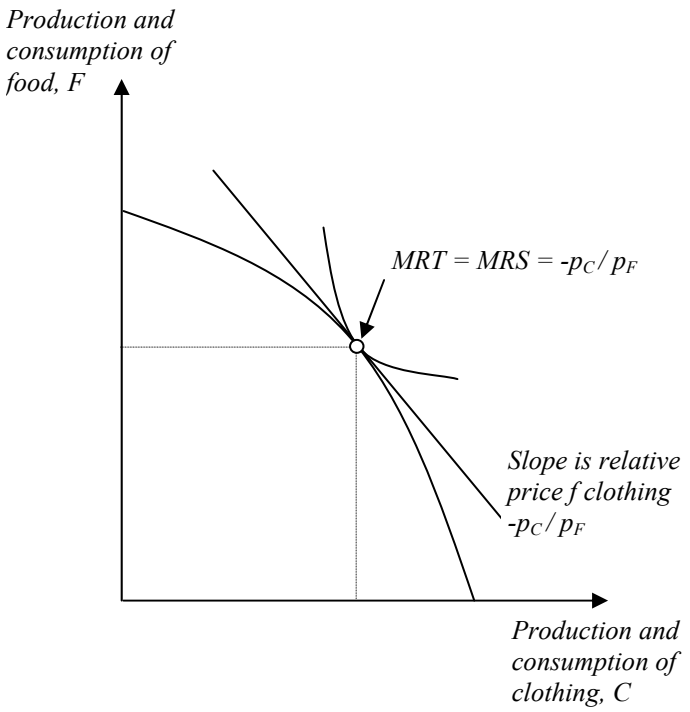
I.e. the manufacturers of food and clothing independently from each other choose such volumes of production, that *the ratio of the prices of the goods is equal to marginal rate of transformation* for the given economy.

Each consumer which maximizes utility aspires to consume so much, that the marginal rate of substitution was equaled to a ratio of the prices of goods:

$$\frac{p_C}{p_F} = MRS_{FC}^{A} = MRS_{FC}^{B}.$$

As the prices both for the consumers and for the producers are identical, the conclusion known as *the first general theorem of well-being* is fair*: the completely competitive markets make efficient distribution of resources*:

Fig. 4. General equilibrium



$$\frac{p_C}{p_F} = MRS_{FC}^{A} = MRS_{FC}^{B} = MRT_{FC}$$

Thus, major factors determining the prices and volumes of production and consumption of the goods and services in the competitive market, are the technological opportunities and stocks of the inputs on the one hand, both tastes and preferences of the consumers - with another. Thus *the competitive market results in efficient distribution of the limited factors of production, goods and services* (see. Fig. 4).

4.2. *The market failure* is the situation, when an exchange between the buyers and sellers in the unregulated market does not result in efficient distribution of resources. The reasons could be presence of market power, state intervention, incomplete and asymmetric information, presence of externalities and public goods.

4.3. The market prices of resources not always reflect valid opportunity cost of these resources (relative production costs and at the same time relative utility for consumers - as in above mentioned model of general equilibrium). The imperfections of the market result in price distortions. Therefore, for example, in the economic analysis of the projects use of the real market prices frequently is not justified.

The shadow price is (opportunity) cost of a resource, good or service from the point of view of economy as a whole, in absence of price distortions inherent in the real market.

In other words, shadow prices is a gain *for public welfare from increase of quantity of the given resource or good on one unit* (marginal change of public welfare from marginal change of availability of a resource). *In ideal conditions of the perfect competition the shadow prices coincide with market prices.*

One of the ways of definition of the shadow prices is use of the prices of international trade, which reflect opportunity cost on the goods and services made inside the country (export) on the one hand, and marginal cost of increasing of internal consumption of the goods and services (import) with another. This approach is applicable to the goods and services involved in the foreign trade (*tradable goods*). Thus the task of definition of the shadow prices for the goods which have been not involved in international trade (*non-tradable goods*) is complicated.

If we consider a task of the most effective distribution of resources in economy as a problem of finding of some *economic optimum* (maximum of economic criterion of optimality) in conditions of resource and technological constraints (similarly to the Kantorovich model), the shadow prices, speaking mathematical language are dual prices for resource and industrial constraints. I.e. at presence of a hypothetical opportunity to construct the model of maximization of public well-being, the shadow prices are determined from the optimum decision of the given model and reflect optimum price proportions for economy (price of general equilibrium).

The practical methods of definition of the shadow prices for the economic analysis of the projects proceed from definition of the price as marginal change of social welfare as a result of marginal change of quantity of a resource in the economy.

The estimation of social welfare can depend not only on increase of well-being of a society as a whole as a result of increase of quantity of a resource, but also from its distribution (between state and private sector, between various social groups, etc.)

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Lecture 11. **Imperfect Competition and Market Power**

1. Monopoly and imperfect competition.
   1.1. Concepts of market power and monopoly.
   1.2. Demand curve for monopolistic producer.
   1.3. Monopoly rents.
   1.4. Monopsony.
   1.5. Market dynamics: barriers to entry.
2. Imperfect competition and market structures.
   2.1. Monopolistic competition.
   2.2. Oligopoly.
   2.3. Monopoly and perfect competition as extremes of oligopolistic market.

1. Monopoly and imperfect competition

1.1. *Monopoly* is a market structure in which a single firm is the seller of a commodity for which there are no close substitutes. Thus, a monopolist faces the market demand curve. Because of the downward slope of the market demand curve, a monopolist can influence market price by changing his output. The more inelastic demand is (and accordingly the steeper the market demand curve is), the bigger is such an influence and the *market power* of a monopolist. Thus a monopoly is constrained by the market demand.

Market power (or monopoly power) is the ability of a firm to affect the price of its product by varying the quantity it is willing to sell.

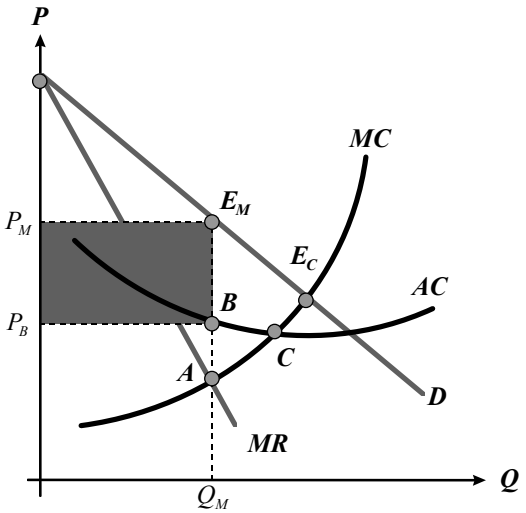

Fig. 11.1

1.2 A profit maximizing monopolist follows the same rules as any other profit maximizing firm: produce with *marginal revenue equal to marginal cost* and shut down when average cost is greater than average revenue at all levels of output.

When compared to a perfectly competitive industry with the same costs, a monopolist produces less output and charges higher price. The output of monopolist in the figure 11.1 is equal to Q_M; the total output in similar competitive industry would be determined by intersection of lines ***D*** and ***MC***.

Let us consider more closely the process of setting monopoly price and quantity. The total revenue is equal to the product of price and quantity sold $TR=P(Q)\cdot Q$, where $P(Q)$ is inverse demand function (the decreasing dependence of price on output).

The marginal revenue ***MR*** is equal to the change in revenue from sales ***TR*** per unit of a small change in quantity sold, or the derivative of ***TR*** with respect to ***Q***:

$$MR = TR' = (P(Q)\cdot Q)_Q = P'(Q)\cdot Q + P(Q)\cdot Q' = \frac{dP(Q)}{dQ}\cdot Q + P(Q). \quad 22$$

Recalling that the price elasticity of demand is equal to

$$E_D = \frac{dQ}{dP}\cdot\frac{P}{Q}, \quad 23$$ we get $$\frac{dP(Q)}{dQ}\cdot Q = \frac{P(Q)}{E_D} \quad 24,$$

letting us to present the marginal revenue as

$$MR = \frac{P(Q)}{E_D} + P(Q) = P(Q)(1+\frac{1}{E_D}). \quad 25$$

The demand function $Q(P)$ is decreasing since the price elasticity of demand is negative. This implies that on the inelastic part of the demand curve $(-1<E_D<0)$ the marginal revenue is *less* than zero. Thus the firm with a market power under inelastic demand for its product cuts down output to increase the total revenue. The point of maximum revenue (as well as the point of maximum profit) are "located" in an elastic segment of demand curve for the product. Marginal revenue equals the marginal cost in the point of maximum of monopoly's profit: $MR=MC$. We combine this equality with the condition $P_Q'<0$, to get $P(Q)>MC$. Thus in

distinction to competitive market the price in monopolistic market exceeds the marginal cost. Suppose that the cost of producing a commodity unit is constant ($MC=AC=c_0$). It follows that the profit share in the price for that firm would be equal to:

$$\frac{P(Q)-AC(Q)}{P(Q)} = \frac{P(Q)-MC(Q)}{P(Q)} = \frac{P(Q)-MR(Q)}{P(Q)} = \frac{1}{|E_D|}$$

As it is evident, the higher the elasticity of demand is, the lower is the monopolistic profit share in the price.

A monopolist can engage in *price discrimination* whenever it sells a product for which arbitrage is difficult or impossible and when the monopolist can easily identify different consumers with different willingness to pay. When these conditions are met, the monopolist divides the market into different segments and sells the profit maximizing quantity to each segment.

1.3. The monopolistic market is an equilibrium market where monopoly finds an equilibrium pair "price-quantity" that maximizes its profit, and consumers find in the market all the quantity demanded *at that price*. Like all profit maximizing firms, a monopolist can be expected to be efficient in production since it minimizes the cost of producing each quantity of output. However, we cannot call this market an efficient one as far as allocation and social welfare effects is concerned. Social losses caused by monopoly are measured by *Deadweight Losses*. The deadweight loss is a difference between the consumer loss caused by price growth and output decline and the surplus of monopoly due to these effects. By producing too little of the monopolized good and by selling it at too high a price (relative to marginal cost), the monopolist introduces allocative inefficiencies into the economy.

The activity of searching out a monopoly from which an economic profit can be made is called rent seeking. The term “rent seeking” is used because “rent” (or “economic rent”) is a general term that includes consumer surplus, and economic profit. The pursuit of an economic profit by a monopolist is rent seeking. It is the attempt to capture some consumer surplus.

1.4. *Monopsony* is a market structure where not sellers but buyers are the price makers. It can be thought of as monopoly theory applied to factor market rather than to product markets. Monopolists exploit their power by producing less of a commodity and charging higher price. Monopsonists exploit their power by buying less of an input and paying less per unit of it.

1.5. An increase in the number of firms can only reduce the monopoly power of each incumbent firm. An important aspect of competitive strategy is finding ways to create *barriers to entry* - conditions that deter entry by new competitors.

Sometimes there are natural barriers to entry. For example, one firm may have a *patent* on the technology needed to produce a particular product. This makes it impossible for other firms to enter the market, at least until the patent expires[5]. Other legally created rights work in the same way - a *copyright* can limit the sale of a book, music, or a computer software program to a single company, and the need for a government *license* can prevent new firms from entering the market for telephone service, television broadcasting, or interstate trucking.

Finally, *economics of scale* may make it too costly for more than a few firms to supply the entire market. In some cases the economies of scale may be so large that it is most efficient for a single firm - *a natural monopoly* - to supply the entire market.

In some oligopolistic markets, some or all of the firms earn substantial profits over the long run because *barriers to entry* make it difficult or impossible for new firms to enter the market. An incumbent firms may take *strategic actions* to deter entry. For example, they might threaten to flood the market and drive prices down if entry occurs, and to make that threat credible, they can construct excess production capacity.

[5] In the United States, patents last for 17 years.

2. Imperfect competition and market structures.

2.1. *Monopolistic competition* combines the elements of monopoly and perfect competition. Food stores, grocery shops, gas stations and many other retail establishments fall into this category.

The essence of monopolistic competition is that each firm sells a product for which there are many close, but not perfect substitutes. Thus, each firm faces a downward sloping firm-specific demand curve. Product differentiation may be inherent in the product - different brands of beer, for example - or it may arise because of differences in the special location.

Since entry is free, an important implication of the monopolistic competition is that whenever profits can be made, firms selling similar products will enter the industry. Entry shifts all firms' firm-specific demand curves toward the origin and continues until the each firm's profit is reduced to zero in the long run.

2.2. Several firms in the market form an *oligopoly*. Oligopoly is the type of market structure which is mostly common in industrial markets. Even the threat of potential entry into a monopolized market forces a monopolist to behave like an oligopolist. A new choice emerges: to collude and form a monopolistic organization or to compete. The essence of oligopoly is an interdependence of all firms serving the same market: each firm has to take into consideration possible reaction of competitors in its decision-making. With different degrees of competition oligopoly can lead to different outcomes, ranging from "pure" monopoly to perfect competition.

A *cartel* is an organization of independent firms formed to capture the benefits of acting like a monopolist. Cartels coordinate the actions of their members in order to restrict output, rise the prices and thus capture monopoly profits.

Cartels are subject to two types of pressures. First, when a cartel raises prices it raises each firm's marginal revenue above each firm's marginal cost. This gives each firm an incentive to cheat on the cartel by lowering price for its own product to increase sales and its own profit. Successful cartels must have effective mechanisms for detecting and punishing members who cheat. Cartel profits can also suffer when firms engage in nonprice competition (quality of services etc.) that raises costs and diminishes profits.

The second source of pressure arises because a successful cartel stimulates the entry of new firms by high industry profits. A cartel's long run success depends on its ability to limit entry. If it cannot, than entry takes place until the typical firm's long run profits converge to zero.

2.3. We will begin a simple model of *duopoly* - two firms competing with each other - first introduced by A.Cournot in 1838. Suppose the firms produce a homogeneous good and know the market demand curve. Each firm must decide how much to produce, and the two firms make their decisions at the same time. The essence of the Cournot model is that each firm treats the output level of its competitor as fixed, and then decides how much to produce.

Consider an industry consisting of n firms. Assume, that each firm is identical with cost function. If the industry is competitive, when each firm will produce Q_i units of output where $P=MC$ (i.e. price = marginal cost).

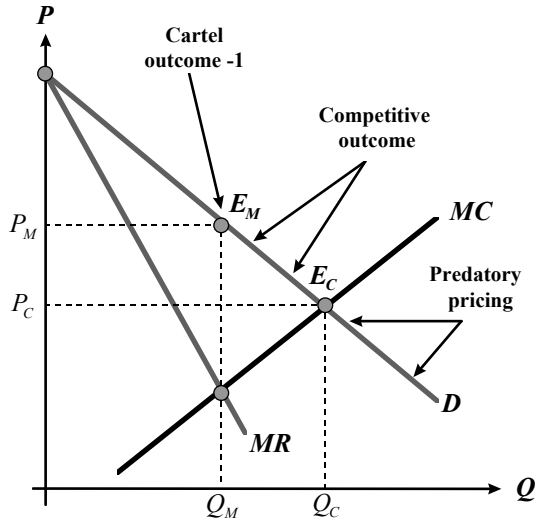

Fig.11.2

Notice the following important point: In the general model (n firms) as the number of firms gets large the outcome gets closer and closer to the competitive outcome. Thus the competitive model can be thought of as the limiting case of Cournot Competition as the number of firms in the industry gets very big.

Note also that n becomes small then the Cournot Outcome becomes nearer to the collusive outcome, where the firms act as a monopoly. Not surprisingly, when $n=1$, these are the same thus we may think of the Cournot Outcome as being between the monopoly and competitive outcomes with the outcome approaching competition for large n (Fig.11.2). Notice that the deadweight loss decreases as we increase n, which, suggests society might be better off with less concentrated industries.

Key Terms

monopoly
market power (or monopoly power)
price discrimination
monopsony
barriers to entry
natural monopoly
monopolistic competition
oligopoly
duopoly

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Lecture 12. **Market Power and Welfare. Antitrust policy. Natural monopoly regulation.**

1. Welfare losses of monopoly. Antitrust.
   1.1.Empirical estimates of monopoly welfare losses.
   1.2.Antitrust law: brief history.
   1.3.Protection of competition on oligopolistic markets.
   1.4.Measuring industry concentration. Herfindahl-Hirshmann index.
2. State regulation of monopolies.
   2.1.Concept of natural monopoly. Natural monopoly regulation.
   2.2.Pricing rules for natural monopoly. Marginal cost and average cost pricing rules. Price ceiling regulation.
   2.3.Negative effects of monopoly price regulation.

1. Welfare losses of monopoly. Antitrust.

As we have seen in the previous lecture, imperfect competition leads to an inefficient resource allocation. In the graph 12.1 below the possible surpluses and losses of producers, consumers and nation as a whole due to monopolistic market power are shown.

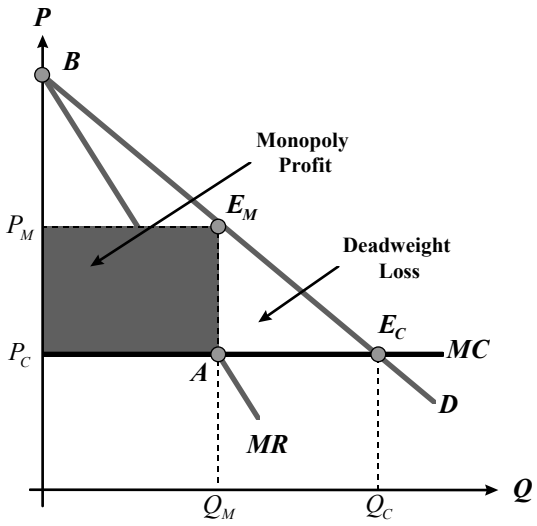

Fig. 12.1 Monopoly versus competitive equilibrium.

With linear demand function D and constant marginal cost MC ($MC=AC=C_0$) the monopoly reduces output Q_M by ΔQ compared with competitive level Q_C; the price P_M is higher than competitive price P_C by ΔP. Under the perfect competition the economic profit of firms is zero, and the consumer surplus is

$$\frac{Q_c(P_0 - P_c)}{2} \quad 26.$$

(Graphically the latter is BE_CP_C area). Under monopoly the consumer surplus is reduced to

$$\frac{Q_m(P_0 - P_m)}{2}$$

27(that is BP_CP_M area) but there arises the monopoly surplus $Q_M(P_M-P_C)$ (that is $P_CP_ME_MA$ area)..

Total consumer surplus is reallocated in favor of monopoly if monopoly succeeds in exercising full price discrimination (area P_ME_MB) which makes the consumers pay maximal (equal to utility) price for a unit of product.

The difference between consumer losses and monopoly surplus is

$$W = \frac{\Delta P \cdot \Delta Q}{2} \quad 28$$ (that is AE_ME_C area, $\Delta Q=Q_C-Q_M$, $\Delta P=P_M-P_C$).

Such loss is the *deadweight loss* of monopoly, or social cost of monopoly. *Social cost of monopoly* is a measure of the loss in net benefits that results from a monopoly's control of output.

Let relative monopolistic "markup" $d_P = \Delta P/P_C$ be small. As far as elasticity is $E_D = (\Delta Q/Q)/d_P$, we get $\Delta Q=E_D \cdot d_P \cdot Q_C$. Deadweight loss of monopoly is $W = (1/2) \cdot P_C Q_C E_D d_P^{\,2}$, i.e. it is proportional to square of relative deviation of monopolistic price from Q_C. The elasticity E_D can not be considered as constant and equal to actual elasticity of demand if d_P is not small.

1.1. The empirical estimation of losses caused by monopoly.

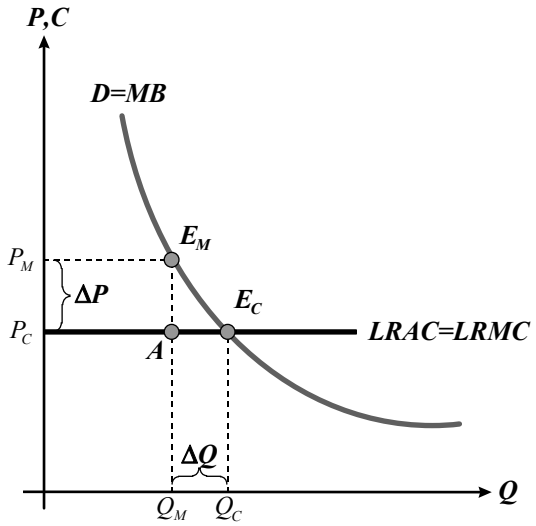

Fig.12.2 Empirical estimates of monopoly welfare loses.

Arnold Harberger was the first to attempt to estimate these losses in 1954. He assumed the unit elasticity of demand. Harberger has collected the data on deviations of industry profits from the average one to calculate d_P. As a result he calculated losses caused by monopoly for a group of industries which produce 45% of output in manufacturing sector of US economy (area AE_ME_C, fig.12.2)

Extrapolating the evaluation for aggregate industrial production in period 1924 - 1928 he estimated the welfare loss equal approximately to 6% of GNP. The same computation for 1988 gives the monopoly waste in US economy at the level of $4.8 bln. or not greater than $20 per capita.

1.2. Deadweight loss is not a sole form of *imperfect competition inefficiency*. Reduced pressure of competition leads to a less strong imposition of cost minimization. The monopoly power can be a sort of compensating mechanism for inefficiency in production. Such inefficiency, which is revealed by non-optimal scale, obsolete technology or suboptimal factor combinations, is called *X-inefficiency*. It might have different forms: too high expenditures on advertizing, excessive production capacities, inflated managerial staff and so on. It is important that such a waste is a result of reduced competition, and not merely a product of bad corporate management.

Many economists (among whom Austrian economist I.Schumpeter is the most prominent figure) have argued that monopoly is not a pure wasteful economic phenomenon. They pointed out to (1) low empirical estimation of deadweight losses; (2) at least ambivalence in influence of monopolization process on Research and Development.

The economic argument against monopoly - deadweight loss due to misallocation of resources - was not a direct cause of implementation of antitrust policies.

Antitrust policy is a set of laws designed to prevent firms from exercising market power by restricting output, increasing prices or engaging in other anticompetitive behavior. The main objective of such policies is to limit anticompetitive tendencies of oligopoly. Among antitrust devices *conduct remedy* is a government order to a firm or an industry to alter its behavior in order to make it more competitive. *Structural remedy* is an antitrust policy in which the structure of an industry is altered to make it more competitive. The breakup of biggest firm in the industry is an example of a structural remedy.

Antitrust statutes is the statutes that seek to prevent unfair business practices that give rise to monopoly power.

Competition (antitrust) Policy in Transition. So why do transition economics need competition policy (i.e. explicit prohibitory rules)? They need competition, certainly, but the abolition of central planning (and consequently the liberalization of prices and removal of quantitative output targets) already represents a major stride in that direction. Why do more?

The liberalization of prices and markets may not be sufficient to ensure competition. The very nature of transition may inhibit the development of competitive industry structures, because of high barriers to entry. There are several reasons to believe that new or small firms may face barriers *to* entry or growth:

1. Credit to new firms is heavily restricted, not only by generally tight financial conditions, but more specifically because existing large (and typically state-owned) firms receive priority access to available funds, be it through deliberate policy or due to banks' desires to shore up their existing portfolios.

2. In the fragmented markets of transition economies, many of the scarce assets needed by new firms if they are to mount a credible challenge to existing monopolists (such as land, premises or distribution networks) are either unavailable or continue to be allocated in distorted ways that favour existing firms.

3. Imperfect enforcement of hard budget constraints on enterprises means that competition from new entrants to an industry may be less likely to drive out existing monopolists than in a more mature market economy; and knowing this, new entrants are less likely to mount a challenge to existing monopoly power in the first place. [8]

1.3. *Oligopoly* is an important field of competitive policy. In the graph 11.2 (see lecture 11) below the possible combinations of prices and quantities on the oligopolistic market are shown. *Predatory pricing* along with cartel outcome are obvious targets for government intervention.

To screen the non-competitive markets many indices are used by the institutions which are responsible for implementation of competitive policies.

The most important antitrust class of per se illegal conduct is agreements among competing firms to fix prices, restrict output, or divide markets. Such actions have the effect of raising prices and lowering output. Even the several critics of antitrust policy can find no redeeming virtue in price fixing.

Other forms of conduct are also limited by antitrust laws. These include:

• *Retail price maintenance,* where retailers agree not to sell below or above, a price specified by manufacturers.

• *Predatory pricing,* in which a firm sells its goods for less than production costs (usually interpreted as marginal cost or average variable cost).

• *Tying contracts* or arrangements, whereby a firm will sell product A only if the purchaser buys product B.

• *Price discrimination,* in which a firm sells the same product to different customers at different prices for reasons not related to cost or meeting competition.

These practices relate to a firm's *conduct.* Whether committed by monopolies or small firms, it is the acts that are illegal; the market power of the firm in question is not at issue.

Companies can gain market power through growth (plowing back earnings and building new plants). But a much easier way to gain market share, or simply to get bigger, is to merge with another company. *Mergers* are matters of concern in antitrust policy when they result in increasing market shares for the merged firms.

Horizontal mergers—in which companies in the same industry combine—are forbidden under the Clayton Act when the merger is likely to reduce competition in the industry substantially.

Vertical mergers occur when two firms at different stages of the production process come together.

A third kind of combination, called *conglomerate mergers***,** joins together unrelated businesses. In a conglomerate merger, a chemical or steel company might buy an oil company, or a firm that has many lines of business (like ITT) might add yet more strings to its bow (hotels, rental cars, or whatever) .

Protection of competition on oligopolistic markets consist of mergers regulation as the mergers could result a limit of competition, and support of contestable. *Contestable market* is a market in which entry is free and exit is costless.

1.4. The concentration index (CR) is showing the share of biggest 4, 8 etc. firms in industry's sales.

Concentration ratio is the percentage of an industry's total output accounted for by the largest firms. A typical measure is the *four-firm concentration ratio,* which is the fraction of output accounted for by the four largest firms.

The market share of a firm is the percentage of annual shipments to a market accounted for by the firm.

Herfindahl-Hirshmann index *(HHI)* takes into account the concentration and relative power of firms composing a market. It has a form:

$$HHI = \sum_{i=1}^{N} s_i^2,$$

where s_i is the market share of i-th firm (in %). Maximum value of *HHI* is 10000 (100% monopoly). Antitrust institutions are following developments in branches where it is higher than 1400.

29

2. State regulation of monopolies.

2.1. Their scope is much broader - to maintain competitive environment in a broader sense. There are some branches of industry where monopolization is beneficial (so called *natural monopoly*) and where government has to regulate prices and quantities to achieve efficiency. Natural monopolies are characterized by large positive economies of scale. The examples are telecommunications and infrastructure.

Natural monopoly is a firm that can supply the entire market demand for a product at a lower average cost than would be possible if two or more firms supplied exactly the same quantity of the product.

The Cost advantage of natural monopoly (figure 12.3)*:* Increasing return to scale can result in lower AC of production as a firm expands. These lower costs can contribute to be establishment of monopoly power. For a natural monopoly, AC declines over the entire range of output for which the demand curve lies above the $LRAC$ curve. For example: the natural monopoly can produce Q_A at lower AC than can two smaller firms, each supplying $Q_A/2$.

2.2. The decline of Average total cost with the expansion of output by the *natural monopolist* means that one firm would always produce a quantity demanded by consumers at a lower cost than several firms. Usually the state creates and defends a monopoly for such a market. But doing this, it should exercise price control and thus assure that monopoly power is suppressed by appropriate competitive regulatory mechanism. There are the following approaches to price control (Figure 12.4). Government uses *the marginal cost scheme* by setting monopoly price equal marginal cost ***($P_C = MC$)*** and makes monopoly follow this regulatory rule. *The average cost scheme* is to transfer to government the total monopoly profit exceeding the normal one. (Price $P_1 = AC$).

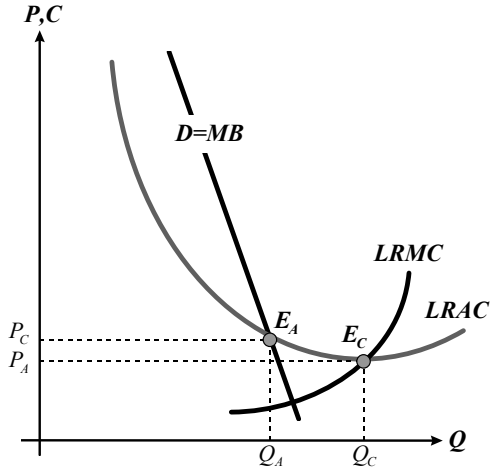

Fig.12.3 Natural monopoly.

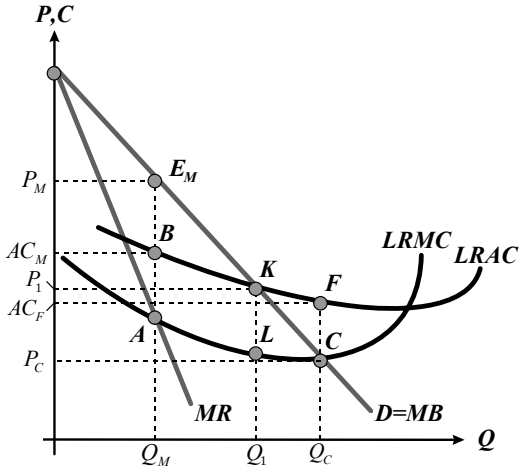

Fig. 12.4 Marginal cost (MC) and average cost (AC) pricing rules.

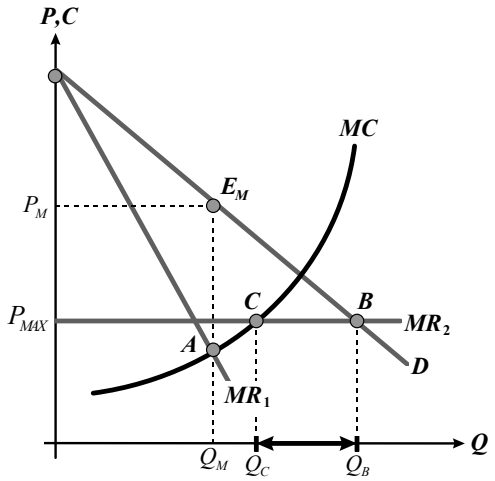

Fig. 12.5 Monopoly reaction to a price ceiling.

A shortage of (Q_D-Q_2) pounds per year exists at the ceiling price.

Besides there is a method of *price ceiling* (Fig.12.5). Price ceilings is a one way to regulate monopoly power; to be effective in reducing price, the ceiling must be below the price corresponding to the output at which $MR = MC$. A price ceiling can cause a monopoly to increase output. For example, the monopoly price is P_M monopoly quantity = Q_M. Imposition of a ceiling of P_{MAX} removes monopoly control of price. Marginal revenue is now MR_2 (the same as price) up to an output of Q_C. The monopoly equilibrium quantity increases from Q_M to Q_C.

2.3. Such regulation meets some difficulties: pricing scheme based on marginal cost leads to losses and the necessity of state subsidies for monopolist (subsidies $s = Q_F (AC_F - P_C)$; average cost pricing rule is at one hand suboptimal (marginal cost is lower that marginal utility: $MC < MB$, if $P=P_1$, $Q=Q_1$, so allocative inefficiency of monopoly is partly reproduced), on the other hand it destroys incentives for monopolist to minimize the costs, since all costs are compensated under such a rule.

Price ceiling usually causes shortages (= Q_B-Q_C, see Fig.12.5).

Part of the controversy centers on the complex question of accurately determining AC of production. Another complex question concerns the incentives established by regulatory price rule (the AC -pricing rule does not provide the utilities with any incentives to minimize their cost of production.

Key Terms

social cost of monopoly
antitrust policy
conduct remedy
structural remedy
antitrust statutes
predatory pricing
tying contracts
horizontal mergers
vertical mergers
conglomerate mergers

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Appendix

Treaty establishing the European Community

(signed in Rome on 25 March 1957)[6]*.*

CHAPTER 1. **RULES ON COMPETITION**

Section 1. **Rules applying to undertakings**

Article 85

1. The following shall be prohibited as incompatible with the common market: all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the common market, and in particular those which:

(a) directly or indirectly Fix purchase or selling prices or any other trading conditions,

(b) limit or control production, markets, technical development, or investment,

(c) share markets or sources of supply,

(d) apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;

(e) make the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts.

2. Any agreements or decisions prohibited pursuant to this Article shall be automatically void.

3. The provisions of paragraph I may, however, be declared inapplicable in the case of:

- any agreement or category of agreements between undertakings;
- any decision or category of decisions by associations of undertakings;
- any concerted practice or category of concerted practices:

which contributes to improving the production or distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit, and which does not:

(a) impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives;

(b) afford such undertakings the possibility of eliminating competition in respect of a substantial part of the products in question.

Article 86

Any abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it shall be prohibited as incompatible with the common market in so far as it may affect trade between Member States.

Such abuse may, in particular, consist in:

(a) directly or indirectly imposing unfair purchase or selling prices or other unfair trading conditions;

(b) limiting production, markets or technical development to the prejudice of consumers:

(c) applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage;

(d) making the conclusion of contracts subject to acceptance by the other parties of supplementary obligations which, by their nature or according to commercial usage, have no connection with the subject of such contracts.

Section 3. **Aids granted by States**

Article 92

1. Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.

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[6] *European Union. Selected instruments taken from the Treaties. Book1, Volume 1. - Brussels-Luxemberg, 1993, pp.193-199.*

2. The following shall be compatible with the common market:

(a) aid having a social character, granted to individual consumers, provided that such aid is granted without discrimination related to the origin of the products concerned,

(b) aid to make good the damage caused by natural disasters or exceptional occurrences,

(c) aid granted to the economy of certain areas of the Federal Republic of Germany affected by the division of Germany, in so far as such aid is required in order to compensate for the economic disadvantages caused by that division.

3. The following may be considered to be compatible with the common market:

(a) aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment;

(b) aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State,

(c) aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest. However, the aids granted to shipbuilding as of I January 1957 shall, in so far as they serve only to compensate for the absence of customs protection, be progressively reduced under the same conditions as apply to the elimination of customs duties, subject to the provisions of this Treaty concerning common commercial policy towards third countries,

(d) aid to promote culture and heritage conservation where such aid does not affect trading conditions and competition in the Community to an extent that is contrary to the common interest;

(e) such other categories of aid as may be specified by decision of the Council acting by a qualified majority on a proposal from the Commission.

Lecture 13. **Externalities in Market Economy and Government Regulations.**

1. Internal and external costs and benefits.
   1.1.Introduction: problem of pollution. Economics of greenhouse effect.
   1.2.Private and social costs and benefits.
   1.3.Positive and negative externalities. Marginal costs and benefits: internal, external and social.
2. Externalities and property rights. Missing markets.
   2.1.Responses to externalities: economic agents and private sector as a whole.
   2.2.Government and externalities: administrative regulation, corrective taxes and subsidies, creating markets of rights to pollute.

1. Internal and external costs and benefits.

1.1. Economies sometimes suffer market failures. For example, some firms pollute the air or dump toxic wastes into the soil. Firm A dumps a toxic chemical into a stream and fouls the stream for people who fish or swim downstream. Firm A has used the scarce, clean water without paying people whose water is fouled.

In addition to public goods, we often see public "bads," which are public goods that impose costs uniformly across a group. These are unintended by-products of consumption or production activities. One critical externality is the "*greenhouse effect*," which results from the buildup of carbon dioxide and other gases. Scientific studies indicate that in the coming decades these gases will cause the climate to become warmer, oceans to rise, and monsoons to shift. Nobody is producing carbon dioxide in order to change the climate. Rather, this externality results unintentionally from activities like the burning of fossil fuels.

In each case, market failure leads to inefficient production or consumption, and a firm has helped or hurt people outside the market transactions. There is an economic transaction without an economic payment. This type of inefficiency arises when there are spillovers or externalities.

Government can play a useful role in curing the disease. This is where governments come in. Government *regulations* are designed to control externalities like air and water pollution. For example, if it shown that CO_2 emissions warm the globe and cause extensive damages, nations might levy pollution taxes on CO_2 emissions as a method of slowing global warming. Some European countries have already imposed CO_2 taxes.

1.2. *Private (internal) cost* characterize internal inputs for producers of a given good. *External cost* describe inputs for the all third parties (i.e. nonsellers and nonbuyers of given good), associated with production and consumption of a given good. *Social (public) cost* characterize joint cost of producers and all third parties, associated with production and consumption of the good. Correspondingly marginal private cost (MPC), marginal external cost (MEC) and marginal social cost (MSC) are increments of private, external and social cost, associated with production and consumption of additional unit of the good.

Private (internal) benefit describe increase of welfare for direct consumers of given good. *External benefit* characterize increase of welfare for the all third parties, associated with production and consumption of the good. *Social (public) benefit* describe total increase of welfare for direct consumers and all third parties, associated with production and consumption of the good. Marginal private benefit (MPB), marginal external benefit (MEB) and marginal social benefit (MSB) are increments of private, external and social benefit, associated with production and consumption of additional unit of the good.

1.3. *Externalities* (external effects) denote the influence of the third parties' actions (of those who have not participated in transaction) on economic agents. An externality arises when the activity of one person or firm directly effects the welfare of another person or firm without the intervention of a market. The effect is external, "invisible" to any market. Therefore, externalities are not reflected in market mechanism operation and lead to its failure and suboptimal allocation of goods in the economy.

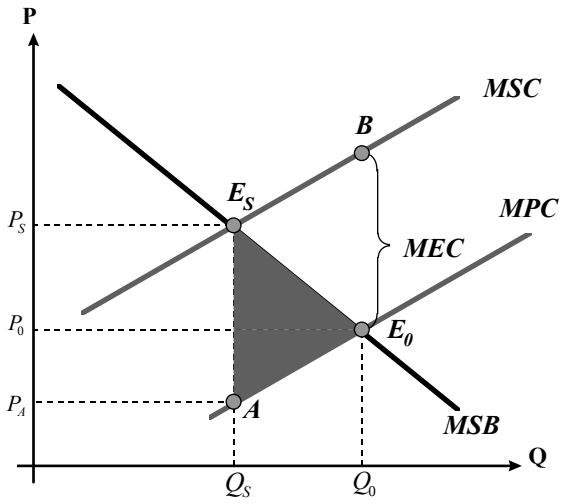

Fig. 13.1 A negative externality.

Negative externalities mean negative influence of actions taken by the third parties on economic agents. Actually it signify hidden use of some resources without corresponding payments. (One of the useful examples is the right to enjoy good environment - fresh air, clean water etc.) It appears external for cost of production MEC (in the figure 13.1 presence of external cost and absence of external benefit are supposed):

The result of negative externality is underestimation and overproduction of the product: Q_0 instead of Q_s and P_0 instead of P_s. It causes an overconsumption of resources in production of the good. It is important to emphasize that negative externalities arise out of agents' rational decisions.

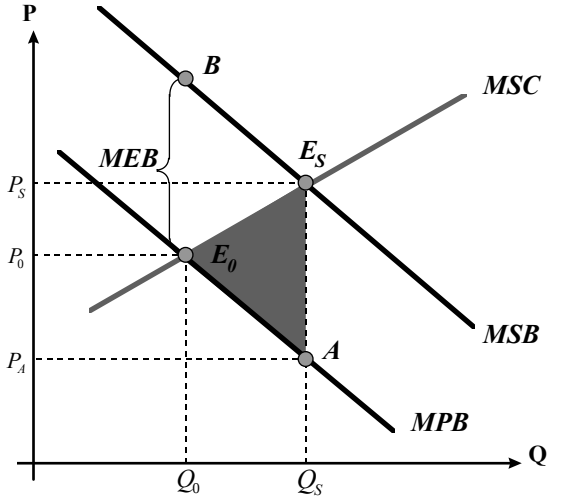

Fig. 13.2 A positive externality.

Positive externalities imply advantageous consequences of the third parties' actions for economic agents. Actually it signifies hidden use of some goods without corresponding payments. It causes the appearance of external benefit from production and consumption of the good (MEB).

The result of positive externality is underestimation and underproduction of the good: Q_0 instead of Q_s and P_0 instead of P_s. It causes an underconsumption of resources in production of the good. So both the positive and negative externalities lead to inefficient use of resources in production. Either negative externalities leading to good's overproduction or positive externalities leading to good's underproduction display market failures.

2. Externalities and property rights. Missing markets.

These market failures habitually are associated with specific markets missing. It leads to free using of specific resources and unpaid production of definite goods. And it leads for example to environment pollution by mineral fertilizers production. Actions related with external effects (for example sulfates production) mean in fact using the hidden rights to execute these actions. And it means the presence of property rights for according resource or product (in our example clean air). But if these property rights are yet undiscovered they can not be reflected in market transactions. Thus such property rights erosion may be an obstacle in market mechanism effective operation and frequently causes different groups of economic agents' conflict of interests. Therefore clear statement of property rights is one of important externalities problem solving prerequisites.

The essence of externalities problem is ineffective allocation and utilization of resources and products because of divergence of private and social cost or private and social benefit. So the method of solving such problems is to make marginal social cost equal to marginal social benefit. It is important to emphasize that such external effects become the own costs and benefits of explicit parties of transactions, and market mechanism operation changes prices and quantities of corresponding goods. It forces correctives in resources and products allocation which becomes effective. At the same time it means that corresponding external effects transform into internal effects. Thus the internalization of externalities occurs.

2.1. Private sector and externalities.

In private sector of economy the externalities problem may be solved in market mechanism operation without external interference. It may be for example *mergers*: in that case it means combining the involved parties, the source and the recipient of externality - for example, the creation of integrated firm, cooperative society etc. In this way the effects formerly external automatically became internal and according demanded quantities' and production technologies' corrective occurs.

The externalities problem is often being solved using *social conventions* - noneconomic ways of solving economic problems, such as moral, traditions, customs etc., being implemented through bringing up, public opinion (support of certain actions and blame for another) etc.

Property rights recognition and redistribution may result from *bargaining*. After the property rights for resources and products distribution their holders may use them for production and consumption or sell it to interested agents. In any case the goods formerly "invisible" for market mechanism receive monetary evaluation and involve into market operations leading to resources and products redistribution and to their effective allocation. The Coase theorem means: at zero transaction costs and clear property rights statement, regardless of property rights distribution among economic agents, private cost is equal to social cost. In other words, the effective resource allocation would be obtained regardless of property rights for these resources distribution, just if the transaction costs were insignificant. As a result of that bargaining all unconsidered resources get market evaluation, and the mostly benefited by them economic agents become (or stay) their owners.

It is important to note that although property rights distribution does not influence the optimal resource allocation, it is significant for economic agents' incomes. These two sides of property rights' significance for externalities problem solving and for economic agents' welfare should not be mixed.

Thus in private sector externalities exist only temporarily, in period for market mechanism to reveal and to eliminate the divergences between private and social costs and benefits.

2.2 *Government responses to externalities.*

Many externalities exist in economy for a long time. It means that transaction costs of property rights clearing and redistribution are significant and can not be ignored. If such costs exceed bargaining benefit, externalities wouldn't be removed. The same is the result of big number of agents involved in externalities problem difficulties in concrete sources of externalities determination, asymmetric information about costs and benefits of bargaining parties. When externalities are stable in the economy, the government should try to solve this problem. In this case the following forms of government intervention are possible.

Administrative regulation. Usually it is related to establishment of pollution standards, maximum rates of harmful influence etc. Such measures allow to reduce the size of externalities, but do not lead to an optimal resource allocation because of ignoring individual differences between involved economic agents.

Corrective taxes and subsidies. Corrective tax (Pigouvian tax) levies on each unit of a producer's output an amount just equal to the marginal external cost ($t=MEC$, figure 13.1).

Creating a markets of the rights to pollute. The important area of government activity is property rights creation in cases where they are missing. It enables to involve market mechanism into externalities problem solution.

Key Terms

greenhouse effect
private (internal) cost
social (public) cost
marginal private cost (MPC)
marginal external cost (MEC)
marginal social cost (MSC)
private (internal) benefit
social (public) benefit
marginal private benefit (MPB)
marginal external benefit (MEB)
marginal social benefit (MSB)
negative externalities
positive externalities
property rights
internalization of externalities
Coase theorem
corrective subsidies
corrective tax (Pigouvian tax)

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Lecture 14. **Welfare State. Microeconomic Foundations of Social Policy.**

1. Private and public goods.
   1.1.Examples of pure and mixed public good. Education - public goods?
   1.2.Free rider problem. Demand curve for public good. Market failure.
   1.3.Government and provision of public goods.
2. Incomes in market economy and redistrubution.
   2.1.Income distribution in market economies: review of data. Measuring inequality: Gini index.
   2.2.Inequality and welfare.
3. Role of the state, the market and the family.
   3.1.The concept of social safety net: State and society.
   3.2.State social assistance. Social insurance.
4. Coherence of different policies: overview.
   4.1.Redistribution of incomes: brief review of aims, instruments and results.
   4.2.The effect of social policy.
   4.3.Taxation: evaluating the social impact.
   4.4.The aim of labor market policies.
   4.5.Role of the State in education and health sectors.

1. Private and public goods.

1.1. Depending on the consumption specifics, the goods are divided into *private goods* and *public goods*. The consumption of private good by any economic agent makes impossible the consumption of it by any other agent. In other words, private goods have high *rivalry in consumption*. Unlike private goods public goods have low rivalry in consumption. It means that consumption of public good by some economic agent allows its consumption by other economic agents at the same time. The extreme, zero rivalry means that marginal cost of any additional consumer (except of the first) equal zero. For example, one more citizen does not increase national defense expenditures.

From the standpoint of property rights goods may be *excludable goods and nonexcludable. Pure private goods* have high excludability. It signifies that economic agent holding the right of using some good is capable to prohibit its consumption by other economic agent. *Pure public goods* have low excludability. Otherwise, such goods may and are in fact consumed collectively as far as nobody may (or has enough interest) to prevent their consumption by other economic agents.

There is extensive government intervention in education. This occurs to some extent because education is a public good. But education is not a pure public good, nor do externalities provide a persuasive justification for the role of the government. The major justification for public support of elementary and secondary education is the belief that the quality of education obtained should not be solely dependent on the resources of the child's parents.

1.2. *Free rider problem* appears when one economic agent may obtain the benefit from other agent actions not paying for it. No potential consumers would pay for this consumption. Hence, pure public good is just a kind of positive externality. Since no potential consumers would pay for good's consumption, the problem of its production's financing arises. After all the consumer who paid for this nonexcludable good has no privileges compared with not paid one. Thus the necessity in pure public goods puts before the economy up two problems: how to achieve effective quantity produced and how to provide this production with free riders existence.

The demand for public goods is not completely identical to the demand for private goods. First of all every consumer can not change the quantity of public good being used, and he/she is forced to consume the whole quantity. For example all citizens of the country use the same warships quantity defending them from outward attack.

Evidently these individual quantities are equal for all consumers: $Q_A=q_1=q_2=...=q_n$, where Q_A is the total quantity supplied of the public good, q_i is the quantity of the public good consumed by person i $(i = 1, 2, ..., n)$. Then all the consumers get certain benefit from the consumption of public good simultaneously.

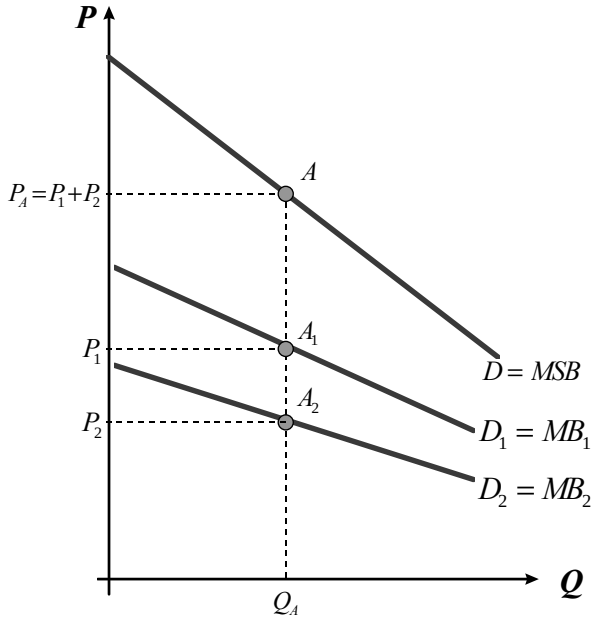


Fig. 14.1 The demand for a public Good (D).

Consequently, the marginal social benefit from the consumption of given additional amount of public good is the sum of all marginal private benefits from its consumption:

$$MSB = MB_1 + MB_2 + ... + MB_n = \Sigma MB_i,$$

where MSB is the marginal social benefit from consumption of public good, MB_i is the marginal benefit from consumption of public good for consumer i $(i = 1, 2, ..., n)$.

Thus the resulting *demand curve for public good* may be obtained as vertical (not horizontal) sum of individual demand curves expressing individual willingness to pay for given amount of public good according to individual benefit from this good's consumption. In the figure 14.1.the total demand curve D of the public good is obtained (in simplest case) as a result of vertical summation of two individual demand curves D_1 and D_2.

Hence the price P_A, which given community is ready to pay for given quantity Q_A, is assembled from individual prices P_1 and P_2: $P_A = P_1 + P_2$.

For effective allocation of resources the public good should be produced in the amount when marginal social benefit from its consumption is equal to marginal cost of its output:

$MSB = MSC$ (point E, fig.14.2).

So, there is some definite amount of public good ensuring maximum allocative efficiency. But determination of this amount relies on exact knowledge of public preferences about this public good.

There are some reasons why the market alone can not allocate the resources effectively.

Among them there are competition imperfection in cases when market power exist, externalities, public goods etc. All of them are sometimes named as *"market failures"*.

1.3. When market is failing, the government may improve the results of its operation. But at the same time there arise new problems.

Public choice theory proceeds from the supposition that when economic agents are engaged in politics, participating in preparation and fulfillment of the government resolutions in economic sphere, they use political institutions for their individual objectives achievement. This hypotheses about fundamental role of individual interest in political activity is analogous to assumption about rationality of different agents behavior in economic activity.

Political (public) decisions are passed by revealing the preferences of the citizens (members of the society). Usually in modern society it presupposes voting. Widespread decision adoption principle in voting is the *rule of majority voting*. But in this case it is possible to get the situation when the society can not determine the priority of its preferences. It happens when the preferences of each voter are transitive, but the preferences of the society as a whole are not.

Often public decisions passed by majority voting indicate the opinion of "*median voter*" whose preferences are disposed in the middle of the scale (Fig.14.2). For example, some public good output amount in this case would be close to its medium amount between maximum and minimum.

To illustrate political equilibrium under simple majority rule, assume that citizens must decide on the quantity of a pure public good to produce. Given the average cost *AC* of producing the good, a tax-sharing scheme is announced whereby each individual will pay the same tax per unit of the good. If the good can be produced under conditions of constant costs and there are *n* individuals in the community, each individual will pay a tax equal to AC/n per unit of the public good. Assuming five voters, Figure 5.2 shows the marginal benefit curves of the voters (MC_A, MC_B, MC_M, MC_C, MC_F), the marginal (and average) cost line for the public good *(MC=AC=500)*, and the tax share per unit of the public good of each of the voters (t_i = *AC/5 = 100).*

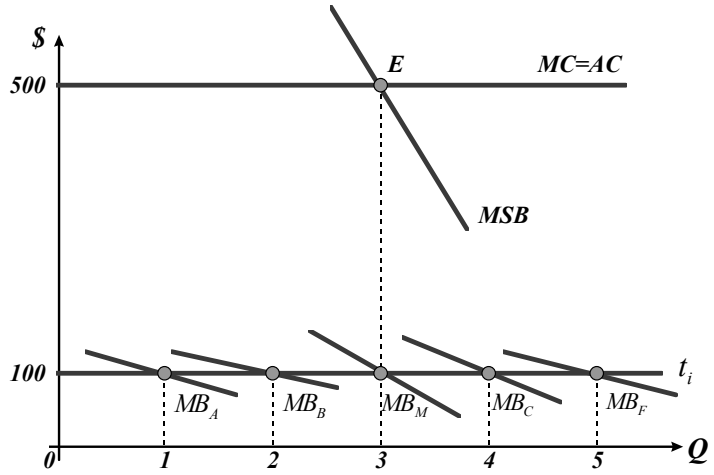


Fig. 14.2 Efficient public good provision.

In Figure 14.2, the voter with the marginal benefit curve MB_M is the median voter. *Political Equilibrium* is an agreement on the level of production of one or more public goods, given the specified rule for making the collective choice and the distribution of tax shares among individuals ($Q=3$).

If the interests of some agents coincide, they may unite in special group. Then *lobbyism* is the activity directed at the arrangement of public verdicts adoption in this group interests.

The consolidated group with special interests operating actively may obtain the public decisions favorable for minority (if their opponents are dissociated, and for each of them individual gain is less than corresponding costs).

The probability of public verdicts favorable only for minority adoption rises with consolidation of different groups with special interests at the basis of *logrolling*: every lobbying group using logrolling votes for favorable for another involved in logrolling group decision in exchange for similar assistance in beneficial for this group decision making.

Rent seeking is the activity directed at the achievement or/and protection of certain economic benefits by manipulating the political institutions. The goals of rent seeking usually are government subsidies, government restrictions of the competition, other benefits distributed by the government leading to resources redistribution in this rent seeking minority interests. The *dissipation of rental incomes* occurs when some (may be almost all) rents is spend in the process of supporting and keeping up necessary privileges. Together with appearance of rent seeking demand for privileges such privileges can be supplied by political agents making decisions.

Generalizing all the above we can state that government economic performance itself is not the guaranty of market failures overcoming and effective resource allocation. Government economic activity deficiencies may become themselves the sources of economic inefficiency. Thus in selection of private or government sector for some economic activity one should remember that each of them has its own pluses and minuses. So it is necessary to compare advantages and disadvantages of market and government mechanisms both.

2. Incomes in market economy and redistrubution.

The kind of social order constructed on the basis of a market economy was from its beginnings hostile to any political or social definition of distributive justice. Its basic premise is that a "fair" distribution of income is determined by the prodictive input of individuals to the economy - "productive" as determined by the marketplace. Specific talents, character traits, and just plain luck enter into the determination of such productivity. Such society holds that this market-based distribution of income creates best economic incentives that encourage production of goods and services. Production provides society's standard of living, which is not necessary shared equally by all. And, this system may shape society in ways not everyone likes. Historically, market-oriented societies have been reluctant to concede to any authority the right to overrule the determination of income distribution provided by the marketplace.

2.1. There are two main frameworks to look at the distribution of income: distribution by sources of income (factor shares) and size distribution of income. But whichever way we choose, it is always the case that all economy's income is ultimately received by households. This happens because households are the ultimate owners and suppliers of all resources (land, labor and capital) used to produce the economy's output.

Incomes of factors are determined on factor markets. What are the principles of market distribution among factor owners? As we know, firms are paying factor owners the value of marginal products received by firms while using those factors. The question is: could anything be left at the firm, not going to factor owners?

The income that remains after the firm has paid for all the factors of production is the *economic profit* of the owners of the firm. The Euler's theorem sets the rules for income allocation in perfectly competitive markets. Its application to economics states that if we assume that the production function has the property

of constant returns to scale and if firm's payments to owners of resources equal to marginal productivities of resources, economic profit must be zero. This surprising conclusion follows from the famous *Euler's theorem*, which states that if the production function $F(K,L)$ (where K is capital, L is labor) has constant returns to scale, the total amount (or value) of output can be split with respect to contributing parts of labor and capital inputs:

$$F(K,L) = (MP_K \cdot K) + (MP_L \cdot L).$$

These two parts correspond accordingly to capital and labor shares in income.

If economic profit is zero, how can we explain the existence of "profit" in the economy? The answer is that the usually used term "profit" is different from economic profit. In the real world most firms own rather than rent the capital they use. The term "profit" usually includes both economic profit and the return to capital. If we call this alternative definition *accounting profit*, we can say that

$$Accounting\ Profit = Economic\ Profit + (MP_K \cdot K).$$

The formula shows the share of main types of incomes - labor income, capital income (interest and profit) and land income (rent). Note that proprietors' income is a complex form - it contains labor income (small businessman labor inputs in their firms), own capital and own land income.

The relatively clear distinction among 'classes" of society according to their main income sources which existed in XIX century is now much more blurred. It is now common for any given individual to receive income from ownership of at least two, and possibly all three factors.

How we can measure size inequality of income? *Quintile and decile ratio* can be used for measuring differentiation. Quintile (decile) coefficient is the ratio of the wealth of 20% (10%) richest households to the wealth of 20% (10%) poorest households. Quintile (decile) ratio is a quite imperfect measure of differentiation, because it does not reflect the wealth distribution among the middle-wealth groups of households. The more precise is *Gini coefficient* of wealth inequality, which is calculated as a sum of absolute deviations of the actual distribution from uniform distribution. It is possible to set the bounds on inequality of wealth distribution and its dynamics using Gini coefficient (or its growth rate). For example, ascending (progressive) tax scale can be used in order to diminish inequality of wealth distribution.

The table 14.1-14.3, is reporting these indicators for different countries. For example, the Gini coefficient in Russia for these data is equal to 48.0% and for US - 40.1%.

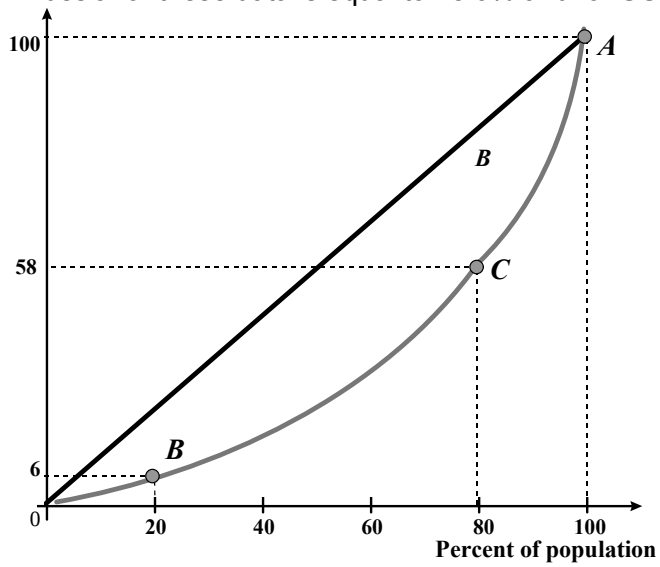


Fig. 14.3 The Lorenz curve ($OBCA$) (example for Ukraine, 1997).

Based on this information, we construct a *Lorenz curve* (fig. 14.3), which gives us a clear idea of how the Gini coefficient is measured

2.2. The inequality is not only important by itself, it is also important as a factor determining a more acute problem than just the concern about "fairness" - a *problem of poverty.* There are three approaches to measure poverty: absolute (fixing the poverty or minimum consumption basket line), relative (what proportion of population is living below 50% of average incomes) and subjective (how many people consider themselves as poor).

None is absolutely right, but what is important is the dynamics of poverty, structure of poverty and its persistence, not just its level.

Table 14.1. Distribution of income (or consumption)[7]

	Survey year	Gini Index	Percentage share of income (or consumption)						
			Lowest 10%	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%	Highest 10%
Australia	1989 c,d	33,7	2,5	7,0	12,2	16,6	23,3	40,9	24,8
Austria	1987 c,d	23,1	4,4	10,4	14,8	18,5	22,9	33,3	19,3
Belarus	1995 c,d	28,8	3,4	8,5	13,5	17,7	23,1	37,2	22,6
Belgium	1992 c,d	25,0	3,7	9,5	14,6	18,4	23,0	34,5	20,2
Brazil	1995 c,d	60,1	0,8	2,5	5,7	9,9	17,7	64,2	47,9

[7] 1999 The World Development Indicators, Bank

Bulgaria	1992 c,d	30,8	3,3	8,3	13,0	17,0	22,3	39,3	24,7
Canada	1994 c,d	31,5	2,8	7,5	12,9	17,2	23,0	39,3	23,8
China	1995 c,d	41,5	2,2	5,5	9,8	14,9	22,3	47,5	30,9
Colombia	1995 c,d	57,2	1,0	3,1	6,8	10,9	17,6	61,5	46,9
Czech Republic	1993 c,d	26,6	4,6	10,5	13,9	16,9	21,3	37,4	23,5
Denmark	1992 c,d	24,7	3,6	9,6	14,9	18,3	22,7	34,5	20,5
Dominican Republic	1989 c,d	50,5	1,6	4,2	7,9	12,5	19,7	55,7	39,6
Estonia	1995 c,d	35,4	2,2	6,2	12,0	17,0	23,1	41,8	26,2
Finland	1991 c,d	25,6	4,2	10,0	14,2	17.6	22,3	35,8	21,6
France	1989 c,d	32,7	2,5	7,2	12,7	17,1	22.8	40,1	24,9
Germany	1989 c,d	28,1	3,7	9,0	13,5	17,5	22,9	37,1	22,6
Hungary	1993 c,d	27,9	4,1	9,7	13,9	16,9	21,4	38,1	24,0
India	1994 a,b	29,7	4,1	9,2	13,0	16,8	21,7	39,3	25,0
Israel	1992 a,b	35,5	2,8	6,9	11,4	16,3	22,9	42,5	26,9
Italy	1991 c,d	31,2	2,9	7,6	12,9	17,3	23,2	38,9	23,7
Kazakhstan	1993 c,d	32,7	3,1	7,5	12,3	16,9	22,9	40,4	24,9
Kyrgyz Republic	1993 c,d	35,3	2,7	6,7	11,5	16,4	23,1	42,3	26,2
Latvia	1995 c,d	28,5	3,3	8,3	13,8	18,0	22,9	37,0	22,4
Lithuania	1993 c,d	33,6	3,4	8,1	12,3	16,2	21,3.	42,1	28,0
Luxembourg	1991 c,d	26,9	4,2	9,5	13,6	17,7	22,4	36,7	22,3
Mexico	1995 c,d	53,7	1,4	3,6	7,2	11,8	19,2	58,2	42,8
Moldova	1992 c,d	34,4	2,7	6,9	11,9	16,7	23,1	41,5	25,8
Mongolia	1995 a,b	33,2	2.9	7,3	12,2	16,6	23,0	40,9	24,5
Netherlands	1991 c,d	31,5	2,9	8,0	13,0	16,7	22,5	39,9	24,7
Norway	1991 c,d	25,2	4,1	10,0	14,3	17,9	22,4	35,3	21,2
Pakistan	1996 a,b	31,2	4,1	7,4	13,0	16,0	20,3	41,2	27,7
Panama	1995 c,d	57,1	0,7	2,3	6,2	11,3	19,8	60,4	43,8
Poland	1992a,b	27,2	4,0.	9,3	13,8	17,7	22,6	36,6	22,1
Romania	1994 c,d	28,2	3,7	8,9	13,6	17,6	22,6	37,3	22,7
Russian Federation	1996 a,b	48,0	1,4	4,2	8,8	13,6	20,7	52,8	37,4
Sierra Leone	1989 a,b	62,9	0,5	1,1	2,0	9,8	23,7	63,4	43,6
Slovak Republic	1992 c,d	19,5	5,1	11,9	15,8	18,8	22,2	31,4	18,2
Slovenia	1993 c,d	29,2	4,0	9,3	13,3	16,9	21,9	38,6	24,5
Spain	1990 c,d	32,5	2,8	7,5	12,6	17,0	22,6	40,3	25,2
Sweden	1992 c,d	25,0	3,7	9,6	14,5	18,1	23,2	34,5	20,1
Switzerland	1982 c,d	36,1	2,9	7,4	11,6	15,6	21,9	43,5	28,6
Turkmenistan	1993 c,d	35,8	2,7	6,7	11,4	16,3	22,8	42,8	26,9
Ukraine	1995 c,d	47,3	1,4	4,3	9,0	13,8	20,8	52,2	36,8
United Kingdom	1986 c,d	32,6	2,4	7,1	12,8	17,2	23,1	39,8	24,7
United States	1994 c,d	40,1	1,5	4,8	10,5	16,0	23,5	45,2	28,5
Vietnam	1993 a,b	35,7	3,5	7,8	11,4	15,4	21,4	44,0	29,0

a. Refers to expenditure shares by percentiles of population, b. Ranked by per capita expenditure, c. Refers to income shares by percentiles of population, d. Ranked by per capita income.

Table 14.2. Inequality indicators[8].

Country	***Year***	***Quintile ratio***	***Decile ratio***	***GNP ($ per capita 1997)***	***GNP PPP ($ per capita 1997)***
Moldova	1992	6.01	9.56	460	1450
Kazakhstan	1993	5.39	8.03	1350	3530

[8] Quintile ratio and decile ratio is calculated on the table 14.1.

Ukraine	1995	12.14	26.28	1040	2170
Belarus	1995	4.38	6.65	2150	4820
Russian F.	1995	12.57	26.71	2680	4280

Table 14.3. Russia and the Soviet Union; estimates of inequality, 1980-95.[9]

	Gini		***Decile ratio***	
	Russia	***USSR***	***Russia***	***USSR***
1980		0.24-0.29		3.25
1985		0.26-0.28		3.30
1988	0.26-0.28	0.29	3.32	3.53
1990	0.26-0.27		2.99	
1991	0.26-0.27		3.24-5.40	
1992	0.29		8.0	
1993	0.40		11.2	
1994	0.41		15.1	
1995	0.38		13.5	

Note: Quintile shares are calculated with total incomes for 1992; monetary incomes for later years. Source: Goskomstat.

Table 14.4. Poverty[10]

	National poverty line		**International poverty line**		
	Survey year	**Population below the poverty line %**	**Survey year**	**Population below $2 a day, %**	**Poverty gap at $2 a day, %**
Azerbaijan	*1995*	*68,1*		*..*	*..*
Belarus	*1995*	*22,5*	*1993*	*6,4*	*0,8*
Estonia	*1994*	*8,9*	*1993*	*32,5*	*10,0*
Kazakhstan	*1996*	*34,6*	*1993*	*12,1*	*2,5*
Kyrgyz Rep.	*1993*	*40,0*	*1993*	*55,3*	*21,4*
Lithuania		*..*	*1993*	*18,9*	*4,1*
Moldova		*..*	*1992*	*30,6*	*9,7*
Mongolia	*1995*	*36,3*		*..*	*..*
Poland	*1993*	*23,8*	*1993*	*15,1*	*7,7*
Russian F.	*1994*	*30,9*	*1993*	*10,9*	*2,3*
Slovak Rep.		*..*	*1992*	*85,1*	*27,5*
Turkmenistan		*..*	*1993*	*25,8*	*7,6*
Ukraine	*1995*	*31,7*		*..*	*..*
Vietnam	*1993*	*50,9*		*..*	*..*

The mostly used index is the *poverty headcount index* - the share of population receiving an income less than some poverty line. It is obvious that such an index is directly influenced by two factors: distribution of incomes and the level at which *poverty line* is drawn.

National poverty rate (see table 14.4) is the percentage of the population living below the poverty line deemed appropriate for the country by its authorities. National estimates are based on population-weighted subgroup estimates from household surveys.

Population below $2 a day are the percentages of the population living on less than $2 a day at 1985 international prices, adjusted for purchasing power parity.

Poverty gap is the mean shortfall below the poverty line (counting the nonpoor as having zero shortfall) expressed as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence.

3. Role of the state, the market and the family.

[9] *S. Commander, A. Tolstopiatenko, R. Yemtsov* Channels of redistribution. Inequality and poverty in the Russian transition. //*Economics of Transition Volume 7 (2) 1999, 411-447.*

[10] 1999 World Development Indicators, World Bank

3.1. Income inequality may be politically or ethically unacceptable. If a democratic society does not like the distribution of income it can steps to change it. Let's say that voters decide to reduce income inequality. What tools could government use?

First, it can engage in progressive taxation. Second, because low tax rates cannot help those who have no income at all, governments have built up a system of *transfer payments,* which are money payments to people.

Such transfers include aid for the elderly, blind, and for those with dependent children, as well as unemployment insurance for the jobless. This system of transfer payments provides a *safety net* to protect the unfortunate from privation.

Government could strive to combat poverty as the most acute problem in different ways - by activity supporting poor, creating adequate earning potential, investing in education and heath etc., or passively - through *transfers*, income support programs (social assistance). The aims of these policies could be achieved with maximum efficiency only when they are well targeted towards those who really need such assistance. Sometimes government assistance just crowds-out private transfers, coping with income support.

3.2. There are two major categories of explicit redistribution programs: public assistance programs, which provide benefits to those poor enough to qualify; and social insurance, which provides benefits to the retired, disabled, unemployed, and sick.

Public assistance program (like social insurance programs) take two forms. Some provide cash, while others provide payment only for specific services or commodities. The latter are referred as *in-kind benefits.*

Social insurance differs from public assistance I that an individual's entitlements are partly dependent on his contributions, which can be viewed as insurance premiums. To the extent that what the individual receives is commensurate with his contributions, social insurance can be viewed as a government "production activity" not a redistribution activity. But since what some receive is far in excess of what they contribute, there is a large element of redistribution involved in government social insurance programs.

The market failures that give rise to the government provision of social insurance include the failure to provide insurance for many of the most important risks facing individuals, the high transaction costs associated with the private provision of insurance, the failure to provide insurance against social risks, and the problem of adverse selection when markets cannot differentiate among individuals with different risk.

The social security retirement program serves three functions: it is a forced savings program, an insurance program, and a transfer program. The social security program has an effect on labor supply (through its effect on early retirements) and on capital formation (through its effect on savings). There is dispute about the significance of these effects.

Changes in birth rates and life expectancy, in labor force participation among the aged, and in the rate of growth of productivity all contributed to recent financial crises facing the social security system in the some countries.

The government affects the distribution of income also through the hidden redistribution programs - the indirect effects of the tax system and other government program (subsidy programs and quotas). Spending for goods and services also has its redistributive consequences; subsidies to urban bus transport may help the poor.

4. Coherence of different policies: overview.

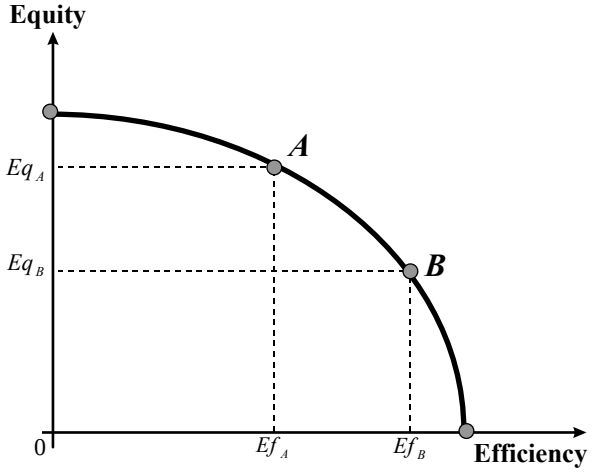


Fig. 14.4 The equity-efficiency trade-off.

The evaluation of a public policy often entails balancing its consequences for economic efficiency and the distribution of income (equity). The *trade-off between equity and efficiency* is at the heart of many discussions of public policy. The trade-off is often represented as in Figure 14.4. To get more equity, some amount of efficiency must be sacrificed.

Two questions are debated. First, there is disagreement about the nature of the trade-off. To reduce inequality, how much efficiency do we have to give up? Second, there are disagreements on the relative value to be assigned to a decrease in inequality, compared to decrease in efficiency.

Some people claim that the inequality is the central problem of society, and the society should simply minimize the extent of inequality, regardless of the efficiency consequences. Others claim that efficiency is the central issue.

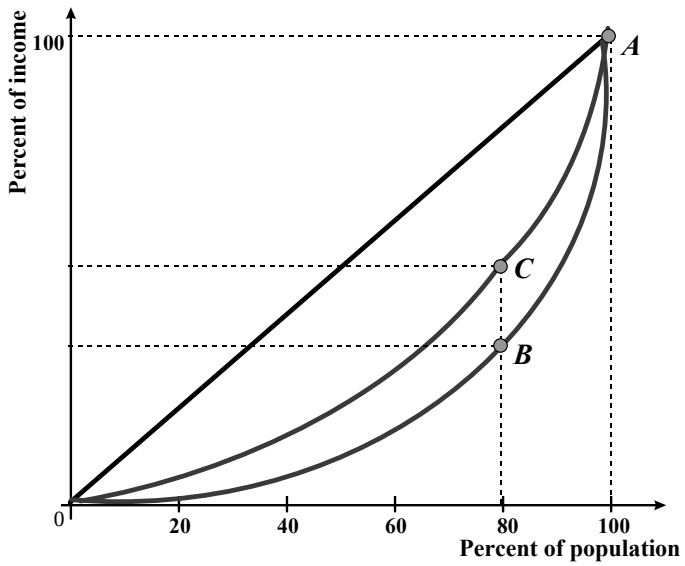
4.1. Redistribution of income creates an equity-efficiency tradeoff, summarized in Okun's leaky bucket analogy. The main leaks are administrative costs and the adverse incentive effects of higher taxes and welfare programs themselves.

The equity-efficiency trade-off is inherent in the provision of welfare and transfer programs. Benefits must fall sharply with increased income, or significant payments must be made to those who are not poor. If benefits fall sharply, as they do in the current system, the poor may face higher marginal tax rates than do the rich.

Public assistance provides cash and in-kind benefits to the poor.

The in-kind redistributive programs have several disadvantages: (a) They are administratively costly, (b) In some cases, they have only an income effect (i.e., they have the same effect as a transfer of cash); in other cases, they have a substitution effect, and in those cases, the government could make the poor better off at less cost through a cash subsidy, (c) The effect of many eligibility standards is to discourage work and, when compounded with payroll and state income taxes, can result in very high marginal tax rates, (d) The structure of eligibility standards provides unintended results; for instance, the food stamp program subsidizes the consumption of housing, (e) They are paternalistic.

Categorical (cash) programs have similar disadvantages: (a) They are administratively costly, (b) They are viewed by some as inequitable, since individuals with the same income may be treated differently, (c) They are sometimes distortionary, as individuals attempt to qualify for subsidies. However, when groups differ in their labor-supply responses (or other responses) to government programs, the government may be able to obtain a higher degree of redistribution, for the same loss of inefficiency, by providing categorical aid.



4.2. The social welfare programs all have real disincentive effects on work and on saving. Social Security, because it is on a pay-as-you-go basis, reduces total saving in the economy; its retirement provisions encourage retirement at particular ages. Welfare programs encourage parents to stay single, may break up families or prevent their forming, and may produce a culture of poverty in which people grow up learning to rely on welfare.

The transfer programs of the past two decades in the many countries have reduced the number of individuals in poverty, and they have had some effect in reducing measures of overall inequality

Fig. 14.5 The Lorenz curve before taxes (OBA) and after taxes (OCA).

(fig.14.5). At the same time, however, there has been an increase in the extent of before-tax/before-transfer inequality.

4.3. Principles of vertical and horizontal equity are used in designing and evaluating tax systems.

Horizontal equity says that equals should be treated equally. *Vertical equity* says that unequals should he treated unequally. One view about how unequals should be treated is that people should pay taxes according to their ability to pay. This suggests that the wealthier should pay more. If they pay proportionately more than do the poor, i.e. pay a higher proportion of their income or wealth, the tax system is progressive: it is regressive if they pay proportionately less.

Taxes on the scale levied in modern economies inevitably create distortions in the allocation of resources. The taxes open up a *wedge* between buyers' and sellers' valuations of goods and factor supplies. For instance, when wages are taxed, the value of the marginal product of labor is higher than the take-home wage of the worker and therefore higher than tier valuation of leisure.

The *tax wedge* between buyers' and sellers' valuations leads the economy away from an undistorted equilibrium and affects the allocation of resources. Taxation creates deadweight losses in that the cost of taxation to the economy is greater than the amount of revenue raised by the government. The amount of the deadweight loss increases with the elasticities of supply and demand in the market where the tax is imposed. If either supply or demand is perfectly inelastic, there is no net loss. The total waste of taxation is minimized by taxing relatively heavily those goods whose demand or supply is relatively inelastic.

A perennial issue in designing a tax system is whether to tax income or consumption. A consumption tax does not tax saving and therefore tends to encourage it.

4.4. Virtually all government income maintenance programs - from welfare payments to unemployment compensation - have work-incentive effects, and the direction and size of these effects are often critical issues in constructing and enacting such programs. It is important to understand how income maintenance programs can affect willingness to work.

Unemployment insurance, workers' compensation, and disability insurance might be called income replacement programs. All three programs are intended to compensate workers for earnings lost owing to their inability to work.

Income maintenance programs, more popularly known as "welfare" or "relief" programs, have the goal *of raising* the income of the poor to some minimum acceptable level. They thus differ from income replacement programs, which are aimed at *restoring* lost income. Because poverty is generally an income-related concept, the benefits paid out under income maintenance programs generally are affected by the level of the beneficiary's actual income.

But income-conditioned benefits inevitably reduce work incentives below what such incentives would be with no income support system for the poor. They simultaneously increase income while reducing the price of leisure (the wage rate), both of which should cause the demand for leisure to increase and the supply of labor to fall. This fact is the root of much of the controversy welfare programs have generated over the years.

4.5. Education is not a pure public good, nor do externalities provide a persuasive justification for the role of the government. The major justification for public support of elementary and secondary education is the belief that the quality of education obtained should not be solely dependent on the resources of the child's parents. Imperfections of capital markets provide the main justification for public support for higher education.

There may be important trade-offs between equity and efficiency in the provision of education. Attempts to provide compensatory education, in which the government attempts to offset the disadvantages that children from a poor background face, may reduce net national output. So long as parents have the option of sending children to private schools, there is only a limited degree of equality that can be obtained through the public school systems.

Though education is not the only determinant of an individual's future wages, there is a systematic correlation between the level of education and wages; there is, however, controversy concerning the explanation of this correlation. Some claim that it is primarily due to the increased skills that children obtain at school (the human capital view), while others claim that it is due to the schools' identifying the very able and differentiating them from the less able (the screening view).

The government has long played an active role in higher education, though its dominance is not as great as at the elementary- and secondary-school levels. Some believe that government aid to higher education is regressive in its effects, since those who benefit from college are likely to have higher

incomes. They believe that direct subsidies should be replaced by loan programs.

The health care industry is characterized by several market failures:

a) Uninformed consumers;
b) Limited competition;
c) Externalities, associated with contagious diseases; and
d) Non-profit-maximizing behavior.

Those who believe that the medical market is competitive believe that if individuals have to bear a larger fraction of the costs, and if hospitals are reimbursed in a way that provides them with an incentive to be efficient and to reduce costs, costs will be reduced.

Some of those who believe that the market is not competitive believe that costs should be controlled by regulation. Most economists, however, are skeptical about the likely success of regulation in a market as complex as that for medicine. Many believe that a change in the methods by which medicine is delivered - in particular, the more extensive use of health maintenance organizations - is the most hopeful way of reducing medical costs.

National expenditures on medical services, the prices of medical services, and public expenditures on medicine have all risen rapidly in recent years. Many economists believe that the rapid increase in medical costs arises from the extensive growth of private insurance plus government programs that cover medical expenses.

Key Terms

private goods
public goods
rivalry in consumption
excludable goods
nonexcludable goods
pure private goods
pure public goods
free ringer problem
demand curve for public goods
"market failures"
median voter
rule of majority voting
political equilibrium
lobbyism
group with special interests
logrolling
rent seeking
dissipation of rental incomes
quintile ratio
decile ratio
Gini coefficient
Lorenz curve
problem of poverty
poverty line
poverty gap
poverty headcount index
transfer payments
safety net
in-kind benefits
trade-off between equity and efficiency
horizontal equity
vertical equity
tax wedge

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Appendix.

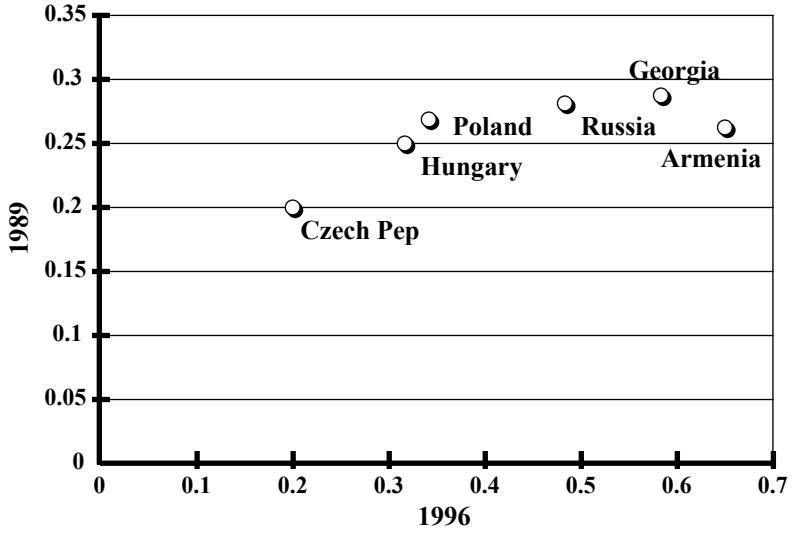
Initial conditions and channels for inequality[11]

The erstwhile planned economies had a common objective in limiting the extent *of* inequality. With assets concentrated in the hands of the state, with earnings dispersion in the dominant state sector explicitly restricted and with tax and transfer policies designed to limit incentives and income differentials, the overall outcome was a level of inequality that was generally significantly lower than in OECD countries. Particularly notable was the way in which the planned economics combined relatively high levels of human capital investment with extremely low returns to skills. Indeed, preferences under the planned system imposed, if anything, a perverse set of returns to skills.

Given these starting points, it could be expected that transition would be associated with more inequality, not least through greater earnings dispersion as a result of institutional changes, greater diversity in income sources and larger regional variation. Without repression of inequality through public policy, inequality might have been expected to jump toward levels observed in countries at roughly equivalent levels of national income. This would, for example, be consistent with the original Kuznets hypothesis.

And, indeed, since the start of transition, matters have changed. Some sense of how inequality has increased can be gained from Figure 1 which reports the change in the Gini coefficient for *per capita* income since 1989 across *&* number (.if countries from both East and Central Europe (ECE) as well as the Former Soviet Union (FSU). While there is evidence of significant differences in inequality ex *ante* and an unambiguous increase in inequality across all the reported countries, the size of the increase varies substantially and is notably larger in the countries of the FSLJ[12].

Figure 1. Inequality in transition: Change in Gini; 1989-96



The principal drivers behind this shift in inequality have included;

• explicit asset redistributions, primarily through privatization, leading to greater wealth inequality;

• liberalization of prices and, in some contexts, redistributions engineered through inflation tax and macroeconomics instability;

• liberalization of wage-setting, tolerance of unemployment and changes in labor market institutions;

• shifts in the level and structure of public spending, including on transfers, education and health;

• tax reforms - generally involving a decline in tax rates - aimed at raising incentives for both firms and individuals; and

• trade liberalization, in turn exposing technological obsolescence and associated loss of skills among workers.

Most of these policy measures associated with transition reveal an underlying preference for greater

[11] P. Aghion, S. Commander On the dynamics of inequality in the transition *//Economics of Transition Volume 7 (2) 1999, 275-298.*

[12] Note, however, the problems in measuring income inequality in a context of high informal sector participation and de-monetization. An alternative measure could be inequality in consumption. For Georgia, Yemtsov (1998) also finds the Gini for consumption on a rising trend but at a significantly lower level (0.36) than for income.

inequality. In the case of privatization, this has been justified by emphasizing capital market imperfections and hence the need to concentrate wealth in order to finance projects. Given the scale of desired restructuring, these financing costs have been assumed to be significant. The remaining measures have largely been justified on incentive grounds, whether in terms of returns to skills or taxation. In Section 3 below, we stylize a number of these major policy initiatives in the framework of a general equilibrium model and show, among other results, the likely effects of different speeds of privatization. However, as we argue in Section 4, an important source of increased inequality is likely to come through changes in the share of public spending allocated to education and, more generally, through similar factors to those that have driven the rise in wage inequality in OECD countries over the past decade.

The degree and speed of implementation of the above mentioned reforms has, of course, varied widely across countries. Further, disentangling the relative size of these effects remains empirically very difficult, if not impossible. For instance, trade opening for an economy endowed with high skills and low wages could, in principle, have positive implications for growth, although inappropriate configurations of output and financing constraints - factors certainly present in most transition economies - might be expected to offset any such positive effect. Moreover, quite what the size of these effects on inequality will be will also critically depend on public policy. In Russia and other countries of the FSU, public transfers have actually declined in progressivity since the start of transition, with both taxation and transfers combined exerting a weak counteractive effect on other sources of inequality increase. By contrast, in the core states of ECE, transfers and taxes have largely offset increased inequality in original income.