Elena A. Tretiakova

MICROECONOMICS

COLLECTION OF TASKS AND CASES

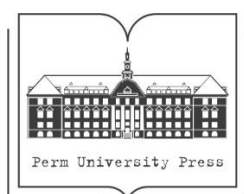Третьякова Е. А.

МИКРОЭКОНОМИКА

СБОРНИК ЗАДАЧ И КЕЙСОВ

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*Допущено методическим советом
Пермского государственного национального
исследовательского университета в качестве
учебно-методического пособия для студентов,
обучающихся по направлению подготовки бакалавров
«Экономика»*

Третьякова Е. А.

Пособие включает основные разделы курса микроэкономики (экономической теории) для бакалавров. Представленные материалы способствуют закреплению теоретических знаний, приобретению умений и навыков решения типовых экономических задач.

Предназначено для студентов высших учебных заведений, обучающихся по экономическим и управленческим направлениям и специальностям подготовки. Может быть полезно преподавателям вузов и колледжей, практическим работникам.

The handbook includes the main sections of the course of microeconomics for bachelors. The presented materials contribute to the consolidation of theoretical knowledge, the formation of skills and abilities to solve economic problems.

The handbook is intended for students of higher educational institutions studying in economics and management. It can be useful for universities and colleges teachers of and practical workers.

Издается по решению ученого совета экономического факультета Пермского государственного национального исследовательского университета

CONTENTS

Topic 1. Economics and Economic Systems

Key terms on the topic

Economics is the social science that studies the production, distribution, and consumption of goods and services.

Microeconomics is a branch of mainstream economics that studies the behavior of individuals and firms in making decisions regarding the allocation of scarce resources and the interactions among these individuals and firms. Microeconomics focuses on the study of individual markets, sectors or industries.

Demand is the desire and willingness to buy a particular good or service supported by the necessary money to buy it.

Free goods are goods that are so widely distributed that their cost is practically nothing, and therefore there is no need for their production.

Economic goods are the result of economic activity, and they are obtainable only in a quantity which is limited compared to the demand in them.

Interchangeable goods (goods-substitutes) are goods those can be used for reaching the same purpose because they meet the same wants.

Complementary goods are those that meet people's needs only when used together.

Private good is a good that is consumed individually by the person who paid for it.

Public good is a good that is collectively consumed by all citizens, whether they pay for it or not.

Resources (**factors of production**) are what is applied and spent in the production process.

Household is a group of people who live in the same living space (share accommodation), share everything they need to live together, and completely or partially combine and spend their money.

Firm (business) is an agent that uses resources to produce goods or services to maximize its profits, and which owns and operates one or more companies.

State (Government) is a set of state institutions and organizations that have the political and legal right to influence the course of economic processes and regulate the economy.

Traditional economy is an economic system in which traditions and customs determine the use of scarce natural resources.

Centralized (command) economy is an economy controlled by state bodies on the basis of policy plans and programs, direct subordination junior bodies to senior ones, and state ownership of means of production.

Market economy is an economy based on the principles of free enterprise, various forms of ownership of the means of production, market pricing, contractual relations between business entities and limited state interference with economic activity.

Mixed economy is a market economy with certain features of traditional economy and elements of centralized governance management.

Production possibility curve (*PPC*) or a **production-possibility frontier (*PPF*)** is a curve that graphically shows different combinations of simultaneous production quantities of two products (or two groups of products) with a certain quantity of resources spent on the production of these products and the same technology.

Inputs are commodities that are used to produce goods and services.

Outputs are the various useful goods or services that result from the production process and are either consumed or employed in further production.

Opportunity costs are an economic term that refers to the lost benefit resulting from choosing one of the alternative uses of resources and thus abandoning other opportunities.

Example of solving the task

Task 1.1.

Given:

The equation of curve of production possibility (*PPC*) is $5 \cdot x + 4 \cdot y^2 = 100$, where *x* and *y* are measured in hundreds of units.

Find:

1) the maximum quantity of good *x*, which can be produced;

2) the maximum quantity of good *y*, which can be produced;

3) the opportunity costs of production of the fourth unit of good *y*;

4) the opportunity costs of production of the fourth unit of good *x*;

5) the new equation of the *PPC*, if the new production technology will allow the production of good *y* twice as much;

6) the new equation of the *PPC*, if the new production technology will allow the production of good *x* twice as much.

Solution:

1) The original equation is $5 \cdot x + 4y^2 = 100$.

If an economic system produces the maximum quantity of good *x*, it cannot produce good *y* (Point *B* on Fig. 1).

Therefore, the quantity of the good *y* is zero. Then the maximum quantity of product *x* equals 20 hundreds of units:

$$5 \cdot x + 0 = 100$$

$$x_{max} = 20 \text{ units.}$$

2) If an economic system produces the maximum quantity of good *y*, it cannot produce good *x* (Point *A* on Fig. 1).
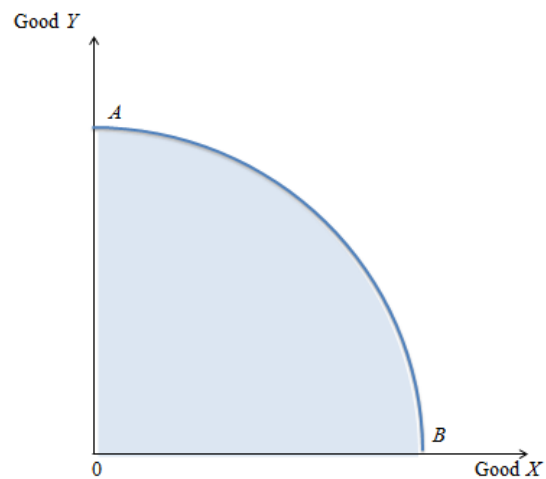

Fig. 1. Production possibility curve (*PPC*)

Therefore, the quantity of the good x is zero. Then the maximum quantity of product y equals 5 hundreds of units:

$$0 + 4 \cdot y^2 = 100$$
$$y^2 = 25$$
$$y_{max} = 5 \text{ hundreds of units.}$$

3) To find opportunity production costs of the fourth unit of product y need to calculate the quantity of produced good x in the production of three units of good y and the quantity of produced good x in the production of four units of good y. Then we will use the difference between these quantities to find these opportunity costs which are equal to 5.6 hundreds of units:

At $y = 3$: $5 \cdot x + 4 \cdot 3^2 = 100$; x (at $y = 3$) = 12.8 hundreds of units.

At $y = 4$: $5 \cdot x + 4 \cdot 4^2 = 100$; x (at $y = 4$) = 7.2 hundreds of units.

Consequently, the opportunity costs of the fourth unit of good y are equal:

$OC_Y = x$ (at $y = 4$) - x (at $y = 3$) = 12.8 - 7.2 = 5.6 hundreds of units of good x

4) To find opportunity production costs of the fourth unit of product x need to calculate the quantity of produced good y in the production of three units of good x and the quantity of produced good y in the production of four units of good x. Then we will use the difference between these quantities to find these opportunity costs which are equal to 0.1 hundreds of units:

At $x = 3$: $5 \cdot 3 + 4 \cdot y^2 = 100$; $y^2 = 21.25$; y (at $x = 3$) = 4.6 hundreds of units.

At $x = 4$: $5 \cdot 4 + 4 \cdot y^2 = 100$; $y^2 = 20$; y (at $x = 4$) = 4.5 hundreds of units.

Consequently, the opportunity costs of the fourth unit of good x are equal:

$OC_X = y$ (at $x = 4$) - y (at $x = 3$) = 4.6 - 4.5 = 0.1 hundreds of units of good y.

5) The original equation has the form: $5 \cdot x + 4 \cdot y^2 = 100$, where the resource costs for one unit of product x are 5, and for one unit of product y are two.

In order to produce twice as much goods from the same amount of resources, we need to reduce the cost of resources for the production of a unit of production twice. From here we get new equations of the curve if the new production technology will allow the production of good y twice as much: $5 \cdot x + y^2 = 100$.

6) Similarly, we find a new equation of the curve if the new production technology will allow us to produce a good x twice as much: $2.5 \cdot x + 4 \cdot y^2 = 100$.

Task 1.2.

Given:

The equation of curve of production possibility (*PPC*) is $9 \cdot x^2 + y = 900$, where *x* and *y* are measured in hundreds of units.

Find:

1) the maximum quantity of good *x*, which can be produced;

2) the maximum quantity of good *y*, which can be produced;

3) the new equation of the *PPC*, if the new production technology will allow the production of good *y* twice as much.

Case study

Case 1.1.[1]

Identify the elements of scarcity, choice, and opportunity cost in each of the following:

1. The Environmental Protection Agency is considering an order that a 500-acre area on the outskirts of a large city be preserved in its natural state, because the area is home to a rodent that is considered an endangered species. Developers had planned to build a housing development on the land.

2. The manager of an automobile assembly plant is considering whether to produce cars or sport utility vehicles (SUVs) next month. Assume that the quantities of labor and other materials required would be the same for either type of production.

3. A young man who went to work as a nurses' aide after graduating from high school leaves his job to go to college, where he will obtain training as a registered nurse.

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 14.

Case 1.2.

Economic Transition in Cuba[1]

Cuba has been ruled by the Communist party since Fidel Castro's revolution in 1959. It is one of the few countries that still has a planned socialist system. Over 80 percent of Cuban workers are employed in the public sector, and the state controls all major industries. The country has a national healthcare program, free public education, and subsidized housing, transportation, and utilities. While the wages of Cuban workers (mostly set by the state) are low, employment guarantee and substantial social programs provides most with access to basic necessities. However, like other one-party communist states, there is limited freedom of expression with state-controlled media, limited access to the internet, and restrictions on political rights and civil liberties. Also, with poor infrastructure and lack of access to technology, the overall living standards in the country are still poor.

One of the key strengths of the Cuban economy is that it has produced an extremely well-trained workforce with significant investments in human capital (education and healthcare) over time. In fact, one of its main sources of revenue is the export of health services by sending nurses, physicians, and healthcare technicians to Brazil, Venezuela, South Africa, and other countries. Tourism and remittances are other key sources of revenue for Cuba.

The country's economy has, however, been suffering since 2008 with slowdown in overall growth With the recent covid crisis, the economy has plunged, with growth in 2020 declining by 11 percent for the first time–much higher than the declines experienced in most other countries. For example, GDP declined by 3.5 percent in the United States, 2.8 percent in Sweden, 3 percent in Russia, 4 percent in Brazil and 8 percent in India.

Cuba is also highly vulnerable to external trade shocks and is reliant on imports for some essential goods such as fuels, food, and machinery. The country has also suffered economically due to the US embargo that restricts exports and travel to the country–the economic cost of the embargo is estimated to be about $130 billion, according to the United Nations. Additionally, the government has been struggling to support its large social programs. Between 2008 and 2016, Cuba's total debt increased by 56.9 percent (from $11.6 billion to $18.2 billion)

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[1] Comparative Economic Systems: Capitalism and Socialism in the 21st Century. – Boston; Global Development Policy Center, Boston University, 2021. – P. 41–43.

amounting to about 20 percent of the country's GDP. The overall debt has declined in more recent years, through debt write-offs from China, Mexico, Russia, and some of its other creditors. In recent years, there has also been an increase in inequality, and a deterioration in the quality of public services.

With these difficulties, the country has been gradually transitioning to a more market- based economy. In 2010, President Raúl Castro introduced reforms that removed state control of smaller firms, made it easier for workers to be self-employed, and allowed market freedom in tourism, and export industries. The country has also established tax free special zones to encourage foreign investments. Another set of reforms were implemented in 2020, by the current President Miguel Díaz-Canel to address the recent downturn. These reforms include expansion of the list of industries that are allowed to privatize, removal of subsidies on a wide range of goods, and cut down in some of the social programs.

With these reforms, some have argued the Cuban economy is transitioning towards capitalism. The government, however, maintains that the intent of the reforms is to preserve socialism, while integrating into a capitalist world. Given that the overall size of the private sector in Cuba is still quite small, and the communist party still has a monopoly over the political process and economic decisions, the country is far from transitioning to capitalism

Questions:
1. What type of economic system are we talking about?
2. What are the advantages of the Cuban economy?
3. What are the disadvantages of the Cuban economy?

Topic 2. Market as a form of social economy

Key terms on the topic

Natural economy is an economy that meets all its needs through independent production.

Commodity economy is a type of economy in which production is market-oriented.

Goods are things that satisfy human wants and provide utility.

Market is an economic relationship between sellers and buyers of goods and services, which results in the formation of the demand, supply and price.

Competition is a contest between producers (sellers) for markets in order to obtain higher income, profits and other benefits.

Price competition is the competition which is realized through price reduction.

Non-price competition is competition realized by improving product quality and sales conditions, prices remaining constant.

Fair competition means competition happening in accordance with the established rules.

Unfair competition is a competition whose participants violate rules and norms of competition adopted on a market, collude against other competitors, try to compromise them, use false advertising of their products, set dumping prices.

Money is a special kind of universal commodity, used as a universal equivalent, through which the value of all other goods is expressed.

The creation of money is the issue of all forms of money into circulation.

Full-bodied money is money whose nominal value corresponds to the precious metal content in it.

Symbolic money is an instrument of payment, whose purchase cost significantly exceeds the cost of their production or the effect of their alternative use not as money.

Cash is money in the form of paper money and coins.

Non-cash money is money in bank accounts used to transfer funds from one account to another.

Electronic (digital) money is a record stored in a distributed database on the Internet, in an electronic computer database, within digital files or within a stored-value card.

Inflation is the depreciation of money, characterized by the increase in prices for goods and services, which is not caused by an improvement of their quality.

Liquidity is the degree of ease with which any assets can be converted into money by the owner.

Case study

Case 2.1.

Cigarettes as Money[1]

Economist R. A. Radford spent time in prisoner of war camps in Italy and Germany during World War II. He put this unpleasant experience to good use by testing a number of economic theories there. Relevant to this chapter, he consistently observed utility-maximizing behavior.

In the P.O.W. camps where he stayed, prisoners received rations, provided by their captors and the Red Cross, including tinned milk, tinned beef, jam, butter, biscuits, chocolate, tea, coffee, cigarettes, and other items. While all prisoners received approximately equal official rations (though some did manage to receive private care packages as well), their marginal rates of substitution between goods in the ration packages varied. To increase utility, prisoners began to engage in trade.

Prices of goods tended to be quoted in terms of cigarettes. Some camps had better organized markets than others but, in general, even though prisoners of each nationality were housed separately, so long as they could wander from bungalow to bungalow, the "cigarette" prices of goods were equal across bungalows. Trade allowed the prisoners to maximize their utility.

Question:

Did cigarettes function as money? Which ones?

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 314.

Topic 3. Market and market Equilibrium

Key terms on the topic

Demand is the quantity of a good that consumers are willing and able to purchase at various prices during a given period of time.

Price of demand is the maximum price that buyers are willing to pay for a certain amount of goods or services at a given time in the given market.

A **complement** is a good that is used with a primary good.

Substitutes are goods that can be used instead of another good.

The function of demand is a quantitative relationship between the amount of demand and its factors (or determinants).

Normal goods are those goods whose demand rises along with the consumer's income.

An inferior good is a good whose demand decreases when consumer income rises (or demand increases when consumer income decreases).

Supply is a quantity of goods and services that a producer is willing and able to sell at a certain price at a certain point in time.

Price of supply is the minimum price at which the seller agrees to sell a certain quantity of a product at a certain time in the market.

The function of supply is the mathematical expression of the relationship between supply and the factors affecting the willingness and ability of a supplier to provide goods for sale.

Equilibrium price is the price where the intentions of buyers and sellers match.

Equilibrium quantity is the quantity demanded and quantity supplied at the equilibrium price in a competitive market.

Consumer surplus is the monetary gain obtained by consumers because they are able to purchase a product for a price that is less than the highest price that they would be willing to pay.

Producer surplus is the amount that producers benefit selling a product at a market price that is higher than the minimal price they would be willing to sell for.

The public benefit of sellers and buyers is the sum of the surplus of the consumer and the surplus of the producer.

Task 3.1.

  Given:

The supply and demand are described by the equations: $Q_D = 30 - P$ and $Q_S = 4 \cdot P - 20$.

  Find:

1) the equilibrium price;

2) the equilibrium quantity of sales;

3) the market situation (surplus or shortage) when the market price is 8 mu (monetary units);

4) the market situation (surplus or shortage) when the market price is 11 mu (monetary unit).

  Solution:

1) At the point of market equilibrium demand and supply are equal (Point E on Fig. 2). Hence, we can equate their functions:

$$30 - P = 4 \cdot P - 20,$$

consequently, $P_E = 10$ mu.

2) Now we know the equilibrium price and can find the equilibrium quantity:

$$Q_D = 30 - P,$$
$$Q_E = 30 - 10,$$
$$Q_E = 20 \text{ phu (physical units)}.$$

So, the equilibrium quantity is 20 units.
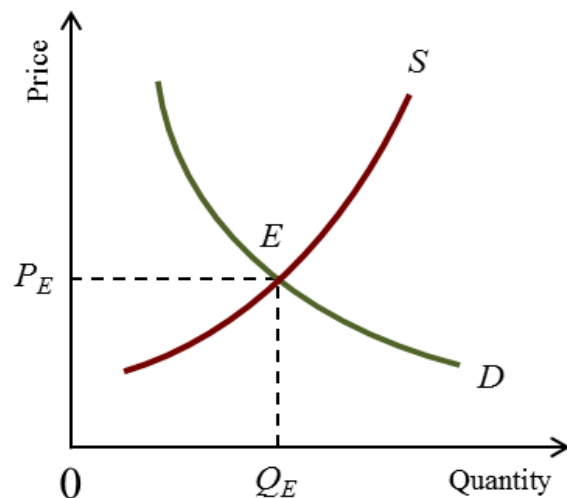
Fig. 2. Market Equilibrium

3) Market price of 8 mu is less than equilibrium price of 10 mu.

Therefore, the market equilibrium is broken.

When the market price is 8 mu:
– the quantity demanded equals

$Q_D = 30 - P = 30 - 8 = 22$ phu,

– the quantity supplied equals

$Q_S = 4 \cdot P - 20 = 4 \cdot 8 - 20 = 12$ phu.

Consequently, there is a shortage (Fig. 3) which equals

Shortage $= Q_D - Q_S = 22 - 12 = 10$ phu.

Fig. 3. Market Situation: Shortage

4) Market price of 11 mu is higher than equilibrium price of 10 mu.

Therefore, the market equilibrium is broken.

When the market price is 11 mu:
– the quantity demanded is

$Q_D = 30 - P = 30 - 11 = 19$ phu,

– the quantity supplied is

$Q_S = 4 \cdot P - 20 = 4 \cdot 11 - 20 = 24$ phu.

Consequently, there is a surplus (Fig. 4) which equals

Surplus $= Q_S - Q_D = 24 - 19 = 5$ phu.
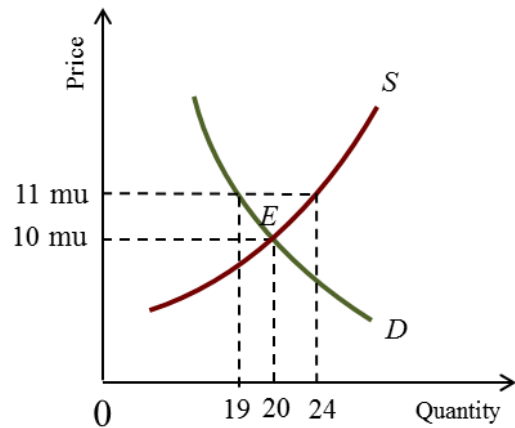
Fig. 4. Market Situation: Surplus

Task 3.2.

Given:

The supply and demand are described by the equations: $Q_D = 30 - P$ and $Q_S = 4 \cdot P - 20$.

Find:

1) the equilibrium price;

2) the equilibrium quantity of sales;

3) the maximum price;

4) the minimum price;

5) the surplus of consumer;

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6) the surplus of producer;

7) the public benefit of sellers and buyers.

Solution:

At the point of market equilibrium demand and supply are equal. Hence, we can equate their functions: $30 - P = 4 \cdot P - 20$.

Therefore

1) $P_E = 10$ mu (monetary units);

2) $Q_E = 20$ phu (physical units);

3) At the point of the maximum market price the demand is equal to zero, therefore

$$30 - P = 0,$$

consequently, $P_{max} = 30$ mu.

4) At the point of the minimum market price the supply is equal to zero, so

$$4 \cdot P - 20 = 0,$$

consequently, $P_{min} = 5$ mu.

Fig. 5. Surplus of consumer and producer

5) Consumer surplus is equal to the square of a triangle $P_{max}P_E\ E$ (Fig. 5). Consequently,

Consumer surplus $= 0.5 \cdot P_{max}P_E \cdot P_E E = 0.5 \cdot (30 - 10) \cdot 20 = 200$ mu.

6) Producer surplus is equal to the square of a triangle $P_E P_{min}\ E$ (Fig. 5). Consequently,

Producer surplus $= 0.5 \cdot P_E P_{min} \cdot P_E E = 0.5 \cdot (10 - 5) \cdot 20 = 50$ mu.

7) The public benefit of sellers and buyers is equal to the sum of the consumer surplus and the producer surplus:

The public benefit = Consumer surplus + Producer surplus $= 200 + 50 = 250$ mu.

Task 3.3.

Given:

The supply and demand are described by the equations: $Q_D = 30 - P$ and $Q_S = 4P - 20$.

Find:

1) the equilibrium price;
2) the equilibrium quantity of sales;
3) the market situation (surplus or shortage) when the market price is 15 mu;
4) the market situation (surplus or shortage) when the market price is 7 mu.

Task 3.4.

Given:

The supply and demand are described by the equations: $Q_D = 30 - 2 \cdot P$ and $Q_S = 2 \cdot P - 10$.

Find:

1) the equilibrium price;
2) the equilibrium quantity of sales;
3) the maximum price;
4) the minimum price;
5) the surplus of consumer;
6) the surplus of producer;
7) the public benefit of sellers and buyers.

Case study

Case 3.1.

The coronavirus pandemic that has spread around the world has changed the situation in many markets. What was the impact?

Using the graphs below, select the correct option from the possible answers and complete the table.

Table 1.

Answers Table

Question	Options				
	a	*b*	*c*	*d*	*e*
1) How has coronavirus infection affected the pharmaceutical market?					
2) How did the coronavirus infection affect the tourist market?					
3) How did the coronavirus infection affect the computer market?					
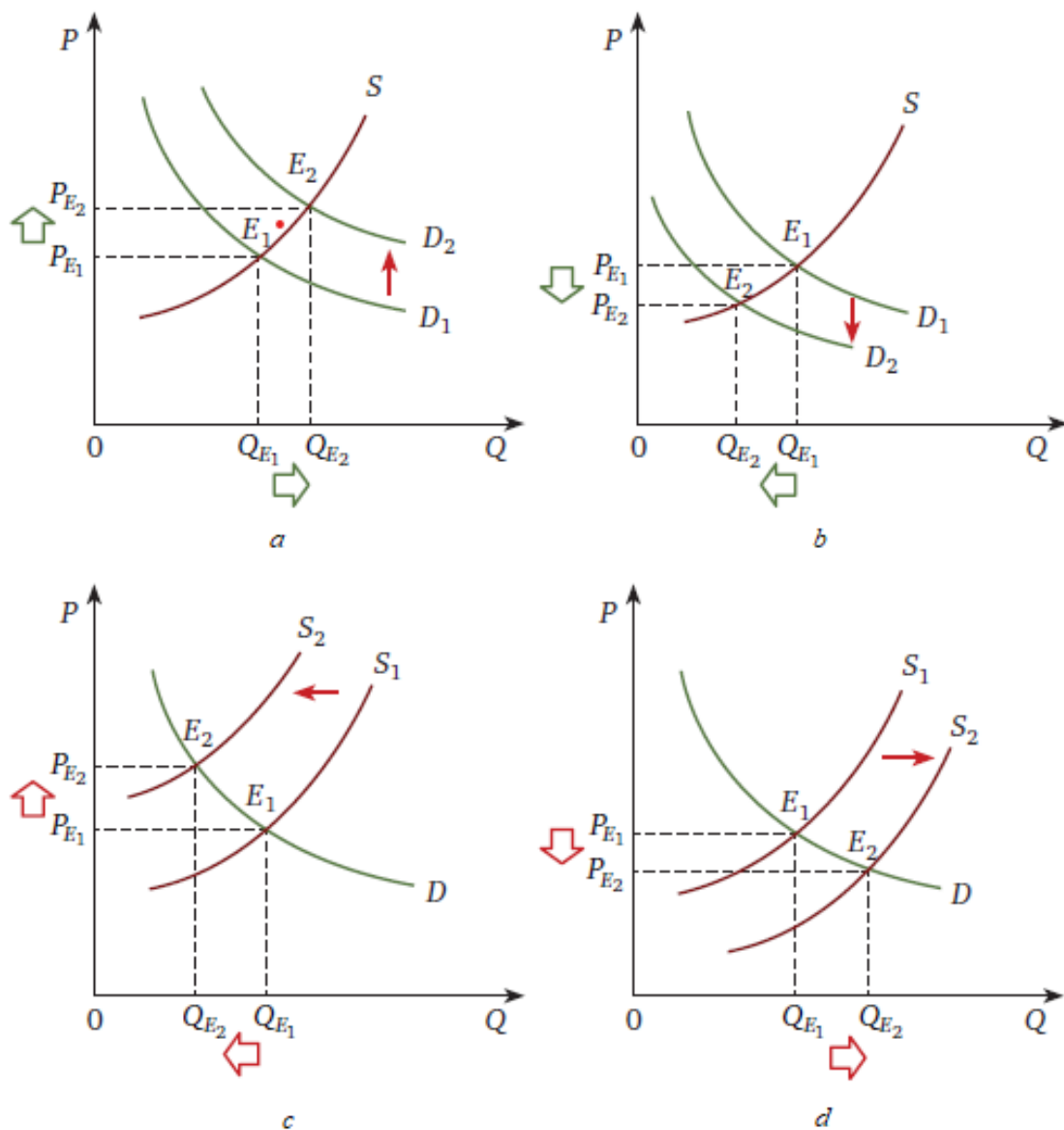
Fig. 6. Shifts in market equilibrium

a) demand increased, the equilibrium market price increased, and the equilibrium sales quantity increased

b) demand dropped, the equilibrium market price decreased, and the equilibrium sales quantity decreased

c) supply increased, the equilibrium market price decreased, and the equilibrium sales quantity increased

d) supply dropped, the equilibrium market price increased, and the equilibrium sales quantity decreased

e) the market situation didn't change

Case 3.2.

For more than a century, milk producers have produced skim milk, which contains virtually no fat, along with regular milk, which contains 4% fat. But a century ago, skim milk accounted for only about 1% of total production, and much of it was fed to hogs. Today, skim and other reduced-fat milks make up the bulk of milk sales[1].

Questions:

1) What curve shifted?

2) What factor shifted it?

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P. 142.

Topic 4. Elasticity of Supply and Demand

Key terms on the topic

Price elasticity of demand is a sensitivity of consumers to a price change.

The coefficient of price elasticity of demand shows the percentage change in the quantity of goods sold at one percent change in price, keeping all other demand factors unchanged.

Total revenue is the total amount the seller receives from the sale of a product in a particular time period.

The cross elasticity of demand measures how sensitive consumer purchases of one product are to a change in the price of some other product.

Income elasticity of demand characterizes the change in demand in response to changes in consumer income.

Price elasticity of supply is a sensitivity of producers to price changes.

The coefficient of price elasticity of supply shows the percentage change in the quantity of goods sold at one percent change in price, keeping all other supply factors unchanged.

Task 4.1.

Given:

The demand is described by the equation: $Q_D = 30 - P$.

Find:

1) the quantity of demand at the price of 10 mu;

2) the quantity of demand at the price of 11 mu;

3) the percentage change in the quantity demanded;

4) the percentage change in the price;

5) the coefficient of price elasticity of demand.

Which group does this product belong to?

Solution:

1) We will use the equation of demand $Q_D = 30 - P$ and put the price into it/

The quantity of demand at the price of 10 mu equals:
$$Q_D(10) = 30 - P = 30 - 10 = 20 \text{ units};$$
2) The quantity of demand at the price of 11 mu equals:
$$Q_D(11) = 30 - P = 30 - 11 = 19 \text{ units};$$
3) The percentage change in the quantity demanded is calculated by dividing the change in quantity by the average quantity. The percentage change in the quantity demanded is:

$$\Delta Q(\%) = \frac{Q_2^X - Q_1^X}{(Q_1^X + Q_2^X)/2} = \frac{(19-20)}{(19+20)/2} = \frac{-1}{19.5} = -0.0526$$

4) The percentage change in the price is calculated by dividing the change in price by the average price. It is equals:

$$\Delta P(\%) = \frac{P_2^X - P_1^X}{(P_1^X + P_2^X)/2} = \frac{(11-10)}{(11+10)/2} = \frac{1}{10.5} = 0.0952$$

5) The coefficient of price elasticity of demand shows the percentage change in the quantity of goods sold at one percent change in price, keeping all other demand factors unchanged:

$$\varepsilon_D = \frac{\text{percentage change in quantity demanded of product } X}{\text{percentage change in price of product } X}$$

So, the coefficient of price elasticity of demand is:

$$\varepsilon_D = \frac{-0.0526}{0.0952} = -0.55 \text{ or } |0.55|$$

This product belongs to the group of inelastic in price because the modulo of elasticity coefficient is less than one.

Task 4.2.

Given:

There are two Russian milk products: Kefir and Bifidok. The price of Kefir has not changed, and the price of Bifidok has decreased from 35 to 30 rubles per package. As a result, the demand for Kefir fell from 250 to 200 packages per day.

Find: the coefficient of cross elasticity of demand.

Which group do these products belong to?

Solution:

The coefficient of cross elasticity of demand ε_{cross} is calculated by relating the percentage change in the consumption of product X to the percentage change in the price of product Y:

$$\varepsilon_{cross}=\frac{\text{percentage change in quantity demanded of product } X}{\text{percentage change in price of product } Y}$$

The coefficient of cross elasticity of demand is:

$$\varepsilon_{cross}=\frac{200-250}{(250+200)/2}\div\frac{(30-35)}{(30+35)/2}=\frac{-50}{225}\div\frac{-5}{32.5}=\frac{-0.22}{-0.15}=1.47$$

These are substitute products, because the cross-elasticity coefficient is greater than zero.

Task 4.3.

Given:

Consumer income increased from 35,000 to 40,000 rubles per month. As a result, demand per capita for margarine fell from 3 to 1 kilo per year, while demand for butter rose from 6 to 8 kilo per year.

Find: the elasticity coefficient of income demand for these two products. Which group do these products belong to?

Solution:

The elasticity coefficient of income demand is calculated by the formula:

$$\varepsilon_I=\frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

Consequently for margarine it will be equal to:

$$\varepsilon_I=\frac{Q_2^X-Q_1^X}{(Q_1^X+Q_2^X)/2}\div\frac{I_2^X-I_1^X}{(I_1^X+I_2^X)/2}$$

$$\varepsilon_I=\frac{1-3}{(1+3)/2}\div\frac{40{,}000-35{,}000}{(35{,}000+40{,}000)/2}=\frac{-2}{2}\div\frac{5{,}000}{37{,}500}=\frac{-1}{0.13}=-7.7$$

Margarine is inferior good. Its income-elasticity coefficient is negative.

For butter the elasticity coefficient of income demand will be equal to:

$$\varepsilon_I=\frac{Q_2^X-Q_1^X}{(Q_1^X+Q_2^X)/2}\div\frac{I_2^X-I_1^X}{(I_1^X+I_2^X)/2}$$

$$\varepsilon_I = \frac{8\text{-}6}{(8+6)/2} \div \frac{40{,}000 \text{ - } 35{,}000}{(35{,}000+ 40{,}000)/2} = \frac{2}{7} \div \frac{5{,}000}{37{,}500} = \frac{0.29}{0.13} = 2.2$$

Butter is normal good. Its income-elasticity coefficient is positive.

Task 4.4.

Given:

The increase in the purchase price from 40 to 60 rubles led to increase in supply of product from 120 to 160 tons.

Find: the coefficient of price elasticity of supply.

Solution:

The coefficient of price elasticity of supply is calculated by the formula:

$$\varepsilon_S = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}}$$

Consequently,

$$\varepsilon_S = \frac{\Delta Q^X}{(Q_1^X + Q_2^X)/2} \div \frac{\Delta P^X}{(P_1^X + P_2^X)/2}$$

$$\varepsilon_S = \frac{160\text{-}120}{(160+140)/2} \div \frac{60\text{-}40}{(60+40)/2} = \frac{0.27}{0.40} = 0.68$$

The coefficient is less than one; therefore, the supply is inelastic in price.

Task 4.5.

Given:

The demand is described by the equation: $Q_D = 50 - P$.

Find:

1) the quantity of demand at the price of 20 mu;

2) the quantity of demand at the price of 21 mu;

3) the percentage change in the quantity demanded;

4) the percentage change in the price;

5) the coefficient of price elasticity of demand.

Which group does this product belong to?

Task 4.6.

Given:

The price of a chocolate bar "Snickers" has not changed, and the price of a chocolate bar "Mars" has increased from 37 to 40 rubles per piece. At the same time, the demand for "Snickers" increased from 200 to 250 pcs. per week, and the "Mars" decreased from 180 to 150 packages per week.

Find: the coefficient of cross elasticity of demand.

1) percentage change in the price of "Mars";

2) percentage change in demand for Mars;

3) percentage change in demand for "Snickers";

4) the coefficient of cross elasticity of demand for "Snickers";

5) which category do these products belong to

Task 4.7.

Given:

Consumer income increased from 28,000 to 35,000 rubles per month. As a result, the demand for boiled sausage in the store decreased from 120 to 80 kg per month, and the demand for pork increased from 90 to 130 kg per month.

Find:

1) percentage change in consumer income;
2) percentage change in demand for boiled sausage;
3) percentage change in pork demand;
4) the coefficient of elasticity of demand for income for boiled sausage;
5) the coefficient of elasticity of demand for pork income;
6) which groups belongs these products to.

Task 4.8.

Given:

The increase in the purchase price from 40 to 55 rubles led to increase in supply of product from 100 to 150 tons.

Find:

1) percentage change in the supply quantity;
2) the percentage change in the price;
3) the coefficient of price elasticity of supply.
4) which group does this product belong to?

Case study

Case 4.1.

The table shows statistical data for Russia. Using this data, calculate the elasticity coefficient of income demand for public air transport, for meat, for bread and for vegetables.

Table 2.

Statistical data for Russia

Indicator	2017	2018
Average per capita money income of population (per month), roubles	33145	33178
Passenger transportation by public air transport mode, mln. persons	108	118
Consumption of meat in households (in kilograms average per household member)	88	89
Consumption of bread product (in kilograms average per household member)	97	96
Consumption of vegetables (in kilograms average per household member)	102	104

Case 4.2.

Orange Paradise

A bumper crop of oranges in Florida last year drove down orange prices. As juice marketers' costs fell, they cut prices by as much as 15%. That was enough to tempt some value-oriented customers: unit volume of frozen juices actually rose about 6% during the quarter[1].

Questions:

1. Given these numbers, and assuming there were no changes in demand shifters for frozen orange juice, what was the price elasticity of demand for frozen orange juice?

2. What do you think happened to total spending on frozen orange juice? Why?

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 221.

Case 4.3.

Restaurant business[1]

Suppose you are the manager of a restaurant that serves an average of 400 meals per day at an average price per meal of $20. On the basis of a survey, you have determined that reducing the price of an average meal to $18 would increase the quantity demanded to 450 per day.

1. Compute the price elasticity of demand between these two points.

2. Would you expect total revenues to rise or fall? Explain.

3. Suppose you have reduced the average price of a meal to $18 and are considering a further reduction to $16. Another survey shows that the quantity demanded of meals will increase from 450 to 500 per day. Compute the price elasticity of demand between these two points.

4. Would you expect total revenue to rise or fall as a result of this second price reduction? Explain.

5. Compute total revenue at the three meal prices. Do these totals confirm your answers above?

---

[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 222.

Topic 5. Consumer Behavior

Key terms on the topic

Utility of a good or service is the satisfaction or pleasure one gets from consuming it.

Total utility is defined as the amount of satisfaction or utility that one obtains from a given quantity of a good.

Marginal utility is defined as the change in total utility that can be attributed to a change in the quantity consumed.

A budget constraint (budget line) means all the combinations of goods and services that a consumer may purchase given current prices within his or her given income.

An indifference curve is the locus of various points showing different combinations of two goods providing equal utility to the consumer.

An indifference map is a graphical representation of a set of indifference curves of some consumer, where each next curve, located further from the beginning of coordinates, expresses a relatively large amount of utility.

The consumer's equilibrium is the point at which the consumer reaches the maximum of total utility of the amount of available funds.

A consumer's optimum is a condition when at existing prices the consumer is able to replace one product by another and at the same time agrees to replace one product by another, without changing the level of his /her satisfaction.

Task 5.1.

Given:

The total utility of watching a movie is expressed by the function $TU = 50 \cdot Q - 10 \cdot Q^2$, where Q is the viewing time (in hours).

Find:

1) the function of marginal utility;

2) the saturation point of the viewer (in hours);

3) the total utility of the viewer at the saturation point;

4) the total utility of the viewer when watching a movie for 3 hours;

5) the marginal utility of the viewer when watching a movie for 3 hours.

Solution:

1) We find marginal utility as a derivative of total utility:

$$MU = 50 - 20 \cdot Q$$

2) In the saturation point marginal utility equals zero, hence the saturation point is:

$$0 = 50 - 20 \cdot Q, \text{ hence } Q = 2.5 \text{ hours}$$

3) Using the total utility equation, we find its size at the saturation point:

$$TU = 50 \cdot Q - 10 \cdot Q^2 = 50 \cdot 2.5 - 10 \cdot 2.5^2 = 125 - 62.5 = 62.5 \text{ utils}$$

4) Using the total utility equation, we find its size at the watching a movie for 3 hours:

$$TU = 50 \cdot Q - 10 \cdot Q^2 = 50 \cdot 3 - 10 \cdot 9 = 60 \text{ utils}$$

5) Using the marginal utility equation, we find its size at the watching a movie for 3 hours:

$$MU = 50 - 20 \cdot Q = 50 - 20 \cdot 3 = -10 \text{ utils}$$

The marginal utility of the viewer when watching a movie for 3 hours is equal to -10 utils, as 3 hours is more than a saturation point of 2.5 hours.

Task 5.2.

Given:

The consumer spends 40 mu per week to buy apples and bananas.

Marginal utility of apples: $MU_X = 10 - 2 \cdot Q_X$, price per apple $P_X = 2$ mu (monetary units).

Marginal utility of bananas: $MU_Y = 20 - 2 \cdot Q_Y$, price per banana $P_Y = 4$ mu.

Find:

1) the budget line equation for a given consumer;
2) the maximum quantity of apples he/she can buy;
3) the maximum quantity of bananas he/she can buy;
4) the optimal quantity of apples for this consumer;
5) the optimal quantity of bananas for this consumer.

Solution:

1) The budget line equation for consumer is $I = Q_X \cdot P_X + Q_Y \cdot P_Y$,

We add revenue and prices to the equation and the result is as follows:
$$40 = 2\ Q_X + 4\ Q_Y$$

2) The consumer will be able to buy the maximum quantity of goods X (apples) if he/she refuses the goods Y (bananas). In this case, the quantity of goods Y equals zero. Consequently, the maximum quantity of apples he/she can buy equals:
$$40 = 2\ Q_X + 0$$
$$Q_X = 20 \text{ units.}$$

3) The consumer will be able to buy the maximum quantity of goods Y (bananas) if he/she refuses the goods X (apples). In this case, the quantity of goods X equals zero. Consequently, the maximum quantity of bananas that he/she can buy equals:
$$40 = 0 + 4\ Q_Y$$
$$Q_Y = 10 \text{ units.}$$

Optimum consumer is characterized by an expression:
$$\frac{MU_x}{MU_n} = \frac{P_x}{P_n},$$

Then
$$\frac{10 - 2Q_X}{20 - 2Q_Y} = \frac{2}{4}$$

From here
$$4(10 - 2Q_X) = 2(20 - 2Q_Y)$$
$$40 - 8 \cdot Q_X = 40 - 4 \cdot Q_Y$$
$$2 \cdot Q_X = Q_Y$$

Based on the budget line equation:
$$40 = 2\ Q_X + 4\ Q_Y$$
$$40 = 2\ Q_X + 4 \cdot 2 \cdot Q_X$$

From here

4) the optimal quantity of apples is: $Q_X = 4$ units,
5) the optimal quantity of bananas is o: $Q_Y = 8$ units.

Using the budget line equation, we check that our solution is correct:

Test: $40 = 2 \cdot 4 + 4 \cdot 8 = 8 + 32 = 40$

$40 = 40$

Task for the self-solution

Task 5.3.

Given:

The utility function of reading historical novels by the reader is described by the equation $TU = 160 \cdot Q - 2 \cdot Q^2$, where Q is the number of pages read. How many pages will be read before the reader is at the saturation point?

Find:

1) the function of marginal utility;

2) the saturation point of the viewer (in pages);

3) the total utility of the reader at the saturation point;

4) the total utility of the reader when reading 60 pages;

5) the marginal utility of the reader when reading 60 pages.

Task 5.4.

Given:

The consumer spends 310 rubles a week to buy Milk and Kefir. The marginal utility function for Milk: $MU_X = 10 - 2 \cdot Q_X$, price per one liter of Milk is $P_X = 30$ mu. The marginal utility function for Kefir : $MU_Y = 20 - 2 \cdot Q_Y$, price per one liter of Kefir is $P_Y = 50$ mu.

Find:

1) the budget line equation for a given consumer;

2) the maximum quantity of Milk he/she can buy;

3) the maximum quantity of Kefir he/she can buy;

4) the optimal quantity of Kefir for this consumer;

5) the optimal quantity of Milk for this consumer.

Topic 6. Producer Behaviour

Key terms on the topic

Production is the process of using manpower, equipment, natural resources and materials to produce certain goods and services.

Factors of production (or production inputs) are resources used in production.

Production technology is a way of combining economic resources to produce a given quantity of goods and services.

Technological efficiency of production characterizes the relationship between the quantity of resources used and the quantity of products received.

Economic efficiency of production reflects the cost relationship between the firm's expenditures on factors of production and its revenue.

Production function is a function that reflects the technological relationship between the amount of resources spent by the firm in a unit of time and the maximum possible amount of output.

Return to scale characterizes the reaction of production amount to changes in the quantity of all factors of production used.

Fixed factors of production are factors that are used by the firm in the same quantity over a certain period of time. Their quantity does not change with changes in production quantity.

Variable factors of production are factors that are used by the firm in different quantities over a given period of time. If their quantity changes, the output also changes.

The total product is the total output of a particular good or service produced within the limits of the set production function.

Average product (AR) shows how much of the produced product accounts for a unit of variable factor.

Marginal product (MP) is an additional product produced by using an additional unit of resource to the production process.

The return to the variable factor input is the relative change in the production amount as the applied quantity of the variable factor of production changes.

Isoquant is a curve representing various combinations of factors of production, costs at which a set quantity of output can be produced.

Isoquant map is a graph combining a number of isoquants, each representing a different quantity of output.

Isocost is a line that shows possible combinations of factors of production that a company can purchase for the same total amount of money.

The cost minimization rule: the optimal combination of production factors is achieved when the last monetary unit spent to buy each factor gives the same increase in total output.

Example of solving the task

Task 6.1.

Given:

Five workers produce 20 units per day, six workers produce 30 units, and seven workers produce 35 units.

Find:

1) the labour productivity of five workers;
2) the marginal product of the sixth worker;
3) the labour productivity of six workers;
4) the marginal product of the seventh worker;
5) the labour productivity of seven workers.

What number of workers is optimal?

Solution:

1) Labor productivity is calculated by dividing the total product by the number of workers.

The labour productivity of five workers is:
$$AP_{L=5} = TP / L = 20 / 5 = 4 \text{ units}$$

2) The marginal product is an additional product produced by using an additional unit of resource. It is calculated by the formula:

$$MP = \frac{Q_2 - Q_1}{L_2 - L_1} = \frac{\Delta Q}{\Delta L}$$

The marginal product of the sixth worker is:

$$MP_{L=6} = (Q_2 - Q_1) / (L_2 - L_1) = (30\text{-}20) / (6\text{-}5) = 10 \text{ units}$$

3) The labour productivity of six workers is calculated by dividing their total product by the number of workers:

$$AP_{L=6} = TP / L = 30 / 6 = 5 \text{ units}$$

4) Marginal product is an additional product produced by using an additional unit of resource. The marginal product of the seventh worker:

$$MP_{L=7} = (Q_2 - Q_1) / (L_2 - L_1) = (35\text{-}30) / (7\text{-}6) = 5 \text{ units}$$

5) The labour productivity of seven workers is calculated by dividing their total product by the number of workers:

$$AP_{L=7} = TP / L = 35 / 7 = 5 \text{ units}$$

Optimal number of employees is seven, because at this level $APL = MPL$.

Labor productivity has reached its maximum and with further increase in the number of workers it will decrease.

Task for the self-solution

Task 6.2.

Given:

Five workers produce 40 units per day, six workers produce 60 units, and seven workers produce 70 units.

Find:

1) the labour productivity of five workers;
2) the marginal product of the sixth worker;
3) the labour productivity of six workers;
4) the marginal product of the seventh worker;
5) the labour productivity of seven workers.

Topic 7. Costs and Profits of the Firm

Key terms on the topic

Costs are expenditures of various economic resources in the process of production and sale of goods, expressed in monetary form.

Accounting (or **explicit, external) costs** are money payments a firm makes to outside suppliers of resources.

Alternative (or **implicit, internal) costs** are the costs of other benefits that could be obtained with the most advantageous of all available alternative ways of using this resource.

Economic costs are the sum of explicit and implicit costs.

Relevant costs are the costs that affect the situation in which the decision is made.

Non-recoverable costs are costs that a firm cannot recover even if it ceases to operate.

Short run period is a period too short for the firm to change the capacity of the enterprise, but long enough to be able to change the degree of its use.

Long run period - is a long enough period to adjust the quantities of all the resources that the firm employs, including plant capacity.

Total costs are full costs, the set of fixed costs not related to the quantity of output, and variable costs, which depend on production amounts.

Average total costs are the costs per unit of output.

Total fixed costs are those costs that in total do not vary with changes in output.

Average fixed costs are the sum of fixed costs per unit of output.

Total variable costs are a firm's costs that are directly related to the quantity of goods and services production.

Average variable costs are the sum of variable costs per unit of output.

The marginal costs *(MC)* are the increase in firm costs required to increase output by one unit.

The long-run average total-cost curve is a curve that encircles an infinite number of short-run average cost curves of total production costs that are in contact with it at their minimum points.

Positive effect on scale of production (or economies of scale) is a considerable decrease in average industrial costs of the firm as the output increases.

Negative effect on scale of production occurs when long- run average costs grow faster than amount of output.

The constant effect on scale of production (the constant returns to scale of production) occurs if the long- run average total costs of the company don't depend on changes in output.

The minimum efficient scale of production is the lowest size of the enterprise, allowing the firm to minimize its long-run total average costs.

Total profit is the excess of revenue from the sale of goods and services over the costs of production and sale of these goods and services.

Average profit is a sum of total profit attributable to the unit of good sold.

Total revenue is a sum of revenue received by the firm from the sale of a certain quantity of goods at certain prices.

Average revenue is the sum of revenue per unit of sales.

The marginal revenue is the increase in total revenue resulting from the increase in sales per unit.

Marginal profit shows the changes in total profit when the output changes by one unit.

Optimal quantity of production is the quantity of production that allows the company to get the maximum profit based on current market and technological conditions.

The profit maximization rule: a firm needs to select a combination of resources where the marginal revenue is equal to the marginal cost.

Accounting profit is the difference between total revenue and accounting costs of the firm.

Economic profit is the difference between total revenue and economic costs of the firm, including normal profit.

Normal profit is the minimum required profit to compensate for unaccounted costs of the entrepreneur.

Profitability is the level of profit that characterizes the efficiency of use of resources and activities of the firm.

Task 7.1.

<u>Given:</u>

Fixed costs for the production of parts are 1,000 mu per year, the costs of materials and wages per unit of production are to 5 mu, the price of the finished part from the supplier is 15 mu, the need in accordance with the production program equals: *A*) 90 units, *B*) 400 units.

<u>Find:</u>

1) program *A*: the costs of producing parts;

2) program *A*: the costs of buying parts;

3) program *B*: the costs of parts production;

4) program *B*: the costs of buying parts;

Formulate a conclusion about the expediency of buying or own production of parts.

<u>Solution:</u>

1) program *A*: the costs of producing parts

$$TC_A = TFC + TVC = TFC + AVC{\cdot}Q = 1{,}000 + 5 \cdot 90 = 1{,}000 + 450 = 1{,}450 \text{ mu};$$

2) program *A*: the costs of buying parts

$$TC'_A = P \cdot Q = 15 \cdot 90 = 1{,}350 \text{ mu}$$

Program *A*: it is expediency to buy parts.

3) program *B*: the costs of parts production

$$TC_B = TFC + TVC = TFC + AVC{\cdot}Q = 1{,}000 + 5 \cdot 400 = 1{,}000 + 2{,}000 = 3{,}000 \text{ mu};$$

4) program *B*: the costs of buying parts

$$TC'_B = P \cdot Q = 15 \cdot 400 = 6{,}000 \text{ mu}$$

Program *B*: it is expediency to produce parts.

Task 7.2.

Given:

The total costs of a firm are described by the equation: $TC = 15 \cdot Q^2 + 10 \cdot Q + 100$.

Find:

1) the total fixed costs (*TFC*);
2) the average fixed costs (*AFC*);
3) the total variable costs (*TVC*);
4) the average variable costs (*AVC*);
5) the average total costs (*ATC*);
6) the marginal costs (*MC*).

Solution:

1) Fixed costs are not related to the quantity (*Q*) of goods production, therefore they are equal:

$$TFC = 100$$

2) Average fixed costs are the sum of fixed costs per unit of output:

$$AFC = TFC / Q = 100/Q$$

3) Total variable costs directly depend on the output, therefore they are equal:

$$TVC = 15 \cdot Q^2 + 10 \cdot Q$$

4) Average variable costs are the sum of variable costs per unit of output:

$$AVC = TVC / Q = 15 \cdot Q + 10$$

5) Average total costs are the total costs per unit of output:

$$ATC = TC / Q = 15 \cdot Q + 10 + 100/Q$$

6) Marginal costs are the increase in firm costs required to increase output by one unit, so to find them, we take the derivative of total costs:

$$MC = TC' = 30 \cdot Q + 10$$

Task 7.3.

Given:

The price per unit of the company production is 10 mu, the sales quantity is 50,000 units per year. The average variable costs are 7 mu, and the fixed costs are 125,000 mu per year.

Find:

1) the total revenue (*TR*);

2) the total variable costs (*TVC*);

3) the total costs (*TC*);

4) the profit (π);

5) the profitability of sales (π_{TR});

6) the profitability of products (π_{TC}).

   Solution:

1) The total revenue is a sum of revenue received by the firm from the sale of a certain quantity of goods at certain prices:

$$TR = Q \cdot P = 50{,}000 \cdot 10 = 500{,}000 \text{ mu}$$

2) The total variable costs directly depend on the output, therefore they are equal:

$$TVC = AVC \cdot Q = 7 \cdot 50{,}000 = 350{,}000 \text{ mu}$$

3) The total costs are the sum of fixed and variable costs:

$$TC = TFC + TVC = 125{,}000 + 350{,}000 = 475{,}000 \text{ mu}$$

4) The profit is defined as the difference between total revenue and total costs:

$$\pi = TR - TC = 500{,}000 - 475{,}000 = 25{,}000 \text{ mu}$$

5) The profitability of sales is calculated as a ratio of profit to the total revenue:

$$\pi_{TR} = \pi / TR \cdot 100 \% = 25{,}000 / 500{,}000 \cdot 100 \% = 5.00 \%$$

6) The profitability of products sales is calculated as a ratio of profit to the total costs:

$$\pi_{TC} = \pi / TC \cdot 100 \% = 25{,}000 / 475{,}000 \cdot 100 \% = 5.26 \%.$$

Task for the self-solution

Task 7.4.

   Given:

Fixed costs for the production of parts are 1, 000,000 mu per year, the costs of materials and wages per unit of production are to 100 mu. The price of the finished part from the supplier is 110 mu. The need in accordance with the production program equals: A) 50,000 units, B) 150,000 units.

   Find:

1) program *A*: the costs of producing parts;

2) program *A*: the costs of buying parts;

3) program *B*: the costs of parts production;

4) program *B*: the costs of buying parts;

Formulate a conclusion about the expediency of buying or own production of parts.

Task 7.5.

Given:

The total costs of a firm are described by the equation: $TC = 30 \cdot Q^2 + 4 \cdot Q + 750$.

Find:

1) the total fixed costs (*TFC*);
2) the average fixed costs (*AFC*);
3) the total variable costs (*TVC*);
4) the average variable costs (*AVC*);
5) the average total costs (*ATC*);
6) the marginal costs (*MC*).

Task 7.6.

Given:

The price per unit of the company production is 20 mu, the sales quantity is 30,000 units per year. The average variable costs are 5 mu, and the fixed costs are 200,000 mu per year.

Find:

1) the total revenue (*TR*);
2) the total variable costs (*TVC*);
3) the total costs (*TC*);
4) the profit (π);
5) the profitability of sales (π_{TR});
6) the profitability of products (π_{TC}).

Topic 8. Pure Competition

 Key terms on the topic

Perfect (pure) competition is a market structure where there are many sellers and buyers of a homogeneous product in the market.

Pure (perfect) monopoly is a market structure in which one firm is the sole seller of a product or service.

Break-even point is an output at which a firm makes a normal profit but not an economic profit.

 Examples of task solutions

Task 8.1.

Given:

An equilibrium price of 230 mu was formed in the market of pure competition. The function of the company's total costs has the form: $TC = 50 \cdot Q + 3 \cdot Q^2$.

Find:

1) the company's marginal cost equation;
2) the quantity of production at which the company's profit is maximum;
3) the amount of the firm's total revenue;
4) the amount of the firm's total costs;
5) the amount of the firm's profit.

Solution:

1) Marginal costs are the derivative of total costs, so the company's marginal cost equation is

$$MC = TC' = 50 + 6 \cdot Q,$$

2) The condition of profit maximization is $MC=P$. Hence:

$$50 + 6 \cdot Q = 230,$$

therefore, the quantity of production that maximizes the company's profit is:

$$Q = 30 \text{ units.}$$

3) The amount of the firm's total revenue is:
$$TR = P \cdot Q = 230 \cdot 30 = 6{,}900 \text{ mu.}$$
4) The amount of the firm's total cost is:
$$TC = 50 \cdot Q + 3 \cdot Q^2 = 50 \cdot 30 + 3 \cdot 30^2 = 4{,}200 \text{ mu.}$$
5) The amount of the firm's profit is:
$$\pi = TR - TC = 6{,}900 - 4{,}200 = 2{,}700 \text{ mu.}$$

Task 8.2.

Given:

Total annual sales of the company's products equals $Q = 100{,}000$ units. Market price is $P = 2.0$ mu. Total production costs are $TC = 210{,}000$ mu, including fixed costs $TFC = 80{,}000$ mu. The company's management decided to stop production. Is this decision correct?

Find:

1) the amount of the firm's revenue;
2) the financial result of the company's activity;
3) the amount of variable costs;
4) the amount of average variable costs;
5) the ratio of price to average variable costs.
Is the management decision correct?

Solution:

1) The amount of the firm's revenue is:
$$TR = P \cdot Q = 2{,}0 \cdot 100{,}000 = 200{,}000 \text{ mu}$$
2) The financial result of the company's activity is:
$$\pi = TR - TC = 200{,}000 - 210{,}000 = -10{,}000 \text{ mu (loss).}$$
If the company stops its production, its losses will increase to the fixed costs, i.e. up to 80,000 mu.
3) The amount of variable costs is:
$$TVC = TC - TFC = 210{,}000 - 80{,}000 = 130{,}000 \text{ mu}$$
4) The amount of average variable costs is:
$$AVC = TVC / Q = 130{,}000 / 100{,}000 = 1.3 \text{ mu.}$$
5) The ratio of price to average variable costs is:
$$P > AVC$$
$$2.0 > 1.3.$$

The management decision is incorrect. The firm should continue production to minimize losses.

Tasks for the self-solution

Task 8.3.
Given:

An equilibrium price of 500 mu was formed in the market of pure competition. The function of the company's total costs has the form: $TC = 600 \cdot Q - 3 \cdot Q^2$.

Find:

1) the company's marginal cost equation;
2) the quantity of production at which the company's profit is maximum;
3) the amount of the firm's total revenue;
4) the amount of the firm's total costs;
5) the amount of the firm's profit.

Task 8.4.
Given:

Total annual sales of the company's products equals $Q = 200,000$ units. Market price is $P = 5.0$ mu. Total production costs are $TC = 1,100,000$ mu, including fixed costs $TFC = 1,000,000$ mu. The company's management decided to stop production. Is this decision correct?

Find:

1) the amount of the firm's revenue;
2) the financial result of the company's activity;
3) the amount of variable costs;
4) the amount of average variable costs;
5) the ratio of price to average variable costs.

Is the management decision correct?

Topic 9. Imperfect Competition

 Key terms on the topic

Pure monopoly is a market structure when a single firm is the sole producer of a product for which there are no close substitutes.

Monopsony is a market structure in which a single buyer substantially controls the market as the major purchaser of goods and services offered by many would-be sellers.

Bilateral monopoly is a market where there are one buyer and one seller.

Price discrimination is the sale of the same good to different consumers at different prices, the difference in prices being not connected with the difference in costs for production and delivery of goods to the market.

Monopolistic competition is a market structure where there is a relatively large number of sellers who sell differentiated products (often promoted through intensive advertising), and where there is an easy entry into and exit from the industry.

Oligopoly is a market dominated by a few large producers of a homogeneous or differentiated product.

Duopoly is an oligopoly at which there are two independent sellers of identical products at the market when there are plenty of buyers.

 Examples of task solutions

Task 9.1.
Given:

The function of demand for the products of the monopolist is: $P = 18 - Q$, the function of the total costs of the monopolist is: $TC = 14 + 2{\cdot}Q + Q^2$.

<u>Find:</u>

1) the function of marginal costs;

2) the function of marginal revenue;

3) the quantity of production at which the firm's profit is maximized;

4) the amount of total revenue;

5) the amount of total costs;

6) the amount of profit.

<u>Solution:</u>

1) The marginal cost function is found as a derivative of the total cost function:
$$MC = (TC)' = 2 + 2 \cdot Q$$

2) The marginal revenue function is found as a derivative of the total revenue function:
$$MR = (TR)'$$
$$TR = P \cdot Q = 18 \cdot Q - Q^2.$$
$$MR = 18 - 2Q$$

3) The quantity of production at which the firm's profit is maximized is according to the rule:
$$MC = MR$$

Therefore:
$$2 + 2 \cdot Q = 18 - 2 \cdot Q.$$

From here
$$4 \cdot Q = 16$$
$$Q = 4 \text{ units.}$$

4) The amount of total income is found by multiplying the price by the quantity of goods:
$$TR = P \cdot Q$$
$$P = 18 - Q = 18 - 4 = 14 \text{ mu}$$
$$TR = P \cdot Q = 14 \cdot 4 = 56 \text{ mu}$$

5) Using the total cost function, we find their amount:
$$TC = 14 + 2 \cdot Q + Q^2 = 14 + 2 \cdot 4 + 4^2 = 38 \text{ mu}$$

6) The amount of profit is found by subtracting total costs from total income:
$$\pi = TR - TC = 56 - 38 = 18 \text{ mu}$$

Task 9.2.

 <u>Given:</u>

The function of demand for the products of a monopolistic competitor is:

$P = 94 – 0.5·Q,$ the function of its total costs is: $TC = 100 + 10·Q + Q^2.$

 <u>Find:</u>

1) the function of marginal costs;

2) the function of marginal revenue;

3) the quantity of production at which the company's profit is maximized;

4) the amount of total revenue;

5) the amount of total costs;

6) the amount of company's profit.

 <u>Solution:</u>

1) The function of marginal costs is:
$$MC = (TC)' = 10 + 2·Q$$

2) The equation of marginal revenue is:
$$MR = (TR)'.$$
$$TR = P · Q = 94·Q – 0.5·Q^2.$$
$$MR = 94 – Q$$

3) The quantity of production at which the company's profit is maximized is:
$$MC=MR.$$
$$10 + 2·Q = 94 – Q$$
$$Q = 28 \text{ units.}$$

4) The amount of total revenue is:
$$TR = P · Q$$
$$P = 94 – 0.5·Q = 94 – 0.5·28 = 80 \text{ mu}$$
$$TR = P · Q = 80 ·28 = 2,240 \text{ mu}$$

5) The amount of total costs is:
$$TC = 100 + 10·Q + Q^2 = 100 + 10·28 + 28^2 = 1,164 \text{ mu}$$

6) The amount of company's profit is:
$$\pi = TR - TC = 2,240 – 1,164 = 1,076 \text{ mu.}$$

Task 9.3.

Given:

The function of demand for the products of the monopolist is: $P = 20 - Q$, the function of the total costs of the monopolist is: $TC = 10 + 4 \cdot Q + Q^2$.

Find:

1) the function of marginal costs;

2) the function of marginal revenue;

3) the quantity of production at which the firm's profit is maximized;

4) the amount of total revenue;

5) the amount of total costs;

6) the amount of profit.

Task 9.4.

Given:

The function of demand for the products of a monopolistic competitor is: $P = 14 - Q$, the function of its total costs is: $TC = 10 + Q^2 + 2 \cdot Q$.

Find:

1) the function of marginal costs;

2) the function of marginal revenue;

3) the quantity of production at which the company's profit is maximized;

4) the amount of total revenue;

5) the amount of total costs;

6) the amount of company's profit.

Case study

Case 9.1.

What type of market structure? [1]

Does the statement below better describe a firm operating in a perfectly competitive market or a firm that is a monopoly?

1. The demand curve faced by the firm is downward-sloping.
2. The demand curve and the marginal revenue curves are the same.
3. Entry and exit are relatively difficult.
4. The firm is likely to be concerned about antitrust laws.
5. Consumer surplus would be increased if the firm produced more output.

Case 9.2.

Monopolistic competition[2]

Suppose the monopolistically competitive barber shop industry in a community is in long-run equilibrium, and that the typical price is $20 per haircut. Moreover, the population is rising.

1. Illustrate the short-run effects of a change on the price and output of a typical firm in the market.

2. Show what happens in the long run. Will the final price be higher than $20? Equal $20? Be less than $20? Assume that nothing happens to the cost of producing haircuts.

3. Suppose that, initially, the price of a typical children's haircut is $10. Do you think this represents price discrimination? Why or why not?

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 441.
[2] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 489.

Topic 10. Characteristics of resource Markets

Key terms on the topic

Marginal product is an additional product produced by involving an additional unit of variable resource in the production process.

Marginal revenue product is the change in total revenue resulting from the use of each additional unit of a variable resource.

Marginal resource cost is amount that each additional unit of a resource adds to the firm's total cost.

Rule for employing resources: it will be profitable for a firm to hire additional units of a resource up to the point at which that resource's marginal revenue product is equal to its marginal resource cost.

Transfer earnings are the revenue that a given factor of production must receive in order to prevent its transfer to another area of use.

Economic rent is revenue received as payment for a resource whose supply is strictly limited.

Example of solving the task

Task 10.1.

Given:

The farm grows tomatoes. The function of tomato production quantity is:

$Q = 300 \cdot L - 1.5 \cdot L^2$, where L is the number of employees. The farm revenue function is: $TR = 20 \cdot Q$. The owner of the firm hires workers in a completely competitive labor market; the wage rate (w) of one worker is 900 mu.

Find:

1) the function of the marginal product of labor in physical terms;
2) the function of the marginal product of labor in monetary terms;
3) the optimal number of workers;
4) the quantity of production of tomatoes (round to the nearest tenths);
5) the total revenue of the farm.

Solution:

1) The marginal product function is a derivative of the total product function:
$$MP_L = TP'$$
So, the function of the marginal product of labor in physical terms is:
$$MP_L = Q' = 300 - 3L$$
2) The function of the marginal product of labor in monetary terms is:
$$MRP = MP \cdot MR$$
In conditions of perfect competition it is:
$$MRP = MP \cdot P$$
$$TR = P \cdot Q$$
From equation $TR = 20 \cdot Q$ it follows that $P = 20$ mu.
Therefore
$$MRP_L = MP_L \cdot P = (300 - 3L) \cdot 20 = 6,000 - 60 \cdot L$$
3) The optimal number of employees is found using the equilibrium condition:
$$MRP_L = MC_L = w$$
So,
$$6,000 - 60 \cdot L = 900$$
Then
$$L = 85 \text{ workers}$$
4) The quantity of production of tomatoes is:
$$Q = 300 \cdot L - 1.5 \cdot L^2 = 300 \cdot 85 - 1.5 \cdot 85^2 = 21,000 - 7,350 = 14,662.5$$
kilograms
5) The total revenue of the farm is:
$$TR = P \cdot Q = 20 \cdot 14,662.5 = 293,250 \text{ mu}$$

Task 10.2.

<u>Given</u>:

The farm grows tomatoes. The function of tomato production quantity is:

$Q = 450 \cdot L - 4.5 \cdot L^2$, where L is the number of employees. The farm revenue function is: $TR = 40 \cdot Q$. The owner of the firm hires workers in a completely competitive labor market; the wage rate (w) of one worker is 1,800 mu.

<u>Find</u>:

1) the function of the marginal product of labor in physical terms;

2) the function of the marginal product of labor in monetary terms;

3) the optimal number of workers;

4) the quantity of production of tomatoes (round to the nearest tenths);

5) the total revenue of the farm.

Topic 11. Labour Market

Key terms on the topic

Workforce is a set of physical, intellectual and organizational abilities of people, acquired skills and experience that are used in the production of goods and services.

Labour productivity (or **workforce productivity**) is the quantity of goods and services that a group of workers produces in a given time period.

The labour resources (or **workforce**, or **labour power**) is the number of people who are ready to be employed.

Employed people in the economy are people who are employed; self-employed people, including farmers, entrepreneurs, students and the military.

Unemployment is a socio-economic situation characterized by a state of disequilibrium in the labour market caused by an excess of labour supply over labour demand.

Employment rate is the ratio of the number of the employed to the total workforce.

Unemployment rate is the ratio of the number of the unemployed to the total workforce.

Wage (**salary**) is a total of payments received by an employee over a certain period of time.

The **wage rate** is the price paid per unit of labor services.

Nominal wage is the amount of money payed to an employee for a certain period of time.

Real wage is the quantity of goods and services a worker can obtain with nominal wages; real wages reveal the "purchasing power" of nominal wages.

Bilateral monopoly is the form of market structure, where there is a single seller and a single buyer.

Example of solving the task

Task 11.1.

Given:

The function of local market demand for labor in thousands of people is:

$D_L = 70 - w$, where w is the price of labor in mu per hour. The local market supply function is: $S_L = 4 \cdot w - 30$. The Government has set a minimum wage of 30 mu per hour. What is the market situation?

Find:

1) the equilibrium wage rate;
2) the equilibrium number of employees;
3) the demand for labour at a wage rate of 30 mu per hour;
4) the labour supply at a wage rate of 30 mu per hour;
5) the amount of excess or shortage of labour.

Solution:

1) The equilibrium wage rate is established in case of equality of supply and demand in the market:

$$D_L = S_L.$$

From here
$$70 - w = 4 \cdot w - 30$$
$$w_E = 20 \text{ mu}$$
2) The equilibrium number of employees is:
$$L_E = 70 - w = 70 - 20 = 50 \text{ thousands of people}$$
or
$$L_E = 4 \cdot w - 30 = 80 - 30 = 50 \text{ thousands of people}$$
3) The demand for labour at a wage rate of 30 mu per hour is:
$$D_{L(30 \text{ mu})} = 70 - w = 70 - 30 = 40 \text{ thousands of people}$$
4) The labour supply at a wage rate of 30 mu per hour is:
$$S_{L(30 \text{ mu})} = 4 \cdot w - 30 = 120 - 30 = 90 \text{ thousands of people}$$
The quantity of labor supply is greater than the quantity of demand for it. Therefore, there is unemployment or an excess of labor in the labor market.
5) The surplus labor force (unemployment) is:
$$U_{(30 \text{ mu})} = S_L - D_L = 90 - 40 = 50 \text{ thousands of people.}$$

Task for the self-solution

Task 11.2.

Given:

The function of local market demand for labor in thousands of people is: $D_L = 50 - w$, where w is the price of labor in mu per hour. The local market supply function is: $S_L = 6 + w$. The Government has set a minimum wage of 40 mu per hour. What is the market situation?

Find:

1) the equilibrium wage rate;
2) the equilibrium number of employees;
3) the demand for labour at a wage rate of 30 mu per hour;
4) the labour supply at a wage rate of 30 mu per hour;
5) the amount of excess or shortage of labour.

Case 11.1.

Law of minimum wage

A minimum wage law is another example of a price floor. Draw demand and supply curves for unskilled labor. The horizontal axis will show the quantity of unskilled labor per period and the vertical axis will show the hourly wage rate for unskilled workers, which is the price of unskilled labor[1].

Task:

Show and explain the effect of a minimum wage that is above the equilibrium wage.

Case 11.2.

Price elasticity of supply for child-care workers

The price elasticity of supply for child-care workers has been estimated to be quite high, about 2.0. What will happen to the wages of child-care workers as demand for them increases, compared to what would happen if the measured price elasticity of supply were lower?[2]

Task:

Show it on the graph.

Case 11.3.

Market for construction workers[3]

Assuming that the market for construction workers is perfectly competitive

Task:

Illustrate graphically how each of the following would affect the demand or supply for construction workers. What would be the impact on wages and on the number of construction workers employed?

[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 165.
[2] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 219.
[3] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 524

1. The demand for new housing increases as more people move into the community.

2. Changes in societal attitudes lead to more women wanting to work in construction.

3. Improved training makes construction workers more productive.

4. New technology allows much of the framing used in housing construction to be built by robots at a factory and then shipped to construction sites.

Topic 12. Capital Market

 Key terms on the topic

Capital is the cost used to make profit through economic activities based on voluntary exchange.

Working (or circulating) capital includes intermediate goods that are used up in the production process and change their form.

Fixed capital is any kind of real, physical asset that is used repeatedly in the production of a product.

Depreciation of fixed assets is the partial or total loss of the original cost of fixed assets, both in operation and inaction.

Physical depreciation of fixed assets is the loss of their original value due to their intensive use and the influence of natural forces, as a result of which fixed assets are destroyed and become unusable.

Moral depreciation of fixed assets is the loss of the value of fixed assets due to the creation of more productive and economical machinery as a result of scientific and technological progress.

Amortization of fixed assets is a transfer of the cost of the worn elements of fixed assets to the final product in the form of the costs included in the average total cost of production.

Amortization rate is the ratio of the annual amount of amortization charges to the average annual amount of fixed assets, expressed as a percentage.

Rate of return indicates the profit earned from capital investments, expressed as a percentage.

Loan capital is a set of monetary capital provided for temporary use on the terms of repayment and for a certain fee in the form of interest.

Interest rate is the ratio of the amount of interest that is paid over a specified period of time to the amount of the loan.

Nominal interest rate is the rate determined by commercial and state banks for credit operations, which is calculated without taking inflation into account.

Real interest rate is the interest rate cleared off inflation.

The Fisher effect: nominal interest rate changes so that the real rate remains the same.

Discounting income and costs is the setting of today's equivalent of the amount to be paid out in the future.

Task 12.1.

Given:

The amount of necessary investments in equipment is 250 thousand mu. The useful life of the equipment is 5 years. It is expected that it can be used to produce 100 thousand units of production per year, which can be sold on the market at 7 mu per unit. At the same time, production costs should not exceed 500 thousand mu.

Find:

1) the amount of expected total revenue of the firm;

2) the amount of expected profit;

3) the rate of return on capital;

4) the annual amortization amount;

5) the annual amortization rate.

Solution:

1) The amount of expected total revenue of the firm is:
$$TR = P \cdot Q = 7 \cdot 100{,}000 = 700{,}000 \text{ mu}$$

2) The amount of expected profit is:
$$\pi = TR - TC = 700{,}000 - 500{,}000 = 200{,}000 \text{ mu}$$

3) The rate of return on capital shows the profit per unit of invested capital:
$$N_c = \frac{\pi}{K} = \frac{200{,}000}{250{,}000} = 0.8 \text{ or } 80\,\%$$

4) The annual amortization amount is:
$$A = \frac{K}{T} = \frac{250{,}000}{5} = 50{,}000 \text{ mu}$$

5) The annual amortization rate is:
$$r_A = \frac{A}{K} \cdot 100\,\% = \frac{50{,}000}{250{,}000} = 20\,\%$$

Task 12.2.

Given:

Investment amount (PV) is 100,000 mu. Interest rate is 5% (or 0.05). Inflation rate is 4% (or 0.04).

Find:

1) the real rate of interest;

2) the future value of today's money (FV) over three years;

3) the interest income over three years.

Solution:

1) The real rate of interest is found by the formula:
$$r_r = \frac{1+r_n}{1+i} - 1.$$

From here
$$r_r = \frac{1+0.05}{1+0.04} - 1 = 0.01$$

2) The future value of today's money is found by the formula:
$$FV = PV(1+r)^t$$

So, the future value of today's money over three years is:
$$FV = 100{,}000\,(1+0.01)^3 = 103{,}030 \text{ mu}$$

3) The interest income over three years is:
$$\text{Interest income} = 103{,}030 - 100{,}000 = 3{,}030 \text{ mu}$$

Task 12.3.

   Given:

Investment amount (I) is 100,000 mu. The future value of income (FV) is 150,000 mu.

Risk-free returns rate (r_f) is 3 % (or 0.03). Inflation rate (i) is 4% (or 0.04). Risk rate (r_{isk}) is 3 % (or 0.03). Project time frame (t) is 3 years.

   Find:

1) the discount rate (d);

2) the present value (PV);

3) the net present value (NPV).

   Solution:

1) The discount rate is found by the formula:
$$d = r_f + i + r_{isk}$$

   From here
$$d = 0.03 + 0.04 + 0.03 = 0.1$$

2) The present value is found by the formula:
$$PV = \sum_{i=1}^{n} \frac{FV}{(1+d)^t}$$

   From here
$$PV = 150{,}000 \, / \, (1+0.1)^3 = 112{,}697 \text{ mu}$$

3) The net present value is found by the formula:
$$NPV = PV - I$$

   From here
$$NPV = 112{,}697 - 100{,}000 = 12{,}697 \text{ mu.}$$

Task 12.4.

   Given:

Suppose that you have the amount of money of 700,000 mu. You can place it as a bank deposit for three years at an annual interest rate of 10%. The forecasted annual inflation rate will not exceed 7% per year.

   Find:

1) the real rate of interest (r_r);

2) the future value of today's money (*FV*);

3) the interest income over three years (*I*);

4) how much money do you need to put in the bank today so that you can buy a car for 760,000 mu in three years' time;

5) how much money do you need to put in the bank today so that you can buy a flat in three years' time at a price of 2,000,000 mu;

6) do you have enough money to buy a car?

7) do you have enough money to buy a flat?

Solution:

1) The real rate of interest is found by the formula:

$$r_r = \frac{1+r_n}{1+i} - 1$$

From here

$$r_r = (1+0.1)/(1+0.07) - 1 = 0.028 \text{ or } 2.8\%.$$

2) The future value of today's money is found by the formula:

$$FV = PV \cdot (1+r)^t =$$

From here

$$FV_p = 700\,000 \cdot (1+0{,}028)^3 = 760{,}462 \text{ mu.}$$

3) The interest income over three years is:

$$I = FV - PV = 760{,}462 - 700{,}000 = 60{,}462 \text{ mu.}$$

4) The amount of money to put in the bank today to buy a car in three years we can find using the formula:

$$PV = \sum_{i=1}^{n} \frac{FV}{(1+d)^t}$$

From here

$$PV \text{ (car)} = 760{,}000 / (1+0{,}028)^3 = 699{,}558 \text{ mu.}$$

5) The amount of money to put in the bank today to buy a flat in three years:

$$PV \text{ (flat)} = 2{,}000{,}000 / (1+0{,}028)^3 = 1{,}840{,}943 \text{ mu.}$$

6) Yes (700,000 > 699,558).

7) No (700,000 < 1,840,943).

The task 12.5.

Given:

The amount of necessary investments in equipment is 300 thousand mu. The useful life of the equipment is 5 years. It is expected that it can be used to produce 200 thousand units of production per year, which can be sold on the market at 5 mu per unit. At the same time, production costs should not exceed 800 thousand mu.

Find:

1) the amount of expected total revenue of the firm;

2) the amount of expected profit;

3) the rate of return on capital;

4) the annual amortization amount;

5) the annual amortization rate.

Task 12.6.

Given:

You have an amount of 600 mu. You can place it for three years in the bank deposit at 9% per annum. The projected annual inflation will not exceed 7% per year.

Find:

1) the amount that you will receive in three years by placing it in a bank at a nominal 9% per annum;

2) the real interest rate;

3) the amount that you will receive in three years, taking into account the real bank interest rate;

4) how much money do you need to place in the bank today so that in three years you can buy a car at a price of 900 mu

Task 12.7.

Given:

The Bank pays its depositors a bank interest of 4% per annum and issues a loan to borrowers at 10% per annum. What is the annual bank profit from depositors' funds of 100,000 mu when issuing loans to borrowers of 50,000 mu?

Find:

1) the annual amount of payments on deposits (P_d);

2) the annual amount of interest income on loans (I_l);

3) the profit of bank (π).

Case study

Case 12.1.

Helping a friend[1]

Suppose your friend Sara asks you to lend her $5,000 so she can buy a used car. She tells you she can pay you back $5,200 in a year. Reliable Sara always keeps her word. Suppose the interest rate you could earn by putting the $5,000 in a savings account is 5%.

Questions:

1) What is the present value of her offer?

2) Is it a good deal for you or not?

3) What if the interest rate on your savings account is only 3%?

Case 12.2.

Aging baby boomers[2]

Suppose that baby boomers become increasingly concerned about whether or not the government will really have the funds to make Social Security payments to them over their retirement years. As a result, they boost saving now.

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 543.
[2] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 561.

Question:

How would their decisions affect the market for loanable funds and the demand curve for capital?

Case 12.3.

Oil Magnate[1]

You have just been given an oil well in Texas by Aunt Carmen. The current price of oil is $45 per barrel, and it is estimated that your oil deposit contains about 10,000 barrels of oil. For simplicity, assume that it does not cost anything to extract the oil and get it to market and that you must decide whether to empty the well now or wait until next year. Suppose the interest rate is 10% and that you expect that the price of oil next year will rise to $54 per barrel.

Questions:

What should you do?

Would your decision change if the choice were to empty the well now or in two years?

Case 12.4.

Coin Collection[2]

You have been given a coin collection. You have no personal interest in coins; your only interest is to make money from it. You estimate that the current value of the collection is $10,000. You are told the coins are likely to rise in value over time by 5% per year.

Questions:

What should you do with the collection?

On what factors does your answer depend?

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 569.
[2] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 577.

Topic 13. Land Market

Key terms on the topic

Land as a factor of production means all natural resources used in the production process.

Land rent is the price paid for the use of land and other natural resources that have a strictly fixed amount of supply.

The net (absolute) rent shall be paid by the tenant from all land plots regardless of fertility and available resources, and is conditioned by the monopoly of private or state ownership of land.

Differential rent is an additional income, which is achieved through a more fertile land plot.

Differential rent I is an additional income, the source of which is the natural fertility of the land, as well as better location of land plots in relation to markets, transport routes, processing enterprises, etc.

Differential rent II is associated with additional investments into a certain plot of land, which provide an additional income in the future.

Renewable natural resources include things like forests and wildlife, which are capable of growing back, or renewing themselves, if they are harvested at moderate rates.

Nonrenewable natural resources include things like oil, coal, and metals, which either are in actual fixed supply or are renewed so slowly as to be in virtual fixed supply when viewed from a human time perspective.

Example of solving the task

Task 13.1.

<u>Given:</u>

A farmer can grow an average of $Q = 400,000$ kg of potatoes per year on his own plot of land. The price of one kilo of potatoes $P = 10$ mu. Total costs of growing potatoes are described by the equation: $TC = 500,000 + 8 \cdot Q$. The current bank interest rate is 10 % per annum. It is expected to decline to 8 % next year.

Find:

1) the amount of total revenue;

2) the amount of total costs;

3) the amount of rent income from the use of this land plot;

4) the current market price of land;

5) the land price in the next year.

Solution:

1) The amount of total revenue is:
$$TR = P \cdot Q = 10 \cdot 400{,}000 = 4{,}000{,}000 \text{ mu}$$

2) The amount of total costs for growing potatoes is:
$$TC = 500{,}000 + 8 \cdot Q = 500{,}000 + 8 \cdot 400{,}000 = 3{,}700{,}000 \text{ mu}$$

3) The amount of rent income from the use of this land plot is:
$$R = TR - TC = 4{,}000{,}000 - 3{,}700{,}000 = 300{,}000 \text{ mu}$$

4) The current market price of land is:
$$P_L(\text{current}) = \frac{R}{r} = \frac{300{,}000}{0.1} = 3{,}000{,}000 \text{ mu.}$$

5) The price of land next year is:
$$P_L(\text{next year}) = \frac{R}{r} = \frac{300{,}000}{0.08} = 3{,}750{,}000 \text{ mu.}$$

Task for the self-solution

Task 13.2.

Given:

A farmer can grow an average of $Q = 700{,}000$ kg of potatoes per year on his own plot of land. The price of one kilo of potatoes $P = 11$ mu. Total costs of growing potatoes are described by the equation: $TC = 800{,}000 + 5 \cdot Q$. The current bank interest rate is 10 % per annum. It is expected to grow to 12 % next year.

Find:

1) the amount of total revenue;

2) the amount of total costs;

3) the amount of rent income from the use of this land plot;

4) the current market price of land;

5) the land price in the next year.

PART 4. MARKET AND GOVERNMENT

Topic 14. Government regulation of the market

Key terms on the topic

Price controls are government rules or laws that inhibit the formation of market-determined prices.

Quotas are physical restrictions on output.

Subsidy is a one-off benefit, provided from the budget or from special funds to individuals or legal entities, local authorities or other States.

Examples of task solutions

Task 14.1.

Given:

The demand function is: $Q_D = 30 - P$. The supply function is: $Q_S = 4 \cdot P - 20$.

Find:

1) the equilibrium price;

2) the equilibrium quantity of sales;

3) the market situation (surplus or shortage) at the government price fixing at the level of 8 mu;

4) the market situation (surplus or shortage) at the government price fixing at the level of 11 mu.

Solution:

1) The equilibrium price is set when supply and demand are equal:
$$Q_D = Q_S.$$

From here
$$30 - P = 4 \cdot P - 20.$$

Therefore
$$P_E = 10 \text{ mu.}$$
2) Using the equilibrium price, we calculate the equilibrium quantity:
$$Q_D = 30 - P = 30 - 10 = 20 \text{ units,}$$

or
$$Q_S = 4 \cdot P - 20 = 4 \cdot 10 - 20 = 20 \text{ units.}$$
Therefore
$$Q_E = 20 \text{ units.}$$
3) At the price set by the government at 8 mu, the demand is equal to:
$$Q_D(8) = 30 - 8 = 22 \text{ units.}$$
In this case, the supply is equal to:
$$Q_S(8) = 4 \cdot 8 - 20 = 12 \text{ units.}$$
Demand exceeds supply:
$$Q_D > Q_S$$
$$22 > 12$$
Consequently, it is shortage of goods:
$$Shortage = Q_D - Q_S = 22 - 12 = 10 \text{ units.}$$
4) At the price set by the government at 11 mu, the demand is equal to:
$$Q_D(11) = 30 - 11 = 19 \text{ units.}$$
In this case, the supply is equal to:
$$Q_S(11) = 4 \cdot 11 - 20 = 24 \text{ units.}$$
Demand is less than supply:
$$Q_D < Q_S$$
$$19 < 24$$
Consequently, it is surplus of goods:
$$Surplus = Q_S - Q_D = 24 - 19 = 5 \text{ units.}$$

Task 14.2.
Given:
The demand function is: $Q_D = 100 - P$. The supply function is: $Q_S = 2 \cdot P - 50$.
The Government introduces 10% sales tax.
Find:
1) the equilibrium price before the introduction of the tax;
2) the equilibrium sales quantity before the introduction of the tax;

3) new supply function after the introduction of the tax;

4) the equilibrium price after the introduction of the tax;

5) the equilibrium sales quantity after the introduction of the tax;

6) the producer's price.

Solution:

1) The equilibrium price before the introduction of the tax was:

$$Q_D = Q_S$$
$$100 - P = 2 \cdot P - 50$$
$$P_E = 50 \text{ mu}$$

2) The equilibrium sales quantity before the introduction of the tax was:

$$Q_D = 100 - P = 100 - 50 = 50 \text{ units.}$$
$$Q_S = 2 \cdot P - 50 = 2 \cdot 50 - 50 = 50 \text{ units.}$$
$$Q_E = 50 \text{ units.}$$

3) The new supply function after the introduction of the tax is:

$$Q_{ST} = 2 \cdot 0.9\, P - 50 = 1.8\, P - 50$$

4) The equilibrium price after the introduction of the tax (rounded to the nearest hundredths) is:

$$Q_D = Q_{ST}$$
$$100 - P = 1.8\, P - 50$$
$$150 = 2.8P$$
$$P_T = 53.57 \text{ mu}$$

5) The equilibrium sales quantity after the introduction of the tax (rounded to the nearest whole number) is:

$$Q_{DT} = 100 - P_T = 100 - 53.57 = 46.43 = 46 \text{ units}$$
$$Q_{ST} = 1.8\, P_T - 50 = 1.8 \cdot 53.57 - 50 = 46.43 = 46 \text{ units.}$$
$$Q_T = 46 \text{ units}$$

Thus, the equilibrium market price rises by 3.57 mu and the equilibrium volume drops by 4 units.

6) The producer's price is:

$$P_S = P_T - T = 53.57 - 0.1 \cdot 53.57 = 48.21 \text{ mu.}$$

Task 14.3.

Given:

The demand function is: $Q_D = 1{,}200 - 5 \cdot P$. The supply function is: $Q_S = 500 + 5 \cdot P$. The Government introduces a subsidy to the producer in the amount of 10 mu per unit of production.

Find:

1) the equilibrium price before the introduction of the subsidy;

2) the equilibrium sales quantity before the introduction of the subsidy;

3) new supply function after the introduction of the subsidy;

4) the equilibrium price after the introduction of the subsidy;

5) the equilibrium sales quantity after the introduction of the subsidy;

6) the price for the producer after the introduction of the subsidy.

Solution:

1) The equilibrium price before the introduction of the subsidy was:

$$Q_D = Q_S$$
$$1{,}200 - 5 \cdot P = 500 + 5 \cdot P$$
$$700 = 10P$$
$$P_E = 70 \text{ mu}$$

2) The equilibrium sales quantity before the introduction of the subsidy was:

$$Q_D = 1{,}200 - 5 \cdot P = 1{,}200 - 5 \cdot 70 = 850 \text{ units.}$$
$$Q_S = 500 + 5 \cdot P = 500 + 5 \cdot 70 = 850 \text{ units.}$$
$$Q_E = 850 \text{ units}$$

3) New supply function after the introduction of the subsidy is:

$$Q_{SH} = 500 + 5(10+P) = 500 + 50 + 5P = 550 + 5P$$

4) The equilibrium price after the introduction of the subsidy is:

$$Q_D = Q_{SH}$$
$$1200 - 5 \cdot P = 550 + 5 \cdot P$$
$$650 = 10P$$
$$P_H = 65 \text{ mu.}$$

5) The equilibrium sales quantity after the introduction of the subsidy is:

$$Q_D = 1{,}200 - 5 \, P_H = 1{,}200 - 5 \cdot 65 = 1{,}200 - 325 = 875 \text{ units.}$$
$$Q_{SH} = 550 + 5 \, P_H = 550 + 5 \cdot 65 = 550 + 325 = 875 \text{ units.}$$

So, The equilibrium market price decreased by 5mu, and the equilibrium volume increased by 25 units.

6) The price for the producer after the introduction of the subsidy is:

$$P_S = P_H + H = 65 + 10 = 75 \text{ mu.}$$

Task 14.4.

Given:

The demand function is: $Q_D = 800 - P$. The supply function is: $Q_S = 2 \cdot P - 700$.

Find:

1) the equilibrium price;

2) the equilibrium quantity of sales;

3) the market situation (surplus or shortage) at the government price fixing at the level of 400 mu;

4) the market situation (surplus or shortage) at the government price fixing at the level of 700 mu.

Task 14.5.

Given:

The demand function is: $Q_D = 150 - P$. The supply function is: $Q_S = 9 \cdot P - 50$.
The Government introduces 5% excise tax.

Find:

1) the equilibrium price before the introduction of the tax;

2) the equilibrium sales quantity before the introduction of the tax;

3) new supply function after the introduction of the tax;

4) the equilibrium price after the introduction of the tax;

5) the equilibrium sales quantity after the introduction of the tax;

Task 14.6.

Given:

The demand function is: $Q_D = 1,500 - 8 \cdot P$. The supply function is: $Q_S = 600 + 12 \cdot P$.
The Government introduces a subsidy to the producer in the amount of 10 mu per unit of production.

Find:

1) the equilibrium price before the introduction of the subsidy;

2) the equilibrium sales quantity before the introduction of the subsidy;

3) new supply function after the introduction of the subsidy;

4) the equilibrium price after the introduction of the subsidy;

5) the equilibrium sales quantity after the introduction of the subsidy;

Topic 15. Market Failure and Government Failure

Key terms on the topic

Market failures are situations when the market is unable to allocate the available resources efficiently.

Private good is a good that is consumed individually by the person who paid for it.

Rivalry means that when one person buys and consumes a product, it is not available for another person to buy and consume.

Excludability means that people who could not pay for the product cannot get it.

Public good is a good that is collectively consumed by all citizens, whether they pay for it or not.

Non-rivalry means that the consumption of a good by one person does not preclude consumption of the good by others.

Non-excludability means there is no effective way of excluding individuals from consumption of a good as soon as it comes into existence.

The free-rider problem is an economic phenomenon meaning that a consumer of a public good tries to avoid paying for it.

Externality is a cost or a benefit accruing to an individual or group – a third party – that is external to a market transaction/

Marginal social benefits are the sum of the marginal private benefits and the marginal external benefits/

Marginal social costs is the sum of marginal private costs and marginal external costs.

Negative externality occurs when the activity of one economic agent causes costs for others.

Positive externality occurs when the activities of one economic agent bring benefits to others.

Corrective tax is a tax on the production of a good by which marginal private costs rise to the level of marginal social costs, causing increase of prices and reduction of output.

Corrective subsidy is a subsidy by which marginal private benefits increase to the level of marginal social benefits, causing increased output.

Examples of task solutions

Task 15.1.

Given:

A chemical company produces products that benefit society and pollute the environment. Function of the total positive effect without taking into account environmental pollution is: $TSB = 50 \cdot Q - Q^2$. Private cost function of the enterprise is: $TPC = 2 \cdot Q + Q^2$. Function of cumulative damage to nature and society is: $TEC = 8Q$.

Find:

1) the output and price of the company;

2) the amount of the corrective tax (T) per unit of production;

3) the optimum output and optimum price from the point of view of the whole society;

4) the public losses from negative externality;

5) the amount of the corrective tax.

Solution:

1) The producer's equilibrium point is point *E* (Fig. 7). The supply and demand curves intersect at this point. The demand curve corresponds to the marginal social benefit, and the supply curve corresponds to the marginal private cost. Consequently, to find the coordinates of the producer equilibrium point, we need to find the functions *MSB* and *MPC*.
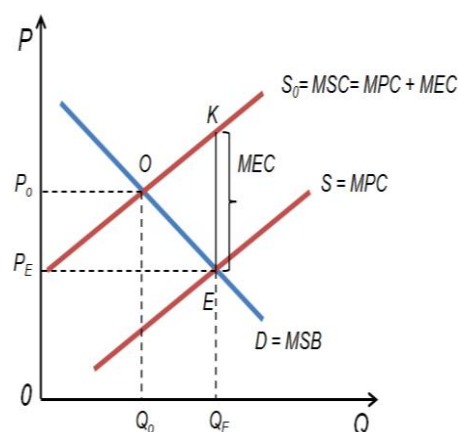

Fig. 7. Negative Externality

We can find *MSB* function as derived from *TSB* function:

$$MSB = TSB' = 50 - 2 \cdot Q.$$

We can to find the *MPC* function as derived from *TPC* function:

$MPC = TPC' = 2 + 2 \cdot Q$ At the producer's equilibrium point, demand and supply are equal. Therefore, we equate the functions *MSB* and *MPC*.

$$50 - 2 \cdot Q = 2 + 2 \cdot Q$$
$$Q_E = 12 \text{ units.}$$
$$P_E = 50 - 2 \cdot 12 = 26 \text{ mu.}$$

So, the equilibrium output (optimum output from the point of view of the producer) is 12 units and the equilibrium price in this case is 26 mu.

2) Corrective tax is set at a rate equal to the marginal external cost per unit of output. We can find the marginal external cost as a derivative of the total external cost:

$$T = MEC = TEC' = 8 \text{ mu.}$$

So, the amount of the corrective tax per unit of production is 8 mu.

3) The optimum point for society is point *O* (Fig. 7). At this point, the demand curve *MSB* and the supply curve *MSC* intersect. We know the function of the demand curve - it is the *MSB* function. We can find the *MSC* function by adding *MPC* and *MEC*:

$$MSC = MPC + MEC = 2 + 2 \cdot Q + 8 = 10 + 2 \cdot Q.$$

We will find the equilibrium point (O) after introducing the corrective tax from equality:

$$MSB = MSC.$$

From here
$$50 - 2 \cdot Q = 10 + 2 \cdot Q$$
$$Q_O = 10 \text{ units.}$$
$$P_O = 50 - 2 \cdot 10 = 30 \text{ mu.}$$

So, the optimum output from the point of view of the whole society is 10 units and the equilibrium price in this case is 30 mu.

We see that the equilibrium output is higher than the socially necessary output and the equilibrium price is lower than the socially necessary price. The introduction of a corrective tax eliminates these imbalances.

4) The total damage from negative externality is expressed by the area of the *OKE* triangle (Fig. 5). Note that $KE = MEC = T = 8$ mu. The height of this triangle, omitted from O on KE, is equal to the difference $Q_E - Q_O = 12 - 10 = 2$ units.

Therefore
$$\text{Public losses} = 0.5 \cdot T \cdot (Q_E - Q_O) = 0.5 \cdot 8 \cdot 2 = 8 \text{ mu.}$$

5) We can find the amount of corrective tax by multiplying the tax rate by the output:
$$\Sigma T = T\,(Q_T) \cdot Q_T = 8 \cdot 10 = 80 \text{ mu.}$$

Task 15.2.

Given:

The function of total social costs (thousand mu) for training one student is: $TSC = 5 + 3 \cdot Q + 0.25 \cdot Q^2$, where Q is the number of graduates, thousand people per year. The function of the external positive effect from the activities of university graduates per year is: $TEB = 8 \cdot Q$. The marginal benefit function of universities is: $MPB = 20 - 0.5 \cdot Q$.

Find:

1) the equilibrium number of graduates and the cost of education per year;

2) the optimal number of graduates from the position of the whole society

3) the optimal cost of education per year from the point of view of the whole society;

4) the amount of the corrective subsidy per student (G);

5) the total amount of the corrective subsidy (ΣG).

    <u>Solution:</u>

1) The producer's equilibrium point is point E (Fig. 8). The supply and demand curves intersect at this point. The demand curve corresponds to the marginal private benefit (MPB), and the supply curve corresponds to the marginal social cost (MSC).
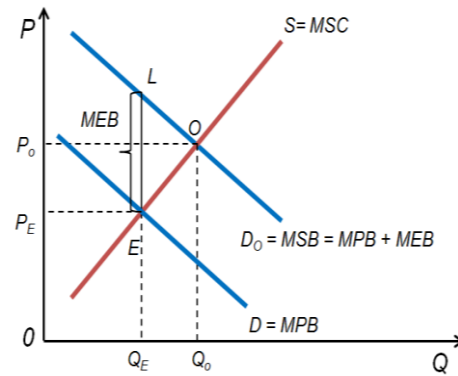

Fig. 8. Positive Externality

    The function of the MPB is known to us. Consequently, to find the coordinates of the producer equilibrium point, we need to find the functions of MSC. We can find this function as a derivative of *TSC*:

$$MSC = TSC' = 3 + 0.5 \cdot Q.$$

    So we have found the function of the supply curve. At the producer's equilibrium point E, demand and supply are equal. Therefore, we equate the functions MSC and MPB:

$$MSC = MPB.$$

$$3 + 0.5 \cdot Q = 20 - 0.5 \cdot Q$$

$$Q_E = 17 \text{ thousand graduates.}$$

    We know the equilibrium output, so we can calculate the equilibrium price:

$$P_E = 20 - 0.5 \cdot Q = 20 - 0.5 \cdot 17 = 11.5 \text{ thousand mu}$$

2) The optimum point for society is point O (Fig. 8). At this point, the demand curve MSB and the supply curve MSC intersect. We know the function of the supply curve and we can find the MSB function as $MSB = MPB + MEB$.

    The function of the MPB is known to us. We need to find the MEB function. We can find this function as a derivative of the function *TEB*:

$$MEB = TEB' = 8 \text{ thousand mu.}$$

    Now we can find the MSB function by adding MPB and MEB:

$$MSB = 20 - 0.5 \cdot Q + 8 = 28 - 0.5 \cdot Q.$$

    We can now equate the MSB and MSC functions to find the coordinates of the optimum point for society as a whole:

$$MSB = MSC.$$

Then
$$28 - 0.5 \cdot Q = 3 + 0.5 \cdot Q,$$
$$25 = Q.$$

From here
$$Q_O = 25 \text{ thousand graduates.}$$

Hence the optimal number of graduates from the position of the whole society is $Q_O = 25$ thousand graduates.

3) We know the optimal number of graduates, so we can calculate the optimal costs of education per year from the point of view of the whole society. To do this, we will use the supply function:
$$P_O = MSC = 3 + 0.5 \cdot Q = 3 + 0.5 \cdot 25 = 15.5 \text{ thousand mu.}$$

Hence the optimal cost of education per year from the point of view of the whole society is 15.5 thousand mu.

4) The corrective subsidy (G) is set to be equal to the marginal external benefits:
$$G = MEB = 8 \text{ thousand mu.}$$

So, the amount of the corrective subsidy per student is 8 thousand mu.

5) The total amount of subsidy (ΣG) is determined by multiplying the number of graduates by the amount of subsidy for one graduate:
$$\Sigma G = G(Q_O) \cdot Q_O = 8 \text{ thousand mu} \cdot 25 \text{ thousand graduates} =$$
$$= 200 \text{ million mu.}$$

Tasks for the self-solution

Task 15.3.

Given:

The food processing plant produces products that benefit society, expressed by the function $TSB = 400 \cdot Q - 5 \cdot Q^2$. Its private costs function is $TPC = 180 \cdot Q + Q^2$. But this plant pollutes the environment. Function of cumulative damage to nature and society is: $TC = 10 \cdot Q + 1,5 \cdot Q^2$.

Find:

1) the equilibrium output of the company;

2) the equilibrium price of the company;

3) the amount of the corrective tax (T) per unit of production;

4) the optimum output from the point of view of the whole society;

5) the optimum price from the point of view of the whole society;

6) the amount of the corrective tax (ΣT).

Task 15.4.

Given:

The function of total social costs (thousand mu) for training one student is: $TSC = 10 + 6 \cdot Q + 0.5 \cdot Q^2$, where Q is the number of graduates, thousand people per year. The function of the external positive effect from the activities of university graduates per year is: $TEB = 10 \cdot Q$. The marginal benefit function of universities is: $MPB = 40 - Q$.

Find:

1) the equilibrium number of graduates and the cost of education per year;

2) the optimal number of graduates from the position of the whole society

3) the optimal cost of education per year from the point of view of the whole society;

4) the amount of the corrective subsidy per student (G);

5) the total amount of the corrective subsidy (ΣG).

Case 15.1.

Market Failure [1]

Here is a list of actual and proposed government programs. Each is a response to one of the justifications for government activity described in the text: correction of market failure (due to public goods, external costs, external benefits, or imperfect competition); encouragement or discouragement of consumption due to consumers not making rational choices; and redistribution of income.

Task:

In each case, identify the source of demand for the activity described.

1. The Justice Department sought to prevent Microsoft Corporation from releasing Windows '98, arguing that the system's built-in Internet browser represented an attempt by Microsoft to monopolize the market for browsers.

2. In 2004, Congress considered a measure that would extend taxation of cigarettes to vendors that sell cigarettes over the Internet.

3. The federal government engages in research to locate asteroids that might hit the earth, and studies how impacts from asteroids could be prevented.

4. The federal government increases spending for food stamps for people whose incomes fall below a certain level.

5. The federal government increases benefits for recipients of Social Security.

6. The Environmental Protection Agency sets new standards for limiting the emission of pollutants into the air.

7. A state utilities commission regulates the prices charged by utilities that provide natural gas to homes and businesses.

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[1] Rittenberg L., Tregarthen T. Microeconomics Principles. 2012. P 632.

Case 15.2.

Taxation

Consider three goods, A, B, and C. The prices of all three goods are determined by demand and supply (that is, the three industries are perfectly competitive) and equal $100. The supply curve for good A is perfectly elastic; the supply curve for good B is a typical, upward-sloping curve; and the supply curve for good C is perfectly inelastic. Suppose the federal government imposes a tax of $20 per unit on suppliers of each good.

Tasks:

1) Explain and illustrate graphically how the tax will affect the price of each good in the short run.

2) Show whether the equilibrium quantity will rise, fall, or remain unchanged.

3) Who bears the burden of the tax on each good in the short run?

ANSWERS TO THE TASKS FOR SELF-SOLUTION

Part 1. Introduction to Economics

Topic 1. Economics and Economic Systems

Task 1.2.

1) the maximum quantity of good x, which can be produced = 10 units;

2) the maximum quantity of good y, which can be produced = 900 units;

3) the new equation of the *PPC*, if the new production technology will allow the production of good y twice as much: $9 \cdot x^2 + 0.5 \cdot y = 900$.

Topic 3. Market and market Equilibrium

Task 3.3.

1) the equilibrium price = 10 mu;

2) the equilibrium quantity of sales = 20 units;

3) surplus = 25 mu;

4) shortage = 15 mu.

Task 3.4.

1) the equilibrium price = 10 mu;

2) the equilibrium quantity of sales 10 units;

3) the maximum price = 28 mu;

4) the minimum price = 5 mu;

5) the surplus of consumer = 280 mu;

6) the surplus of producer = 50 mu;

7) the public benefit of sellers and buyers = 330 mu.

Topic 4. Elasticity of Supply and Demand

Task 4.5.

1) $Q_D = 30$;

2) $Q_D = 29$;

3) the percentage change in the quantity demanded = -0.034;

4) the percentage change in the price = 0.025;

5) $\varepsilon_D. = -1.36$ or $|1.36|$

This product belongs to the group of elastic in price.

Task 4.6.

1) percentage change in the price of "Mars" = 0.078 or 7.8 %;

2) percentage change in demand for Mars = -0.182 or 18.2 %;

3) percentage change in demand for "Snickers" = 0.222 or 22.2 %;

4) the coefficient of cross elasticity of demand for "Snickers" = 0.2846;

5) these are substitute products, because the cross-elasticity coefficient is greater than zero.

Task 4.7.

1) percentage change in consumer income = 0.222 or 22.2 %;

2) percentage change in demand for boiled sausage = -0.400 or 40.0 %;

3) percentage change in pork demand = 0.364 or 36.4 %;

4) the coefficient of elasticity of demand for income for boiled sausage = -1.80;

5) the coefficient of elasticity of demand for pork income = 1.64;

6) boiled sausage is inferior good (its income-elasticity coefficient is negative), pork is normal good (its income-elasticity coefficient is positive).

Task 4.8.

1) percentage change in the supply quantity = 0.400 or 40.0 %;

2) the percentage change in the price = 0.316 or 31.6 %;

3) the coefficient of price elasticity of supply = 1.27.

4) the coefficient is more than one; therefore, the supply is elastic in price.

Part 2. Microeconomics of Product Markets

Topic 5. Consumer Behavior

Task 5.3.

1) the function of marginal utility: $MU = 160 - 4 \cdot Q$;

2) the saturation point of the viewer = 40 pages;

3) the total utility of the reader at the saturation point = 3,200 u;

4) the total utility of the reader when reading 60 pages = 2,400 u;

5) the marginal utility of the reader when reading 60 pages = -80 u.

Task 5.4.

1) the budget line equation for a given consumer: $310 = 30\ Q_X + 50\ Q_Y$;

2) the maximum quantity of Milk he/she can buy = 10 liters;

3) the maximum quantity of Kefir he/she can buy = 6 liters;

4) the optimal quantity of Kefir for this consumer = 5 liters;

5) the optimal quantity of Milk for this consumer = 2 liters.

Topic 6. Producer Behaviour

Task 6.2.

1) the labour productivity of five workers = 8 units;

2) the marginal product of the sixth worker = 20 units;

3) the labour productivity of six workers = 10 units;

4) the marginal product of the seventh worker = 10 units;

5) the labour productivity of seven workers = 10 units.

Topic 7. Costs and Profits of the Firm

Task 7.4.

  Find:

1) program *A*: the costs of producing parts = 6,000,000 mu;

2) program *A*: the costs of buying parts = 5,500,000;

  It is cheaper to buy parts, the economy equals 500,000 mu;

3) program *B*: the costs of parts production = 16,000,000 mu;

4) program *B*: the costs of buying parts = 16,500,000 mu;

   Own production of parts is cheaper, the economy equals 500,000 mu.

Task 7.5.

1) $TFC = 750$;

2) $AFC = 750 / Q$;

3) $TVC = 30·Q^2 + 4·Q$;

4) $AVC = 30·Q + 4$

5) $ATC = 30·Q + 4 + 750 / Q$

6) $MC = 60·Q + 4$.

Task 7.6.

1) $TR = 600,000$ mu;

2) $TVC = 150,000$ mu;

3) $TC = 350,000$ mu;

4) $\pi = 250,000$;

5) $\pi_{TR} = 41.67$ %;

6) $\pi_{TC} = 71.43$ %.

Topic 8. Pure Competition

Task 8.3.

1) $MC = 600 - 6·Q$;

2) $Q_{opt} = 100$ units;

3) $TR = 50,000$ mu;

4) $TC = 30,000$ mu;

5) $\pi = 20,000$ mu.

Task 8.4.

1) $TR = 1,000,000$ mu;

2) $\pi = -100,000$ mu;

3) $TVC = 100,000$ mu;

4) $AVC = 0.5$ mu

5) $P > AVC$; $5.0 > 0.5$

The management decision is incorrect.

Topic 9. Imperfect Competition

Task 9.3.

1) $MC = 4 + 2 \cdot Q$;

2) $MR = 20 - 2 \cdot Q$;

3) $Q_{opt} = 4$ units;

4) $TR = 64$ mu;

5) $TC = 42$ mu;

6) $\pi = 22$ mu.

Task 9.4.

1) $MC = 2 \cdot Q + 2$;

2) $MR = 14 - 2 \cdot Q$;

3) $Q_{opt} = 3$ units;

4) $TR = 33$ mu;

5) $TC = 25$ mu;

6) $\pi = 8$ mu.

Part 3. Microeconomics of resource Markets

Topic 10. Characteristics of resource Markets

Task 10.2.

1) $MP_L = 450 - 9 \cdot L$;

2) $MRP_L = 18,000 - 360 \cdot L$;

3) $L = 45$ workers;

4) $Q = 11,137.5$ kilograms;

5) $TR = 445,500$ mu.

Topic 11. Labour Market

Task 11.2.

1) $w_E = 22$ mu;

2) $L_E = 28$ thousands of people;

3) $D_{L\,(40\,mu)} = 10$ thousands of people;

4) $S_{L\,(40\,mu)} = 46$ thousands of people;

5) Unemployment $= 36$ thousands of people.

Topic 12. Capital Market

Task 12.5.

1) $TR = 1{,}000{,}000$ mu;

2) $\pi = 200{,}000$ mu;

3) $N_c = 0.67$ or 67 %;

4) $A = 60{,}000$ mu;

5) $r_A = 20$ %.

Task 12.6.

1) $FV = 777.02$ mu;

2) $r_r = 0.0187$ or 1.87 %;

3) $FV_r = 634.29$ mu;

4) $PV = 851.34$ mu

Task 12.7.

1) $P_d = 4{,}000$ mu;

2) $I_l = 5{,}000$ mu;

3) $\pi = 1{,}000$ mu.

Topic 13. Land Market

Task 13.2.
1) $TR = 7{,}700{,}000$ mu;
2) $TC = 4{,}300{,}000$ mu;
3) $R = 3{,}400{,}000$ mu;
4) $P_L(\text{current}) = 34{,}000{,}000$ mu;
5) $P_L(\text{next year}) = 42{,}500{,}000$ mu.

Part 4. Market and Government

Topic 14. Government regulation of the market

Task 14.4.
1) $P_E = 500$ mu;
2) $Q_E = 300$ units;
3) Shortage $= 300$ units;
4) Surplus $= 600$ units.

Task 14.5.
1) $P_E = 20$ mu;
2) $Q_E = 130$ units;
3) $Q_{ST} = 0.95 \cdot 9\ P - 50 = 8.55\ P - 50$;
4) $P_T = 20.9$ mu;
5) $Q_{ST} = 129$ units;

Task 14.6.
1) $P_E = 45$ mu;
2) $Q_E = 1{,}140$ units;
3) $Q_{SH} = 720 + 12 \cdot P$;
4) $P_H = 39$ mu;
5) $Q_H = 1{,}188$ units;

Topic 15. Market Failure and Government Failure

Task 15.3.

1) $Q_E = 20$ units;

2) $P_E = 240$ mu;

3) $T = 10$ mu;

4) $Q_O = 19$ units;

5) $P_O = 248$ mu;

6) $\varSigma T = 190$ mu.

Task 15.4.

1) $Q_E = 17$ thousand graduates; $P_E = 23$ thousand mu;

    2) $Q_O = 22$ thousand graduates;

3) $P_O = 28$ thousand mu;

4) $G = 10$ thousand mu;

5) $\varSigma G = 280,000$ thousand mu.

LIST OF BASIC AND ADDITIONAL EDUCATIONAL LITERATURE

List of basic educational literature：

1. Dirk Kaiser. "Economic Theory in the 21st Century" / Dirk Kaiser // Springer. – 2020. – 110 p. ISBN978-3-658-30639-7. – URL: https://link.springer.com/book/10.1007/978-3-658-30639-7#about https://link.springer.com/book/10.1007/978-3-658-30639-7

2. Wei-Bin Zhang. "The General Economic Theory" / Wei-Bin Zhang // Springer. – 2020. – 342 p. ISBN978-3-030-56204-5 – URL: https://link.springer.com/book/10.1007/978-3-030-56204-5#about https://link.springer.com/book/10.1007/978-3-030-56204-5

List of additional educational literature

1. Martin Kolmar. "Principles of Microeconomics" / Martin Kolmar // Springer. – 2017. – 336 p. ISBN 978-3-319-57589-6 – URL: https://link.springer.com/book/10.1007/978-3-319-57589-6#about https://link.springer.com/book/10.1007/978-3-319-57589-6

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