Unit 10. Introduction to welfare economics

Learning objectives:

➢ to examine the conditions for economic efficiency;

➢ to apply Lorenz curve and Gini coefficient as key measures of income distribution;

➢ to apply the marginal social benefit and marginal social cost principle;

➢ to examine the ways in which externalities, public goods and monopolies create market failures;

➢ to understand the arguments for and against government intervention in an otherwise competitive market;

➢ to study the effectiveness of government policies such as subsidies, taxes, quantity controls, transfer programs and public provision of goods and services;

➢ to examine government's attempt to restrain market power of monopolies by using antitrust policy and regulations.

Questions for revision:

✓ Equilibrium of a competitive market;

✓ Pareto-efficiency;

✓ Pfoduction possibilities frontier;

✓ Government regulation of a competitive market.

10.1. Perfect competition and Pareto efficiency. Equity and efficiency. Income distribution. Distortions and the second best

The model of general competitive equilibrium puts together several concepts discussed throughout the course. The model is based on the following assumptions:

✓ consumers are owners of resources and firms;

✓ each consumer maximizes his/her utility subject to budget constraint;

✓ each producer maximizes profit;

✓ demand is equal to supply (stocks) at each market.

Let's consider first general equilibrium in exchange. Suppose that an economy consists of two consumers who posses initial endownments of two goods and exchange them to maximize individual utility. Edgeworth

box is a useful tool to analyse welfare aspects of general equilibrium. It combines two graphs, each of them illustrates a consumer's choice.

Personal welfare in economic system
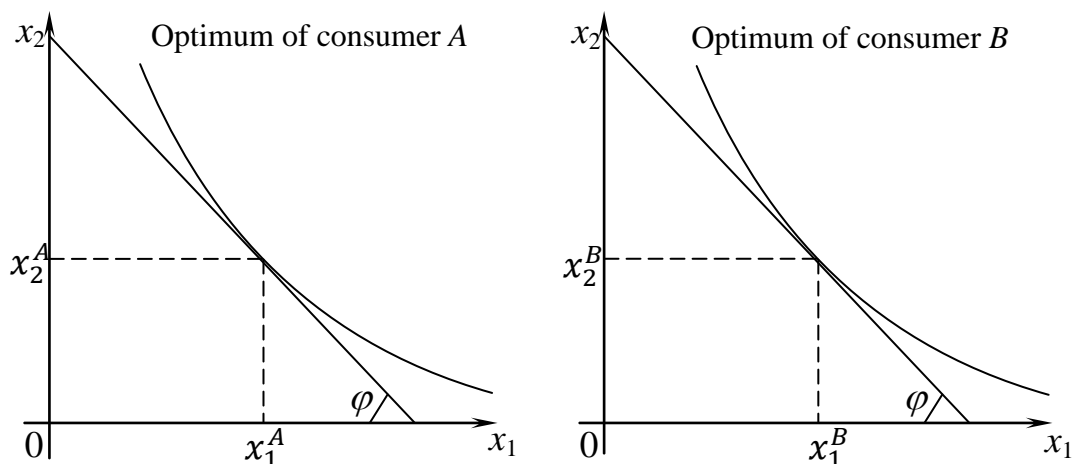
In the Edgeworth box origin for consumer A is situated in the lower left corner and origin for consumer B is put into the upper right corner. Each side of the box is equal to the total stock of the good which the two consumers have at their disposal.

Edgeworth box
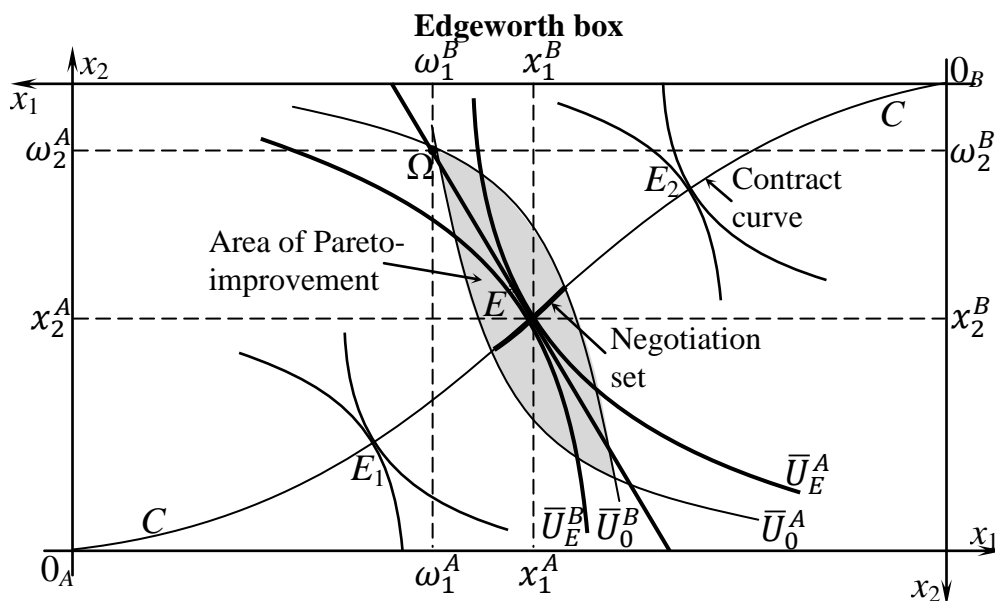
Pareto efficiency is one of the main concepts in welfare economics. A situation is Pareto-efficient, if it is impossible to make any economic agent better off without making worse off anybody else.

If consumers' bundles (x_1^A, x_2^A), $(x_1^B, x_2^B) = (\omega_1 - x_1^A, \omega_2 - x_2^A)$ are Pareto-efficient, indifference curves of the two consumers are tangent in this point of the Edgeworth box. It means that marginal rates of substitution for the two consumers are equal. Under general economic equilibrium the budget constraint of each of the consumers is the common

tangency line for their indifference curves. Its slope equals price ratio $\left(tg\varphi = \frac{p_1}{p_2}\right)$. So the conditions of general competitive equilibrium are:

$$\frac{MU_1^A}{MU_2^A} = \frac{p_1}{p_2} = \frac{MU_1^B}{MU_2^B}.$$

Thus, the Pareto-efficient bundles (x_1^A, x_2^A), (x_1^B, x_2^B), that are situated on the contract curve, satisfy the equation:

$$MRS_{12}^A = MRS_{12}^B.$$

Pareto-efficiency means impossibility of Pareto-improvement. Let's prove that competitive equilibrium means Pareto-efficient allocation of goods.

In the situation of general competitive equilibrium each consumer maximizing utility spends her total budget. Improvement in individual welfare is possible only by increasing personal endowments. Stocks are equal to demand for every good, that is a rise in personal endowments is possible only due to reallocation of resources. Consequently, to improve a person's welfare means to reduce welfare of someone else. Pareto-improvement is impossible. General competitive equilibrium is Pareto-efficient.

The same considerations as we used discussing general economic equilibrium in exchange (consumption) can be applied to productive economic system. Suppose that an economic system consists of two competitive producers (firms), each of them produces single good which is different from output of the other one. The firms posses initial stocks of factors of production and exchange them to maximize profits (or output).

We are going to use Edgeworth box to analyse general economic equilibrium in production (see the figure below). A side of the Edgeworth box is equal to total stock of the factor of production in economy as a whole. If there is Pareto-efficiency in production, isoquants of the two producers are tangent. All these tangency points constitute the production contract curve. Each tangency point of the isoquants of the two firms on the production contract curve corresponds to a combination of outputs of the two goods provided full utilization of scarce resources in the economy. We can put these combinations on a special graph where output of the first good is ploted along the horizontal axis and output of the second good –

along the vertical axis; and thus get the production possibilities frontier of the economy (recall unit 1 "Basic economic concepts").

General competitive equilibrium and production possibility frontier

Edgeworth box   Production possibility frontier
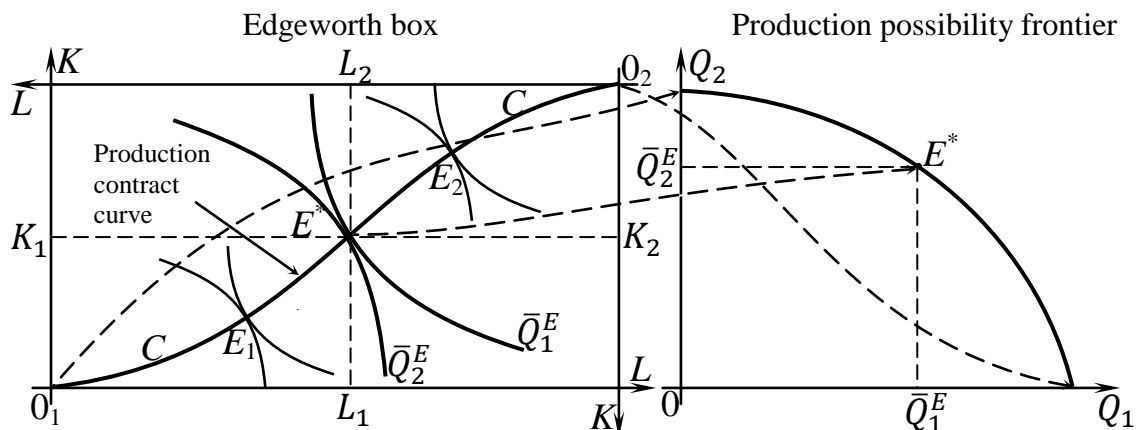
Variuos points on a contract curve correspond to different allocations of initial endowments of goods between the economic agents and to different final distributions of incomes.

Gini coefficient is one of the key measures of income distribution in a society. Lorenz curve can be used to illustrate it. Lorenz curve shows the correspondence between the cumulative population share and the share of total incomes earned by these people (see the figure below). In case of perfect equity in the society Lorenz curve becomes a straight line. In general Lorenz curve is convex, and its convexity reflects inequality of income distribution in the society.

Lorenz curve
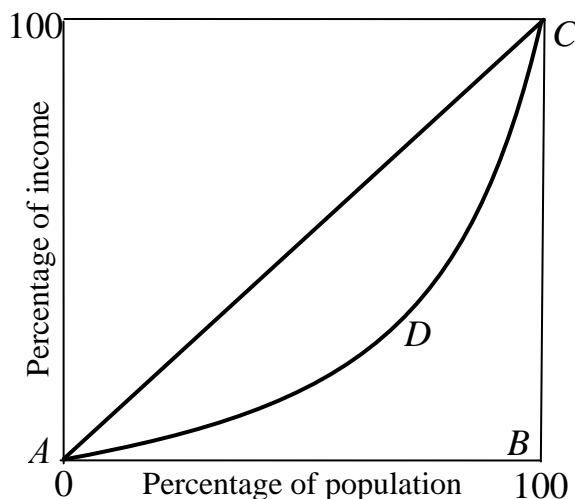
Gini coefficient (*G*) is calculated as the ratio of the area above the Lorenz curve bounded from above by the diagonal *AC* of the square *AECB*, i.e. the line of perfect equity, to the triangle *ACB*:

$$G = \frac{S_{ADC}}{S_{ABC}}.$$

4

In case of perfect equity Gini coefficient is zero, and in case of absolute inequality $G = 1$.

The actual income distribution is a subject of social choice. The theory of social choice studies different methods of decision making in a society. For instance, there exist criteria of social efficiency that can be considered as alternative to Pareto-efficiency which claims that social welfare cannot be improved by sacrifice of an individual's welfare. This is, for example, Kaldor-Hicks compensation principle. It says that social welfare will be improved if those who gain can compensate losses for those who are hurt.

Condorcet voting paradox served as an origin to social choice theory. The table below shows the essence of this paradox. The schedule gives individual preference orderings of three alternatives (α, β, γ).

Condorcet voting paradox

Person	Structure of preferences		
A	α	β	γ
B	β	γ	α
C	γ	α	β

The two persons prefer α for β. The two persons prefer β for γ. According to majority voting rule with pair comparisons, α should be preferred for γ. But in fact, vice versa, majority prefers γ for α. This is Condorcet voting paradox. It shows that majority rule cannot serve as an appropriate voting mechachanism if there are three alternatives which are a subject of social choice.

According to K. Arrow, the proper social choice mechanism should:

➤ Satisfy two rationality axioms (completeness and transitivity) for any three opportunities
➤ Be appropriate with Pareto principle
➤ Be independent of a third opportunity
➤ Not be imposed
➤ Not be dictatorial

Arrow possibility theorem says that majority rule is an appropriate social choice mechanism in the case of two alternatives. This is a mental basis of British and American two-party political system.

Arrow impossibility (of democracy) theorem says that in the case of more than two alternatives every social choice mechanism that satisfies rationality, Pareto principle and independency conditions is either imposed or dictatorial.

Externalities, public goods, monopolies and taxation at least at a single market distort Pareto efficiency of economic system as a whole.

These phenomena distort:
- ✓ Price structure;
- ✓ Structure of output as compared with competitive equilibrium;
- ✓ Allocation of resources because factors displaced from the given industry will be employed at other industries.

Consequently, in case when distortions cannot be eliminated at the given market it should be better to give up with efficiency at other markets in order to improve situation in economy as a whole. This is the essence of the theory of second best.

10.2. Market failures: externalities

There are several reasons for the price adjustment mechanism to fail:
- Several firms can use market power to influence prices,
- Externalities: production or consumption decision of an economic agent affects others bypassing market prices,
- Public goods.

In the prevous units we have discussed various market structures of imperfect competition, when firms posses market power. We are going to consider now another sourse of market failures – externalities.

A negative externality results when the activity of one person or a business imposes a cost on someone else. Positive externalities occur when the activities of a person or a firm result in benefits, the value of which the producer is unable to internalize or enjoy.

Externalities can emerge in production or consumption. Technological externality is the influence of production of an economic agent on production (or ulility) of other economic agents. Consumers' externality the influence of consumption of an individual on utility (or production) of other economic agents.

The consequence of externalities is that private and social equilibrium diverge. Assume that a good is produced in a perfectly competitive industry and that this product yields costs to individuals who are neither consumers nor producers of the good.

Private output and price in the industry will be Q_p and p_p correspondingly (see the figure below). The socially optimum level of output and price will be Q_s and p_s.

The government can use taxation to achieve the socially optimum level of output. A per-unit tax should be equal to marginal external cost (*MEC=MSC–MPC*) at the socially optimal level of output. This is the so called Pigouvian tax.

This fiscal policy of the government can improve social welfare at the market.

Social welfare without tax is the sum of consumers' surplus ($S_{AP_pE_p}$); producers' surplus ($S_{FP_pE_p} = S_{0P_pE_pQ_p} - S_{0FE_pQ_p}$, where $S_{0P_pE_pQ_p}$ and $S_{0FE_pQ_p}$ – are total revenue and total private cost) reduced by external cost (S_{FKGE_p}):

$$SW_0 = S_{KAE_s} - S_{GE_sE_p}.$$

When the Pigouvian tax is imposed on producers consumers' surplus is reduced up to $S_{AP_sE_s}$. $S_{0P_sE_sQ_s}$ is total revenue of producers, but $S_{BP_sE_sC}$ are their tax expenses; so S_{0BCQ_s} is total after-tax revenue. S_{0FCQ_s} are total private costs; so $S_{FBC} = S_{KP_sE_s}$ is producers' surplus. Total external costs go down up to S_{FKE_sC}, and coincide with the Pigouvian tax. As a result social welfare with tax is equal to the area:

$$SW_t = S_{AP_sE_s} + S_{KP_sE_s} + S_{BP_sE_sC} - S_{FKE_sC} = S_{KAE_s}.$$

Summing up, the reduction in consumers' and producers' surplus is: $\Delta CS = S_{P_pE_pE_sP_s}$ and $\Delta PS = S_{P_pE_pCB}$ correspondingly. Tax revenues of the government are $S_{BP_sE_sC}$. Besides the society gains due to reduction in total external costs due to tax: $S_{E_pGE_sC}$. Thus welfare gain due to Pigouvian tax (see the figure below) is:

$$\Delta SW = SW_0 - SW_t = S_{BP_sE_sC} + S_{E_pGE_sC} - S_{P_pE_pE_sP_s} - S_{P_pE_pCB} = S_{GE_sE_p}.$$

Pigouvian tax
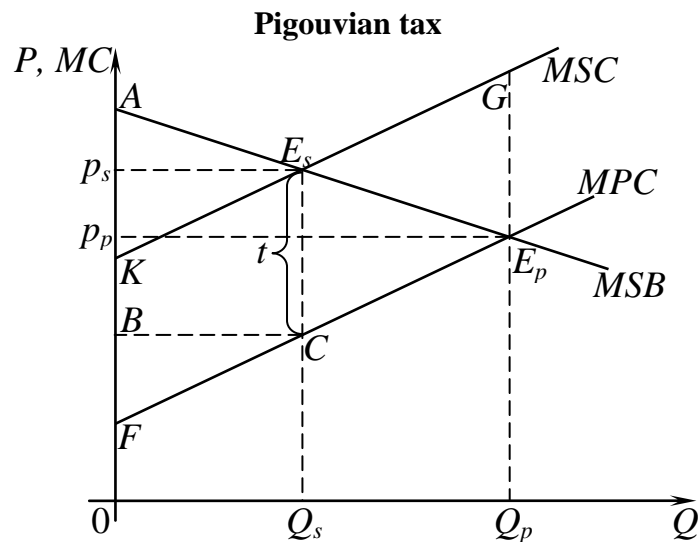
10.3. Property rights and transaction costs

The Coase theorem theats the opportunity of private settlement of the problem of externalities. It claims that provided properly specified property rights, transaction costs and wealth effect are zero, under conditions of perfect competition the final allocation of resources will not depend on initial specification of property rights.

Wealth effect means that the actual ownership of an asset affects the ability of a party to pay.

Transaction costs are the costs of interaction between economic agents concerning appropriation and alienation of any social rights and liabilities. For instance, specification, appropriation, protection and alienation of property rights are important sources of transaction costs. Property rights can be roughly described by a triada: ownership, disposal, use. Tracsaction costs in economics are similar to friction in physics.

The Coase theorem says that in an economy without transaction costs if an initial allocation that is inefficient – when the property rights are assigned to the party who does not attribute the greatest value to the right, the situation will be corrected by the competitive market.

The Coase theorem yields there corollaries:
- Externalities are bilateral.
- Externalities are zero under the conditions of the theorem.
- Property rights are the means to internalize external benefits and costs.

8

10.4. Public goods

An excludable good can be excluded from consumption of all the individuals except the single one who has bought it. The good is unexcludable if the price mechanism cannot be used to appropriate the good by a single person because the costs of exclusion of the others from its consumption are extremely high.

A competitive good cannot be consumer by several people simultaneously. Competitive goods annihilate in the process of individual consumption. The good is noncompetitive if it can be consumer by other people at the same time when or after it is consumed by the other one.

A private good is an excludable and competitive good. A pure public good is a nonexcludable and noncompetitive good. There are a number of intermediate cases of mixed goods which are summarized in the following table.

Public goods: criteria

		Appropriability (excludability)	
		Yes	No
Competitiveness	Yes	Food, clothes, apartments	Pastures, fish in a sea, fresh air
	No	Bridges, roads (except rush-hours)	City lighting, national defence, fundamental science

Demand for public goods is not a horizontal, as in the case of private goods, but a vertical sum of individual demand curves (see the figure below).

Public goods: market equilibrium
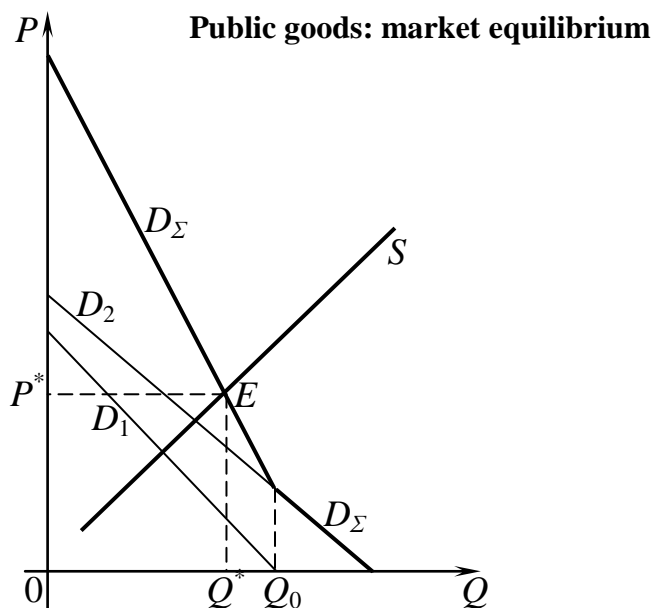
Production of public goods is a source of a free-rider problem. Free riding exists when an individual uses without any pay the goods produced by somebode else. The following "chicken game" can serve as an example of free-rider problem (a<b). There are multiple Nash equilibria with free riding in this example.

		Player 1: To buy a watch dog?	
		Yes	No
Player 2: To buy a watch dog?	Yes	→ ↓ (a,a)	(0,a)
	No	(a,0)	(b,b) ↑ ←