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MACROECONOMICS

Tutorial

Recommended by the Methodical Commission
of the Institute of Economics and Entrepreneurship, studying at the B.Sc.
Programme 38.03.01 "Economics" in English

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РОССИЙСКОЙ ФЕДЕРАЦИИ

**Федеральное государственное автономное образовательное
учреждение высшего образования
«Национальный исследовательский Нижегородский
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МАКРОЭКОНОМИКА

Учебно-методическое пособие

Рекомендовано методической комиссией Института экономики и
предпринимательства ННГУ для иностранных студентов,
обучающихся по направлению подготовки 38.03.01 «Экономика»
(бакалавриат) на английском языке

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Рецензент: д.э.н., профессор Г.Г. Господарчук

В настоящем пособии изложены учебно-методические материалы по курсу «Макроэкономика» для иностранных студентов, обучающихся в ННГУ по направлению подготовки 38.00.01 «Экономика» (бакалавриат).

Пособие включает 8 базовых единиц курса, для каждой из которых приведены основные понятия, принципы и модели, практические задания. В приложении приведен перечень основных эффектов и проблем макроэкономики, а также словарь терминов. Пособие завершает список рекомендуемой литературы.

Ответственный за выпуск:
председатель методической комиссии ИЭП ННГУ,
к.э.н., доцент Летягина Е.Н.

In this tutorial, the educational materials on the course "Macroeconomics" for foreign students studying at the UNN in the direction of training 38.00.01 "Economics" (bachelor degree) are presented.

The tutorial includes 8 basic units of the course, each of which contains the basic concepts, principles and models, practical tasks. The appendix contains a list of the main effects and problems of macroeconomics, as well as a glossary of terms. The tutorial is supplemented with a list of recommended literature.

Contents

Unit 1. **Main Macroeconomic Variables and Identities**

> Gross Domestic Product and Gross National Income, their types and methods of calculation. Other indicators of the System of National Accounts. Price Indices (deflator, CPI, etc.)

Aggregate sectors of the national economy:

Households, Firms, Government, and Foreign Sector (the Rest of the World).

Main macroeconomic problems: 1) inflation; 2) unemployment; 3) the rate of economic growth; 4) stability of the balance of payments («the magic quadrangle» after Jan Tinbergen).

Main regulative policies:

Fiscal, Monetary, Exchange Rate, and Foreign Trade Policy.

Short-run and long-run periods of economic performance:

Short-run is the period of time when:

- price level rigidity (non-elasticity) takes place;
- money supply affects the real economic variables;
- the economy does not adapt to the shocks completely;
- the actual GDP may deviate from its potential level, and the actual unemployment does not coincide with its natural level.

Long-run is the period of time when:

- price level is perfectly flexible;
- neutrality of the money takes place, that is, changes in money supply do not affect the real economic variables;
- the economy adapts to the shocks completely;
- the actual GDP is equal to the potential GDP, and the actual level of unemployment is equal to its natural level.

Types of macroeconomic variables:

1. Nominal and real variables.

2. Stock and flow variables.

Macroeconomic models differ:

1. Exogenous and endogenous variables (inputs and outputs).

2. Some models are based on perfect mobility of the resources (mainly the capital), and other assume non-perfect mobility.

3. Statics, Comparative Statics and Dynamics.

4. Short-run and long-run performance.

Main aggregate variables

Indicators of production and income at the national level

1. ***Gross domestic product (GDP)*** − a monetary valuation of all domestically produced final goods and services over any period of time, usually per year.

Approaches of calculating GDP: 1) gross value added (production method); 2) the sum of primary incomes received («flow-of-cost» method); 3) the sum of expenditures («flow of product» method).

Gross value added is the difference between the value of output (revenues) and the value of intermediate consumption (the cost of the material factors of production).

Table 1

Calculation of GDP

Income approach	Expenditure approach
1. Compensation of employees: wages and salaries (w).	1. Personal consumption expenditures (C − **consumption**).
2. Depreciation, or fixed capital consumption (A).	2 Gross private domestic investment (Ig − **investment**).
3. Gross profits of firms (Pr):	3 **Government purchases** of goods and services (G − government).
• taxes on profits;	4. **Net export** (NX= Exports − Imports).
• dividends;	
• undistributed profits.	
4. Indirect taxes (T_{in}).	
5. Interest by lenders: on deposits, deposit certificates, corporate bonds (i).	
6. Rents of property owners (R).	
7. Incomes for individual investment (H).	
Total: $GDP = w+A+Pr+T_{in}+i+R+H$	Total: $GDP=C+I+G+NX$

Gross Private Domestic Investment includes depreciation (allocations for recovery of fixed capital) and net investment: $I_g = A + I_n$.

Types of GDP:

- *Nominal GDP* − measured at current prices (operating in a given year): $Y_n = \sum\limits_{i=1}^{m} p_{i1} \times q_{i1}$;

- *Real GDP* − measured at constant (basic) prices: $Y_r = \sum\limits_{i=1}^{m} p_{i0} \times q_{i1}$. It allows to adjust GDP for inflation;

These types of GDP let us to calculate:

✓ *GDP deflator* − the ratio of nominal GDP to real GDP, that is the price index for

domestic products: $Def_{GDP} = \dfrac{Y_n}{Y_r} = \dfrac{\sum p_1 \times q_1}{\sum p_0 \times q_1}$. Inflation for domestic goods:

$$\pi_t = \left(\frac{Def_t}{Def_{t-1}} - 1\right) \times 100\% .$$

✓ *Economic growth rate* − increase in physical output of production:

$$g_t = \left(\frac{Y_{Rt}}{Y_{Rt-1}} - 1\right) \times 100\% .$$

- *Actual GDP* − actually produced in a given period (Y);
- *Potential GDP* − the maximum amount that economy can produce when it achieves full employment of resources (Y_f) without influence on inflation.

On their basis there can be calculated:

✓ *Output gap* − relative deviation of actual GDP from potential GDP, that is an

indicator of «overheating» or «recessionary range» of an economy: $\dfrac{Y - Y_f}{Y_f}$.

2. ***Gross national income (GNI)*** − a monetary valuation of all final goods and services produced by national factors, both within the territory of the country and abroad over any period of time, usually per year.
   ✓ GNI = GDP + factor incomes earned by residents abroad − factor incomes earned in the domestic economy by nonresidents.
   ✓ GNI = GDP − net income by foreign factors.
   ✓ GNI = GDP + net primary income from abroad.
3. ***Net national income (NNI)*** = GNI − consumption of fixed capital, depreciation (A).
4. ***Personal income (PI)*** − is the total income received by households before their payments of individual taxes.

Personal Income = National Income

− Indirect business taxes (VAT, excise taxes, taxes on use of natural resources, customs duties).

− Social security contributions

− Corporate income taxes

− Undistributed corporate profits

− Interest income of business

+ Interest income of households, including the interest on the public debt

+ Social transfer payments (pensions, scholarships, grants).

Note: Gross profit = Corporate income taxes (taxes on profit) + Dividends + Undistributed corporate profit.

5. ***Personal disposable income (PDI)*** = Personal income − personal current taxes (personal income tax, property tax, land tax, etc.).

Personal disposable income spent on consumption (C) and saving (S): PDI=C+S.

Price level and inflation rate indicators

- ***Deflator*** (see hereinabove);

- ***Consumer price index (CPI)*** – the ratio of the cost of consumer basket at current prices to the cost of the same basket (of the same composition) at basic prices or at prices of the previous period.

$$CPI = \frac{\sum p_1 \times q_0}{\sum p_0 \times q_0} = \sum \frac{p_1}{p_0} \times \eta_0, \ \eta_0 = \frac{p_0 \times q_0}{\sum p_0 \times q_0}.$$

CPI is officially used for measuring inflation: $\pi_t = \left(\frac{CPI_t}{CPI_{t-1}} - 1 \right) \times 100\%$.

- ***Producer price index (PPI)*** − index of the cost of producer wholesale goods basket.

Statistical methods for calculating price indices:

1. *Laspeyres price index*: $I_L = \frac{\sum p_1 \times q_0}{\sum p_0 \times q_0}$ (used for calculating CPI and PPI).

2. *Paasche price index*: $I_P = \frac{\sum p_1 \times q_1}{\sum p_0 \times q_1}$ (used for calculating GDP deflator).

While the Laspeyres index overestimates inflation, the Paasche index usually underestimates the level of prices in the country.

3. *Fisher price index*: $I_F = \sqrt{I_L \times I_P}$ – mutually compensates for the shortcomings of the two previous indices.

Main macroeconomic identities

1. Formation and distribution of gross national income: $\boxed{Y = C + I_p + G + NX}$, where C − consumption; I_p − gross private domestic investment; G − government purchases of final goods and services; NX − net export (export (X) – import (Z));

2. Formation and distribution of disposable income: $Y_d = Y - T + TR + N$ − formation of gross income at the disposal of the home private sector, where T − taxes; TR − transfers from

government to private sector; N – paid interests for public bonds held by private sector. $Y_d = C + S_p$ – distribution of disposable income, where S_p – private savings.

3. Interaction between aggregate sectors: $S_p + (T - TR - N) + Z = I_p + G + X$ (withdrawals (leakages) = injections).

4. Distribution of private savings: $\boxed{S_p = I_p + BD + NX}$, where BD – public budget deficit ($BD = G + TR + N - T$).

5. Balance of payments: $NX = I_r + \Delta R$, where NX – trade account, I_r – capital outflows abroad, i.e. domestic country's foreign investment (capital account of the balance of payments with an opposite sign), $\Delta R = \Delta R_P + \Delta R_g$ – changes in the country's international reserves, both private (ΔR_P) and official ones (ΔR_g).

6. State budget balance: $BD = \Delta M_{bd} + \Delta B$. Budget deficit is financed by credits to government from the Central Bank and thus by money emission (ΔM_{bd}) and by government offering of public bonds ($\Delta B = \Delta B_p + \Delta B_g$), that are finally purchased by the private sector (ΔB_p) and by the Central Bank (ΔB_g).

7. Three channels of money supply: $\Delta M = \Delta M_1 + \Delta M_2 + \Delta M_3$, ΔM_1 – Central Bank gets credits to the national economy: commercial banks and government («credit channel»): $\Delta M_1 = \Delta M_{cb} + \Delta M_{bd}$ (in stationary economy $\Delta M_{cb} = 0$); ΔM_2 – central bank purchases the public bonds («stock channel») to finance the part of budget deficit ($\Delta M_2 = \Delta B_g$); ΔM_3 – central bank purchases foreign currency («exchange channel») and replenishes the official reserves ($\Delta M_3 = \Delta R_g$).

8. Finally, private savings are distributed in the forms: $\boxed{S_p = I_p + I_r + \Delta M + \Delta B_p + \Delta R_p}$.

9. General rule for savings and investment: $\boxed{S_p + S_g + S_r = I_p + I_g + I_r}$. Summary savings from all the sectors of economy are equal to their summary investment.

Problems

Problem 1.1. Using the information below, determine: 1) GDP by income approach and expenditure approach; 2) GNI; 3) NNI; 4) personal income (PI); 5) personal disposable income (PDI); 6) dividends received by private shareholders; 7) household savings; 8) share of taxes in GDP; 9) the state of the state budget (provided that the other items of state incomes and expenditures do not exist).

Expenses and income in domestic country	Amount	Expenses and income in domestic country (except n. 20)	Amount
1. Personal taxes	63	11. Depreciation of fixed capital	98
2. Net private investment	85	12. Government purchases of goods and services	103
3. Undistributed corporate profits	12	13. Personal consumption expenditures	462
4. Social transfer payments	140	14. Rents of property owners	35
5. Exports	170	15. Incomes for individual investment	46
6. Gross profit	65	16. Interests on government bonds received by households	24
7. Imports	156	17. Indirect taxes on business	98
8. Income received by non-residents in the country	83	18. Corporate income taxes	34
9. Salaries of employees	372	19. Total interest payments	48
10. Social security contributions	88	20. Income received by residents abroad	53

Describe the state of the economy, and suggest the measures to improve it. Justify suggestions with calculations.

Problem 1.2. A certain country produces two types of goods: grain and cars.

Year	Quantity		Price	
	Grain (tons)	Cars (units)	Grain (thousand rubles per ton)	Cars (thousand rubles per unit)
2012	600	800	12	500
2013	800	1000	15	600
2014	900	900	16	550

Determine: a) nominal GDP for each year; b) real GDP for each year, supposing the first year basic; c) the GDP deflator and the rate of inflation in the 2nd and the 3rd year; d) the rate of economic growth in the 2nd and 3rd year.

Problem 1.3. Population of a certain country consumes three types of goods.

Groups of goods / Year	2013		2014	
	Price ($)	Quantity (units)	Price ($)	Quantity (units)
Food	10	100	12	120
Non-food products	28	60	30	70
Consumer services	60	30	80	50

Assume 2013 year as the basic. Determine the price increase in 2014 based on the following indices: a) the Laspeyres index (consumer price index); b) the Paasche index; c) the Fisher index.

Problem 1.4. Suppose some economy has shown the following annual results: gross income Y=2800; consumption: C=2000; government purchases G=600; transfers from government to public TR=300; interests paid for public bonds at the disposal of private holders Z=100; taxes T=800; net export NX=−300.

Determine the value of: a) gross internal private investment; b) deficit/surplus of state budget; c) income at the disposal of private sector; d) private savings.

Problem 1.5. Suppose some economy has shown the following annual results: C=2000; G=300; TR=240; T=450; trade balance surplus is equal to 180. Gross income is equal to 3100.

Evaluate the share of gross private savings aimed at financing gross internal private investment.

Problem 1.6. Suppose some economy has shown the following annual results: consumption C=2400; gross internal investment I=700; government purchases G=800; social transfers TR=100; paid interest for public debt bonds at the disposal of private sector Z=200; autonomous taxes T=800. Budget deficit is planned to be covered for 80% by bonds offering, and for 20% by money emission.

What share of new private savings should be presented in the form of public bonds purchases?

Answers to the problems

Problem 1.1: 1) GDP=762 units; 2) GNI=732; 3) NNI=634; 4) PI=566; 5) PDI=503; 6) Dividends=19; 7) S=41; 8) the share of taxes in GDP = 25.6%; 9) budget deficit = 48 (6.3% of GDP).

Problem 1.2: A) Nominal GDP: 407.2 million units; 612 million; 509.4 million. B) Real GDP: 407.2 million; 509.6 million; 460.8 million. B) GDP deflator: 1; 1.2009; 1.1054. The inflation rate: + 20.9% and -7.9% (for two years: 10.5%). D) the rate of economic growth: + 25.1% and -9.6% (for two years: + 13.2%).

Problem 1.3: a) $I_L = 1.205$ (CPI); b) $I_P = 1.224$; c) $I_F = 1.215$.

Problem 1.4: a) $I_g = 500$; b) $BD = 200$; c) $Y_d = 2400$; d) $S_p = 400$.

Problem 1.5: 0.7 (or 70%).

Problem 1.6: 24%.

Unit 2. **Aggregate Market of Goods and Services**

Keynesian vs. Neoclassical Approaches in Macroeconomics. The basic Keynesian model of macroeconomic equilibrium on the aggregate goods market. Aggregate demand and its determinants. Short-run aggregate supply and long-run aggregate supply and their changes. Neo-Keynesian approach to the equilibrium on the aggregate goods market: the AD-AS model.

Table 2

Differences between Keynesian and Neoclassical approaches

	Keynesian approach	Neoclassical approach
Relevant period	Short-term	Long-term
State of the economy	Deviation from full employment	Full employment of resources
Prices	Rigid	Flexible
Look of Aggregate Supply function	Horizontal (SRAS – short-run aggregate supply)	Vertical (LRAS – long-run aggregate supply)
The existence of equilibrium	Non-equilibrium on the goods market is often observed, due to the imbalance of investment and savings	Equilibrium always exists, because balance of investment and savings (I=S) is achieved through the flexibility of the interest rate
Side of equilibrium that is important	Aggregate demand (AD)	Aggregate supply
What affects that side	Active economic policy managing the components of aggregate demand	Resources availability and their productivity, level of technology (based on Cobb-Douglas production function)
Change of equilibrium	In short-run	In long-run
Attitude to Monetary and Fiscal Economic Policy in short-run	Effective (affects the output)	Non-effective (does not affect output, but causes price level change)
Attitude to money	Absolutely liquid asset, the	Just medium of exchange and

demand for which is changeable. They affect the real economy.	means for price measuring. They are neutral to the real economy.

Macroeconomic equilibrium: Keynesian model

Initially Keynes considered a closed economy without public sector. In such an economy two sectors interact: households and business sector. Income: $Y = C + S$. Expenditures: $Ex = C + I$. Equilibrium condition: $S = I$.

- *Consumption function*: $\boxed{C = C_a + MPC \times Y}$,

where C_a — autonomous consumption (which does not depend on income); Y – income;

$MPC = \dfrac{\Delta C}{\Delta Y}$ — marginal propensity to consume, which decreases as income increases

(according to *Fundamental psychological law* by Keynes). $APC = \dfrac{C}{Y} = \dfrac{C_a}{Y} + MPC$ — average

propensity to consume, which also decreases when income grows.

- *Saving function*: $\boxed{S = -C_a + MPS \times Y}$,

where $MPS = \dfrac{\Delta S}{\Delta Y}$ — marginal propensity to save, which rises as income increases.

$APS = \dfrac{S}{Y} = -\dfrac{C_a}{Y} + MPS$ — average propensity to save, which also rises when income grows.

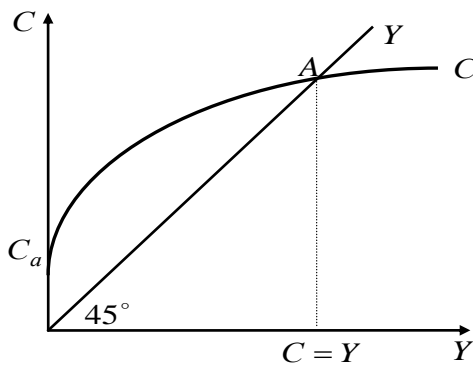Note: $MPC + MPS = 1$, and $APC + APS = 1$.
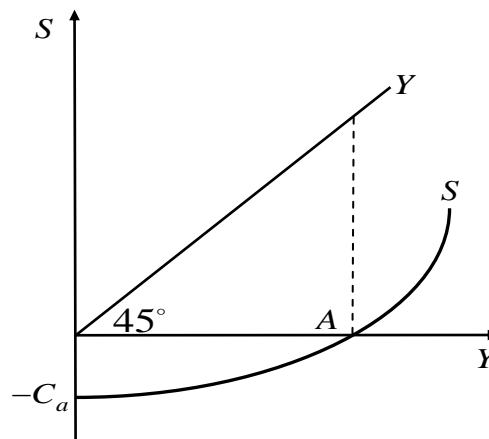

Figure 1. Consumption function Figure 2. Saving function

- *Investment function*: $\boxed{I = I(\overset{+}{MR_K}, \overset{-}{r}, \overset{-}{t}, \overset{-}{\pi_e})}$,

where MR_K – expected marginal return on capital, r – real interest rate (nominal interest rate minus inflation), t – level of taxation, π_e – expected rate of inflation.

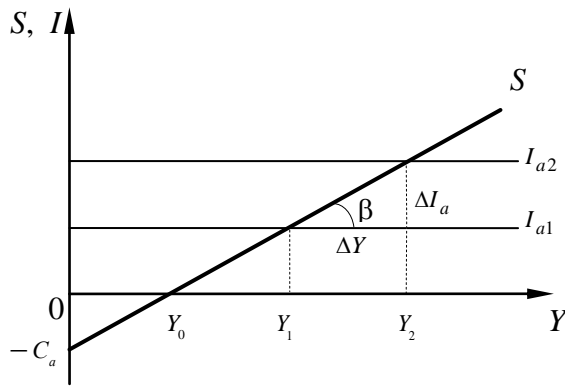- *Equilibrium of planned savings and autonomous investment* (figure 3).

Figure 3. Equilibrium of savings and investment and multiplier effect

- *Multiplier effect.* Investment multiplier indicates how much increase in autonomous investment affects increase in income:

$$m_I = \frac{\Delta Y}{\Delta I_a} = \frac{Y_2 - Y_1}{I_{a2} - I_{a1}},$$

$$m_I = \frac{1}{tg\beta} = \frac{1}{MPS} = \frac{1}{1 - MPC}.$$

The more the marginal propensity to consume, the more the investment multiplier.

- *Accelerator effect* − demonstrates the influence of income growth in the previous period on the growth of investment in the current period.

$$I = I_a + I_{ind}, \quad I_{ind} = v \times \Delta Y_{t-1} = v \times (Y_{t-1} - Y_{t-2}),$$

where I_{ind} − induced investment, v − value of accelerator.

- *The paradox of thrift* (the paradox of saving) − a situation when an increase in savings leads to a decrease in aggregate demand, income, and savings in the future.

- *Effective demand management.*

Full function of aggregate demand in an open economy with the public sector: $AD = C + I + G + NX$. And now C is the function of disposable income: $Y_d = Y - T(taxes) + TR(transfers)$.

✓ Fiscal policy affects consumption through taxes and transfers. $T\uparrow \rightarrow Y_d \downarrow \rightarrow C\downarrow \rightarrow AD\downarrow$. $TR\uparrow \rightarrow Y_d \uparrow \rightarrow C\uparrow \rightarrow AD\uparrow$.

✓ Fiscal policy affects government purchases of goods. $G\uparrow \rightarrow AD\downarrow$.

✓ Monetary policy affects investment through interest rate (Keynesian channel). M_S(money supply)$\uparrow \rightarrow$ r(real interest rate)$\downarrow \rightarrow I\uparrow \rightarrow AD\downarrow$.

✓ Exchange rate policy affects net export. ER (exchange rate) $\uparrow \rightarrow$ Exports$\downarrow$, imports$\uparrow \rightarrow$ NX$\downarrow \rightarrow AD\downarrow$.

Two cases when effective demand governance is necessary:

1. *Recessionary gap* − is the amount by which the potential full-employment GDP (Y_F) exceeds equilibrium GDP (Y_E). In this case authorities have to pursue expansive policies stimulating aggregate demand.

2. *Inflationary gap* − is the amount by which the equilibrium GDP (Y_E) exceeds potential full-employment GDP (Y_F). In this case authorities have to pursue restrictive policies of contraction in aggregate demand.
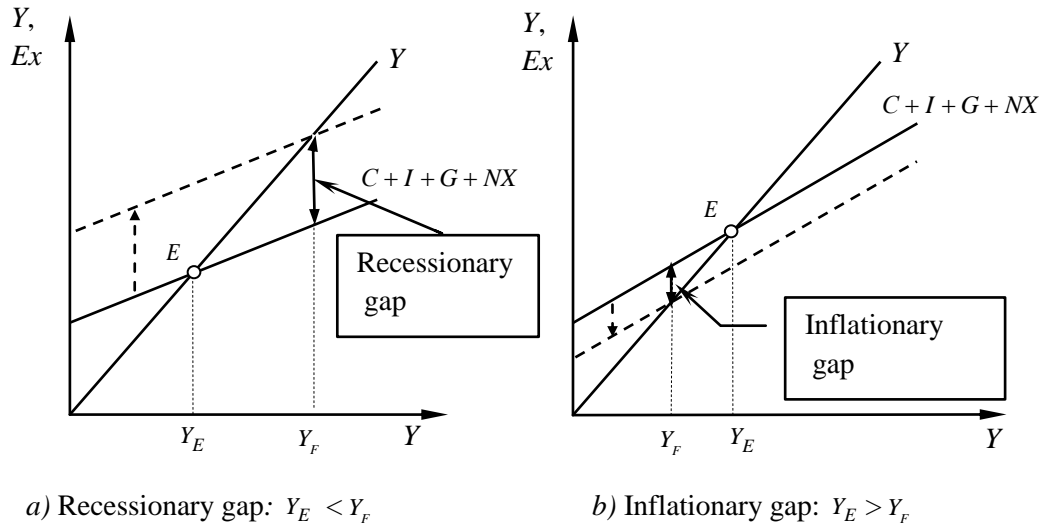

a) Recessionary gap: $Y_E < Y_F$ b) Inflationary gap: $Y_E > Y_F$

Figure 4. Inflationary and recessionary gaps

AD-AS model

AD−AS model was developed by Paul Samuelson and James Tobin in the framework of Keynesian-neoclassical synthesis. It combines Keynesian and Neoclassical approaches to commodities market equilibrium. In this model, aggregate demand and aggregate supply are functions of the general price level.
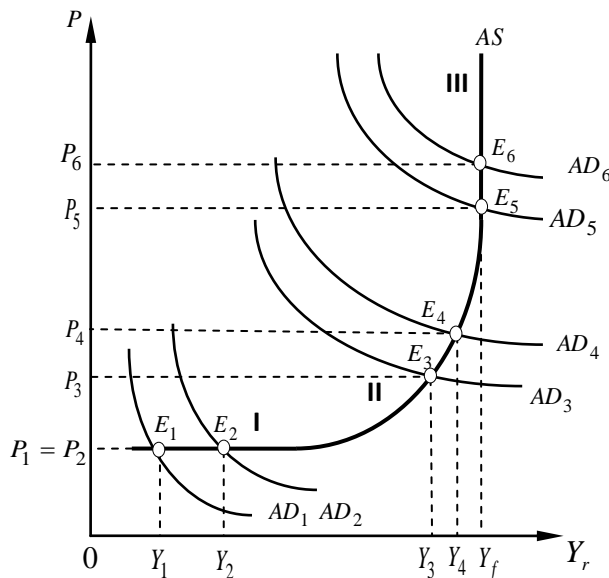
Figure 5. AD−AS model

- *Aggregate demand* – different quantities of domestic goods and services that aggregate sectors of households, firms, the government and foreign sector can and wish to buy at each price level.

AD function negative slopes are attributable to three effects:

- Pigou's Wealth Effect;
- Keynes's Interest-Rate Effect;
- Mundell-Fleming's Exchange-Rate Effect

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- *Aggregate supply* – different quantities of goods and services that aggregate sector of firms can and wish to produce and sell at each price level.

In Figure 5:

P (vertical axis) − is the general price level for all goods and services.

Y (horizontal axis) – is the level of real expenditures and real GDP.

I − horizontal (Keynesian) section of AS, characterized by underemployment of resources. On this section the aggregate demand rise leads to an increase in output without changing the general price level.

II − sloping section, characterized by the appearance of scarcity some resources. On this section the aggregate demand rise causes both increase in the output and growth of the general price level.

III − vertical (Neoclassical) section, characterized by full employment of resources and reached potential GDP. On this section the aggregate demand rise has no positive effect, just negative, because it causes inflation without changing the output.

Main internal factors resulting in the shift of AD curve to the right (i.e. increase in aggregate demand):

- Expansive monetary policy (an increase in money supply or decrease in discount rate of the central bank),
- Expansive fiscal policy (tax cuts or increase in government spending (government purchases or transfers)),
- Exchange rate depreciation policy,
- Optimistic changes in expectations that cause additional consumer or investment spending.

Main factors causing the shift of AS curve (i.e. change in aggregate supply):

In short-run (including supply shocks):

- Change in resources prices,
- Changes in indirect taxes and subsidies,
- Changes in availability of resources (drought, crop failures, wars, man-made disasters).

In long-run (shifting the vertical section of the curve):

- Changes in technologies and resources productivity,
- Changes in the business environment (administrative barriers, etc.).

"Ratchet effect" (inertial effect) refers to the tendency of price level to rise in case of aggregate demand growth, but to be sticky in case of aggregate demand reduction.

Explanations of the price inelasticity to down:

• Long-term contracts on the labor market.

• Maintenance by employers so-called "effective rate of wages" to retain the more productive workers.

• Investments in training.

• The laws on minimum wages.

• The "menu cost" (cost of the goods reassessment).

• Fears of price wars.

The critics of the Keynesian Absolute Income Hypothesis and his consumption function:

✓ "The S. Kuznets Paradox". Short-run and long-run consumption function.

✓ The intertemporal choice by Irving Fisher.

✓ Life-cycle hypothesis by Franco Modigliani.

✓ Permanent income hypothesis by Milton Friedman.

Problems

Problem 2.1. In some economy in past period the consumption was 520 units; private investments were 110 units; government purchases for public needs were 120 units. Taxes are autonomous. After an increase of investment by 20 units, the equilibrium national income had risen to 810 units. Determine the marginal propensity to consume, assuming that it does not depend on income. Derive consumption function. What is the investment multiplier value?

Problem 2.2. In some economy an income in the period "t-1" was 1200 units, in period "t" it increased to 1450 units. Autonomous investment volume in the period "t-1" was 200 units, and in the period "t" it remained the same. The accelerator is 1.8. What is the amount of investment in the period "t"?

Problem 2.3. A certain open economy with private and public sectors is described by the following data: $C = 400 + 0{,}84 \cdot Y_d$, $I = 200 + 0.16 \cdot Y$, $NX = 800 - 0.3 \cdot Y$, $G = 600 + 0.18 \cdot Y$, $t = 1/3$. Find the equilibrium income.

Problem 2.4. In a certain open economy consumption function takes the form: $C = 200 + 0{,}75 \cdot Y_d$, where Y_d − disposable income. Autonomous investments: $I_a = 400$; autonomous government purchases of commodities and services: $G_a = 500$; net exports: $NX = -200$. The state budget revenues are collected through income tax with the rate $t = 0.2$. Tasks: a) calculate the autonomous expenditure multiplier and the equilibrium level of income;

b) determine the change of aggregate demand in the short term following: increase in public purchases by 100 units; increase of the income tax rate to $t = 0.24$.

Problem 2.5. Potential GDP is equal to 1200. Aggregate demand and aggregate supply functions in short-run take the form: $Y_D = 2800 - 600 \cdot P$, $Y_S = 300 + 400 \cdot P$. Determine the equilibrium income and the equilibrium price level in short-run and long-run.

Problem 2.6. In a certain economy aggregate supply and aggregate demand functions take the form: $Y_S = 250 \cdot P$, $Y_D = 6750 / P^2$. Tasks: a) calculate the parameters of equilibrium on the goods market; b) describe their changes after 33.1% increase in aggregate demand.

Answers to the problems

Problem 2.1: $MPC = 2/3$; $C = 20 + 2/3 \cdot Y$; $m_I = 3$.

Problem 2.2: $I = 650$ units.

Problem 2.3: $Y_E = 5000$ units.

Problem 2.4: A) $m_a = 2.5$, $Y = 2250$; b) $\Delta Y(\Delta G) = 250$, $\Delta Y(\Delta t) \approx -157$ units.

Problem 2.5: In short-run: $Y_E = 1300$; $P_E = 2.5$. In long-run: $Y_E = 1200$; $P_E = 2.67$.

Problem 2.6: a) $P_E = 3$; $Y_E = 750$; b) $P_E = 3,3$; $Y_E = 825$ (both equilibrium price level and equilibrium income increase by 10%).

Unit 3. **Money Market**

Money functions. Demand for money, money supply and equilibrium on money market in Neoclassical and Keynesian approaches. Money aggregates and the process of money multiplication. The role and functions of Central Bank; foundations and instruments of monetary policy.

Modern macroeconomics deals with three main money functions:

- *Unit of account (measure of value)* – money serves for measuring the market value of goods, services, and other transactions, and assessing their relative worth. Following G. Mankiw, "money provides the terms in which prices are quoted and debts are recorded"[1].
- *Medium of exchange* – money is used as intermediary in the exchange of goods and services.
- *Store of value* – money serves as a means of accumulation of purchasing power and is an alternative absolutely liquid asset.

The types of money (historically): commodity, paper and electronic money; fiat and credit money.

Demand for money:

1. *Neoclassical approach*.

✓ Equation of exchange after I. Fisher:

$$M \times V = P \times Y_r,$$

where M – money supply, V – velocity of money, i.e. the number of sales transactions, served by one monetary unit for any period of time, usually one year, P — the general level of commodity prices, Y_r – physical amount of produced goods and services, i.e. the real GDP. And $Y_n = P \times Y_r$ – nominal GDP.

Hence there is determined *transactional demand for money*:

$$M_{Dt} = \frac{P \times Y_r}{V}.$$

✓ Cambridge equation of money demand after A. Marshall and A.C. Pigou:

$$M_D = k \times P \times Y_r,$$

where k – is proportion of nominal income which economic agents prefer to keep in liquid form.

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[1] Mankiw G. (2009). Macroeconomics. 7th ed. P. 80.

Money demand in terms of real balances: $M_{Dt}/P = \dfrac{Y_r}{V}$ and $M_D/P = k \times Y_r$.

2. *Keynesian approach*. Three motives and three types of money demand:

✓ *Transactions demand for money* – is demand for money as medium of exchange, it is in direct proportion to the nominal income;

✓ *Precautionary demand for money* is associated with the uncertainty of the future, the need to maintain safety stock of contingency payments. Precautionary demand is positively related to income;

✓ *Speculative demand* (*assets demand*) *for money* refers to the need for money as an alternative liquid asset, the form of income savings. Speculative demand is inversely related to the interest rate.

The total demand for money in the J.M. Keynes model takes the following form:

$$M_D = M_{Dt} + M_{Dsp} = L_t(Y) + L_{sp}(r),$$

where M_{Dt} — transactions and precautionary demand for money, M_{Dsp} — speculative demand for money, r — the market interest rate on bank deposits.

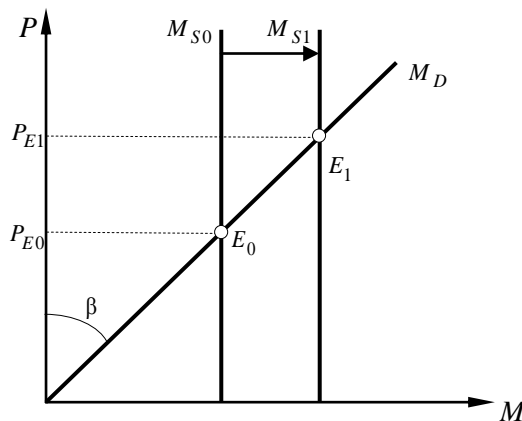**Money market equilibrium and its change after money supply increase**

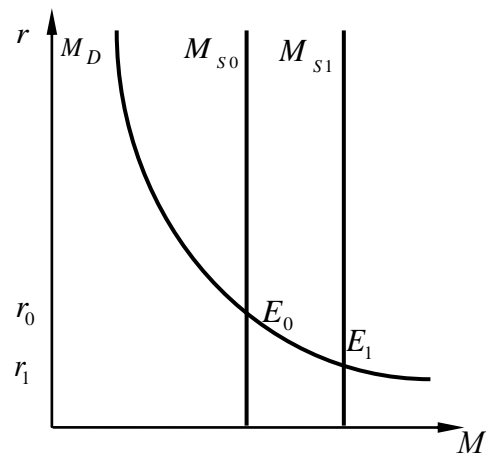Figure 6. Money market equilibrium: Neoclassical approach

Figure 7. Money market equilibrium: Keynesian approach

In the Neoclassical approach, the balance of supply and demand for money installs due to adjustment of the general price level (see Fig. 6). The growth of money supply pushes the price up, which increases the demand for money appropriately. Monetary policy doesn't affect production and therefore it isn't effective.

In the Keynesian approach, money market equilibrium is achieved through adjustment of the real interest rate (r). Increase in the money supply leads to a rate of interest decrease, which

in turn causes the growth of investment. Thus, by controlling the money supply, the government can influence the total expenditures, the level of output and employment.

Money supply

Broadly money supply consists of three elements: currency (banknotes and coins), deposits and quasi-money (highly liquid bills, certificates and other assets that can partially fulfill the functions of money). Monetary aggregates (M0, M1, M2, M3) include different components of the money supply. Each broader aggregate further comprises less liquid components of money.

Monetary aggregates calculated by Central Bank of Russia:

- M0 = cash in circulation;
- M1 = M0 + checks, demand deposits (including bank debit cards);
- M2 = M1 + time deposits;
- M3 = M2 + savings deposits, certificates and government bonds.

Coefficient of monetization of the economy – the ratio of broad money (the aggregate M2) to nominal GDP.

Money creation. Initially, additional money is provided by the Central Bank, which issues new money in three ways: 1) lending money to financial institutions; 2) purchase the government bonds; 3) purchase the foreign currency to replenish the official reserves. All these ways expand the monetary base as the basis of the money supply. Then credit organizations (primarily commercial banks) numerously extend this money base through lending to the economy via process of creating new deposits and loans. They are involved in so-called process of the banking multiplication with fractional reserve. In this process the *required reserves ratio* plays an important role.

The required reserves ratio – officially set by the central bank the share of commercial banks deposits which they are required to deposit to the central bank.

Estimated bank multiplier shows how much commercial banks can expand the monetary base in the process of banking multiplication. It is defined by the formula: $m_b = \dfrac{\Delta M}{\Delta B} = \dfrac{1}{r_r}$, where ΔB — initial increase in the money base, ΔM — ultimate money supply growth, r_r — the required reserves ratio.

The actual bank multiplier is less than the estimated multiplier because:

• besides obligatory reserve, banks create excessive reserves, which may be voluntary or constrained;

• part of the money leaves deposits, turning into cash (for example, through payment of wages).

Let's introduce:

$c_r = C/D$ – the "currency ratio": proportion in which the public prefers to distribute money between cash C and deposits D;

$r_r = R_o/D$ – "the required reserves ratio": the ratio of obligatory reserves R_o to deposits D;

$r_+ = R_e/D$ — "the excessive reserves ratio";

$B = C + R_o + R_e$ — money base.

Table 3

The actual bank multipliers

	Formula	The impact
Money multiplier	$m_m = \dfrac{C+D}{B} = \dfrac{C+D}{C+R_o+R_e} = \dfrac{1+c_r}{c_r+r_r+r_+}$	Increase in money: $\Delta M = m_m \times B$
Deposit multiplier	$m_d = \dfrac{D}{B} = \dfrac{D}{C+R_o+R_e} = \dfrac{1}{c_r+r_r+r_+}$	Increase in deposits: $\Delta D = m_d \times B$
Credit multiplier	$m_c = \dfrac{D-(R_o+R_e)}{C+R_o+R_e} = \dfrac{1-(r_r+r_+)}{c_r+r_r+r_+},$ $m_c = \dfrac{C+D-(R_o+R_e+C)}{C+R_o+R_e} = m_m - 1.$	Increase in loans (credit) to economy: $\Delta K = m_c \times B$

Central Bank, its functions and instruments

Central Bank – is an institution of monetary authority that manages national currency, money supply, interest rates and conduct monetary policy in the country. It serves as a "lender of last resort" to the banking sector in case of insolvency or financial crisis.

Monetary policy is a complex of measures related to the management of money supply and interest rate, carried out by the central bank to maintain price stability, the stability of the national currency and stimulate economic growth in the country.

Goals of monetary policy:

- Price stability, reducing inflation.
- High business activity, full employment, non-inflationary economic growth.
- Stability of the banking system and the development of financial markets. It often includes interest rate stability.

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- Stability of the balance of payments in the country. It often includes foreign exchange stability.

Some of these goals are complementary while the others are conflicting.

In monetary policy the central bank uses three major instruments:

✓ **The required reserves ratio** (see above the definition).

Increase in reserve requirements leads to a decrease in the money multiplier, which causes money contraction. On the contrary, decrease in reserve requirements leads to an increase in the money multiplier and causes money expansion.

✓ **Interest rates**. Central banks may set officially different interest rates.

The *discount rate* (base rate, or repo rate) – the officially set rate by which the central banks lend to commercial banks. The increase in the discount rate reduces the commercial banks demand for loans from the central bank. In this case the monetary base and money supply decreases. In addition, the discount rate affects all other rates in the economy, making money more expensive.

✓ **Open market operations** – the purchase and sale of government bonds by the central bank.

By buying government bonds, the central bank increases the money base. Money supply grows. By selling government bonds, the central bank tightens monetary base. Money supply decreases.

In some countries, the central bank regulates the exchange rate of national currency and for that purpose it *purchases or sells the foreign currency on open exchange market*. This causes changes in the money supply, often undesirable. In this case, to adjust the money supply the central bank carries out **operations to sterilize the money supply** by inverse open market operations with government bonds.

Types of monetary policy:

1. Passive – a policy which is based on "monetary rule" by Milton Friedman, that asserts: change in money supply should exactly meet the long-term trends in real GRP and ignore its short-term fluctuations. Otherwise it enhances short-term fluctuations in output because of lag effects. Excessive money supply in long-run results in inflation, while insufficient money supply causes deflation.

2. *Active* – discrete policy which varies counter-cyclically in short-run:

✓ *Expansionary monetary policy* – conducting during the recession and aimed at economic growth. It includes increase in the money base, reducing the discount rate and diminishing the reserve requirements ratio;

- ✓ *Restrictive monetary policy* – conducting during the boom and overheating of economy and aimed at curbing inflation. It includes reducing growth of money base, an increase in the discount rate and reserve requirements ratio.

Types of monetary regimes:

- *Monetary aggregates targeting* ("money anchor") – the central bank sets the benchmark for growth of some monetary aggregates (money base, M0, M1). This policy was applied in 80's in some advanced countries and in the first half of the 90's in post-socialist countries.

- *Exchange rate targeting* ("exchange rate anchor") – the central bank establishes and maintains the fixed or tightly managed exchange rate ("creeping fixation", "currency corridor"), up to the binding the money supply through the exchange rate to reserves (currency board). The purpose of such policy is to control inflation through the exchange rate, creating the "discipline effect" of monetary policy. This policy was used in the second half of the 90's by central banks of most post-socialist countries.

- *Inflation targeting* – a benchmark of inflation rate, measured on the basis of CPI or core CPI, is considered the only goal of the monetary policy. This regime was pioneered in New Zealand in 1990. Now it is the most popular monetary policy in the world that is used in many advanced countries (United Kingdom, Canada, Australia, South Korea etc.), including Eurozone (it is applied by European Central Bank) and it was adopted by a number of developing countries such as Egypt, South Africa, Brazil etc.

- *Interest rate targeting* – the central bank regulates the interbank interest rate. This policy is aimed at the stability of financial markets and used by United States Federal Reserve, Swiss National Bank and the Bank of Korea as part of mixed regime. This policy is based on *the John Taylor rule*:

$$i_{mb} = \pi + r_{emb} + \alpha \times (\pi - \pi_{tr}) + \beta \times (\frac{Y - Yf}{Y_f}),$$

where i_{mb} – the target short-term interbank nominal interest rate, π – the rate of inflation measured by the GDP deflator, r_{emb} – equilibrium real interbank interest rate, π_{tr} – the target (desired) rate of inflation, $\pi - \pi_{tr}$ – the inflationary gap, Y – the actual GDP, Y_f – the potential GDP, $\frac{Y - Y_f}{Y_f}$ – the gap of output. The coefficients of the gaps, α and β, are determined on the basis of an econometric model based on the empirical material of concrete country, and may

vary, depending on the state of its economy. The Taylor rule also satisfies the following condition: $\alpha + \beta = 1$. In 1993 paper Taylor proposed setting $\alpha = \beta = 0,5$ for USA economy.

- *Nominal GDP targeting* – the theoretical regime proposed by James Meade and James Tobin, based on determining the future level[http://en.wikipedia.org/wiki/Nominal_income_target - cite_note-1](http://en.wikipedia.org/wiki/Nominal_income_target_-_cite_note-1) of economic activity in nominal terms.

Problems

Problem 3.1. In a certain country the real GDP grew by 5% for a year, and the money supply increased by 12% over the same period. The velocity of money has remained unchanged. How much have prices changed in average, in accordance with the equation of exchange by I. Fisher?

Problem 3.2. In a certain country in the current year the average money supply is 1530 money units; the velocity of money is 2.5; inflation measured by the GDP deflator amounted to 12.5% per year. On the basis of the equation of exchange by I. Fischer determine the real GDP in the current year in the prices of the previous year.

Problem 3.3. The money demand of economic agents for transactions is 40% of their income. Motivated the precautions they keep further 10% of their income in liquid form. Their demand for liquidity as value of store is inversely dependent on the real interest rate: $L_{sp} = 10000 \big/ (r+2)^2$, where "r" is measured in percentages.

Tasks: a) Derive the overall money demand function; b) determine the amount of money in circulation that allows to achieve national income $Y = 1200$ and keep interest rate at 3% without a rise in general price level; c) determine new equilibrium interest rate in the short term, if national income rises to $Y = 1360$ under the same money supply; g) calculate further change of the interest rate, if under the terms of p. "b" the central bank increases the money supply by 15%, and investment and national income has not yet had time to react to it.

Problem 3.4. The "currency ratio", the required reserves ratio and the excessive reserves ratio in the banking system are: $c_r = 0.2$ $r_r = 0.1$ $r_+ = 0.2$. Task: a) Describe the process of banking multiplication, if the central bank will increase the monetary base by 100 units ($\Delta B = 100$); b) calculate the values of money, deposit and credit multipliers; c) determine the change in the multipliers, the money supply, the volume of deposits and the volume of loans in economy, if the central bank increase the ratio of compulsory reserves to 20% of deposits.

Problem 3.5. The assets and the monetary base of the central bank are 360 money units, the deposits of economic agents in the banking system are 800 money units, the mandatory

reserves is 6% of deposits, and banks prefer to keep excess 4% of liquidity for making settlements. The money demand for transactions and for unforeseen expenses is given by the formula: $L_{tr+pr} = 150 + 0.384 \cdot Y$. The demand for money in assets portfolio is inverse function of the average return of bonds: $L_{sp} = 50 + 4000/(i+4)$. In the current financial market bonds yield: $i = 6\%$.

Tasks: a) calculate the total money supply; b) determine the level of income at which there will be observed a balance in the money market, and appropriate coefficient of monetization of the economy; c) assume the actual revenue is $Y = 1400$ units. Amount by which the central bank should expand the monetary base to ensure equilibrium in the money market without changes in bond yields?

Problem 3.6. In a certain economy the banking reserves amounted to 20% of deposits, and the share of cash in the total money supply is 0.25. To finance the budget deficit, the government issued public bonds for total 200 billion money units. The central bank bought 1/5 of these bonds on the secondary financial market. Calculate the change of money supply in the economy as a result of the open-market operations by the central bank.

Answers to the problems

Problem 3.1: Prices have risen by 6.7%.

Problem 3.2: $Y_r = 3400$ units.

Problem 3.3: A) $L = 0.5 \cdot Y + \dfrac{10000}{(r+2)^2}$; b) $M_S = 1000$ units; c) interest rate rises up to $r \approx 5.59\%$; г) interest rate falls to $r \approx 2.26\%$.

Problem 3.4: b) $m_m = 2.4$; $m_d = 2$ and $m_c = 1.4$; c) after rise in the reserve requirements ratio, the money supply and the volume of deposits decreased by 16.7%, while the volume of loans by 28.6%.

Problem 3.5: a) $M_S = 1080$ m.u.; б) $Y = 1250$ units; monetization coefficient = 86.4%; c) the central bank should increase the monetary base by 19.2 m.u.

Problem 3.6: $\Delta M_S = 100$ money units.

Unit 4. **Co-equilibrium of Aggregate Market of Goods and Services and Money Market**

The IS-LM model. Influence of fiscal and monetary policy on economic performance. Neo-Keynesian multipliers, Haavelmo theorem and crowding out effect. Aggregate demand function AD formation. Special cases in the IS-LM model.

IS−LM model was developed in the 30s of XX century by J. Hicks, who was representative of the Neo-Keynesian thought, to demonstrate the Keynesian equilibrium. In the 50s A. Hansen using this model revealed different influence of monetary and fiscal policy on the parameters of the macroeconomic equilibrium: namely, real GDP and real interest rate. The model demonstrates simultaneously achieved equilibrium in the goods market and the money market.

IS curve

The IS (investment−saving) curve demonstrates different combinations of real income (Y_r) and real interest rate (r) for which there exists the balance of real investment (I) and real savings (S). At the same time it means the balance of aggregate demand (AD) and aggregate supply (AS), i.e. the equilibrium on goods market.

Simple IS curve is constructed for the two-sector economy in which the household sector (savers) and firms sector (investors) are interacting. In this model investment is inversely related to the interest rate (r), and savings is directly related to income (Y_r). Thus, all local equilibriums $S\left(\overset{+}{Y_r}\right) = I(\overset{-}{r})$ form an inverse relationship between income and interest rate.

More complex IS curve represents the interaction of three sectors of economy: households, firms and government. It is constructed for the balances: $S\left(\overset{+}{Y_r}\right) + T = I(\overset{-}{r}) + G$, where $T = T_a + t \times Y$ − taxes including autonomous part (T_a), which doesn't depend on income, and income-based part, where t is the rate of income tax.

IS curve shifts to the right when:

✓ government decreases autonomous taxes (T_a) or income tax rate (t). In the first case the curve shifts in parallel, in the second case it changes the slope;

✓ government increases purchases of goods and services (G);

✓ government increases transfers to households and firms (TR_a).

Impact of these measures on the real demand is implemented via "multiplier effect" (table 4).

Table 4

Multipliers in three-sector closed economy

Multiplier of…	Formula for calculation	Total expenditures influence
- autonomous expenditures	$m_a = \dfrac{1}{1 - MPC \times (1-t)}$	$\Delta Y^D = m_a \times \Delta A_a$
- government purchases	$m_G = \dfrac{1}{1 - MPC \times (1-t)}$	$\Delta Y^D = m_G \times \Delta G_a$
- transfers	$m_{TR} = \dfrac{MPC}{1 - MPC \times (1-t)}$	$\Delta Y^D = m_{TR} \times \Delta TR_a$
- autonomous taxes	$m_T = \dfrac{-MPC}{1 - MPC \times (1-t)}$	$\Delta Y^D = m_T \times \Delta T_a$
- balanced budget	$m_{BD} = \dfrac{1 - MPC}{1 - MPC \times (1-t)}$ (when extra government purchases are financed by additional autonomous tax) $m_{BD} = \dfrac{1 - MPC}{1 - MPC} = 1$ (when extra government purchases are financed by additional income tax)	$\Delta Y^D = m_{BD} \times \Delta G_a$ (on conditions that: $\Delta G_a = \Delta T_a$)

Note: MPC – marginal propensity to consume as to disposable income; t – income tax rate; $MPC \times (1-t)$ – marginal propensity to consume as to gross income;

Multiplier in open economy with induced investment takes the form: $m_a = \dfrac{1}{1 - [MPC \times (1-t) - \mu + \eta]}$, 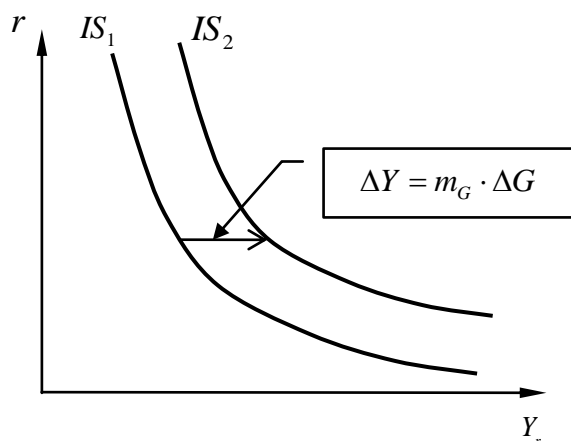where μ – marginal propensity to consume import goods and services; η – marginal propensity to induced investment.

The Haavelmo theorem affirms that an increase in the public expenditures, which is financed fully over additional income taxes, primarily results in the same product increase, thus $\Delta G = \Delta T = \Delta Y$.

Figure 6. IS curve its shift after government purchases increase

$$\Delta Y = m_G \cdot \Delta G$$

IS function arithmetic:

$$Y = A + m_G \times G_a + m_T \times T_a - \beta \times m_I \times r,$$

where $A = \dfrac{C_a + MPC \times TR_a + I_a}{1 - MPC \times (1-t)} = m_a \times A_a$ – multiplied autonomous expenditures, which is a

constant value; $I = I_a - \beta \times r$ – function of investment.

Alternative views on results of tax cuts:

Keynesian Economics: Tax cut $\rightarrow$ Aggregate Demand increase $\rightarrow$ Output and prices rise. Budget deficit will increase because of decrease in state revenues.

Supply-side Economics: Tax cut $\rightarrow$ Workers and firms keep more their earnings, that stimulate productivity $\rightarrow$ Aggregate Supply increase $\rightarrow$ Output and employment rise, prices fall. Budget deficit will decline because of greater increase in productivity in comparison with decrease in taxes.

LM curve

The LM (liquidity–money) curve demonstrates different combinations of real income (Y_r) and real interest rate (r) for which there exists the balance of liquidity preference (L) and real money supply (S). It presents the equilibrium on money market for constant volume of real money supply ($M/P = const$).

The transactions demand for money is a direct function of the real income, and speculative demand for money is an inverse function of the real interest rate. Since their sum is equal to the real money supply, all local equilibriums ($M_S / P = L(\overset{+}{Y_r}, \overset{-}{r})$) form a direct relationship between income and interest rate.

When the central bank increases the money supply (M_S), the LM curve shifts to the right
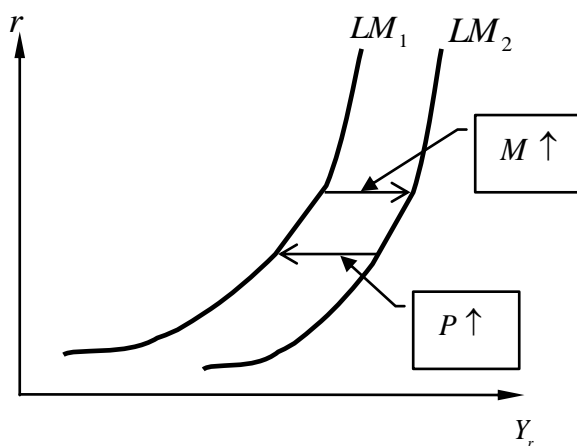

Figure 7. LM curve its shift after monetary impulse

in short-run. In response to this, in the long-run, the general price level rises, and the curve LM shifts back to the left.

LM function arithmetic:

$$Y = -L + \frac{h}{k} \times r + \frac{1}{k} \times \left(\frac{M_S}{P} \right),$$

where M_S / P is real money supply;

$L(Y, r) = L_a + k \times Y - h \times r$ - real money demand; $M_S / P = L(Y, r)$ – equilibrium

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in money market; $L = \dfrac{L_a}{k}$, $\dfrac{h}{k}$ and $\dfrac{1}{k}$ – coefficients, which are constant.

IS-LM equilibrium

Model IS–LM demonstrates that in a concrete economy under given parameters of monetary and fiscal policy, there exists the only combination of real income and real interest rate, for which both markets (goods and money) come to equilibrium at the same time.

Changing the parameters of equilibrium (Y_r, r) in the model are influenced by:

- ✓ fiscal policy, shifting the IS curve;
- ✓ monetary policy, shifting the LM curve;
- ✓ external shocks affecting the expected return on capital, assets demand for money etc.

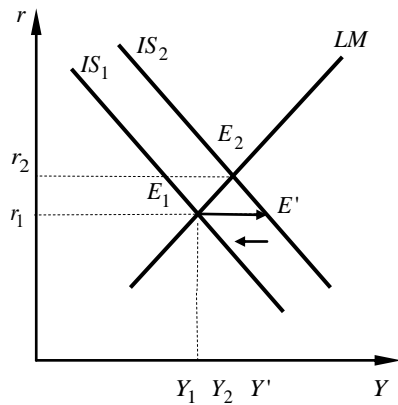The expansionist fiscal policy generates so called "crowding-out effect".

Figure 8. Consequences of fiscal expansion in the IS-LM model (short-run)

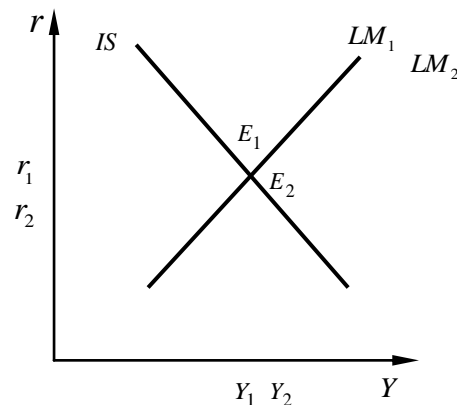Figure 9. Consequences of monetary expansion in the IS-LM model (short-run)

$Y_2 - Y'$ - crowding-out effect

Crowding-out effect – the offset in aggregate demand that results when expansionary fiscal policy rises the interest rate and thereby reduces investment spending[2].

The function of aggregate demand in Neo-Keynesian approach is derived from IS-LM model (fig. 10).

Private (extreme) cases of equilibrium in the IS-LM model

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[2] Mankiw G. (2010). Macroeconomics.

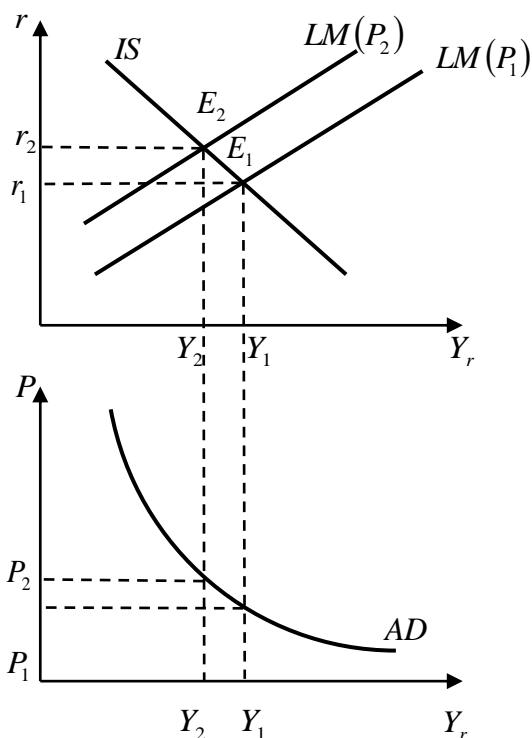1. *Full employment – vertical LM*. In this case in short-run fiscal policy is ineffective and monetary policy is highly effective. In the long-run because of rising prices monetary policy is also ineffective.

Figure 10. Aggregate demand formation

2. *Liquidity trap (completely elastic demand for liquidity) – horizontal LM*. In this case fiscal policy is absolutely effective, the crowding-out effect equals to zero. Monetary policy is ineffective because it is impossible to further decline r.

3. *Investment trap (inelasticity of investment to the interest rate) – vertical IS*. In this case fiscal policy is absolutely effective, the crowding-out effect equals to zero. Monetary policy is ineffective because the reduction in the interest rate does not affect the investment.

Problems

Problem 4.1. Suppose the economy of some country is characterized by the following data: $Y = C + I + G + NX$, $C = 200 + 0.6 \times Y_d$, $I = 400 - 2000 \times r$, $NX = 100 - 0.1 \times Y$, $M_d/P = 0.5 \times Y - 3000 \times r$.

Tasks:

a) Derive the equations for IS and LM functions;

b) Let $T = 400$, $G = 300$, $M_S = 600$, and $P = 1$. Evaluate the equilibrium income and the equilibrium interest rate for these conditions;

c) Develop the equation for AD curve as the relation between the real expenditures and the real money supply, autonomous taxes and government purchases;

d) Suppose the Government has decided to increase aggregate demand in short-run by 180 units. How much should it change the autonomous taxes or the public purchases of goods and services to achieve this aim? Estimate the crowding-out effect in this case. Determine equilibrium interest rate change.

e) Suppose not the Government but the Central Bank has set the goal to increase the income by 180 units by means of monetary policy. How much it has to change money supply in the short-run period? Estimate the changes in equilibrium level of the interest rate and investment in this case.

Problem 4.2. Imagine some closed economy with the following characteristics: consumption function is $C = 600 + 0,6 \times (Y - T)$; investment function is $I = 500 - 1600 \times r$ (r is expressed as a fraction); tax function is $T = 100 + 0,25 \times Y$; government purchases function is $G = 400 + 0,15 \times Y$. Demand for real money is $(M/P)_d = 0,5 \times Y - 3000 \times r$; money supply is $M_S = 1600$; price level is $P = 2$.

Suppose the government has increased autonomous government expenditures by 200 units. Estimate the crowding-out effect. What should the Central Bank undertake to neutralize this effect entirely?

Answers to the problems

Problem 4.1:   a) IS: $Y_{IS} = 1400 - 1,2 \times T + 2 \times G - 4000 \times r$; LM: $Y_{LM} = 2 \times \dfrac{M_S}{P} + 6000 \times r$; b)

$Y_E = 1392$ units; $r_E = 0,032$ (or $3,2\%$); c) AD: $Y_{AD} = 840 - 0,72 \times T + 1,2 \times G + 0,8 \times M_S/P$; d)

$\Delta T = -250$ units, or $\Delta G = +150$ units. The crowding-out effect is equal to 120 units in both cases. $r_E = 0,062$ (or $6,2\%$); e) $\Delta M_S = +225$ units, $\Delta r = -4,5\%$; $\Delta I = +90$ units.

Problem 4.2: The crowding-out effect is equal to 200 units. The Central Bank should increase money supply by $\Delta M_S = 500$ units.

Unit 5. **Labor market, unemployment, social policy**

Definition and types of unemployment, the Okun's law. Voluntary and forced unemployment. Labor market. Inequality in personal income distribution, its measurement and linkage to economic development. Social transfers and their role in income redistribution.

The entire population of the country (P) is divided into two categories: economically active population (i.e. labor force − L) and the economically inactive population (persons outside the labor force − H). The labor force does not include some categories of population: children under 15 years, old-age pensioners (after 72 years), the disabled persons, students and pupils (not looking for work), militaries of regular term, prisoners, housewives, vagrants, and persons providing their own.

$$P = L + H.$$

The *level of economic activity*: $l = \dfrac{L}{P}$.

The entire labor force (L) is divided into two categories: employed (N) and unemployed persons (U):

$$L = N + U.$$

- **Unemployed** – persons in the labor force (related to the economically active population), actively looking for a job and ready to start it, but do not have it.

  The *unemployment rate* – the percentage of unemployed persons in the labor force:

$$u = \dfrac{U}{L}.$$

  The types of unemployment:

- ✓ *Frictional* unemployment – this is a normal amount of people voluntarily seeking a job for reasons of natural origin: a change of residence, the search for more favorable terms, the completion of a seasonal contract, graduation, dismissal from the army.

Under frictional unemployment the number of vacancies equals to the number of applicants for them, and professional structure of labor demand coincides with the professional structure of the labor supply. Frictional unemployment is short-term. Duration of frictional unemployment depends on the labor market institutions condition (maturity of the labor market

information channels, the perfection of institutions for job search, hiring and firing, labor monitoring and so on).

- ✓ *Structural* unemployment – caused by changes in the production structure or by shifts in technologies (technological unemployment) that makes someone's jobs outdated.

Structural unemployment has two differences from the frictional unemployment. Firstly, under structural unemployment the aggregate demand for labor is equal to the aggregate supply for labor, but they are not identical in structure. Thus the excess demand and excess supply for individual labor markets are in sum mutually nullified. Second, structural unemployment is longer, as it takes time to retrain workers to other specialties or enhance their skills.

- ✓ *Cyclical* unemployment – generated by the general decline in aggregate demand and production while the economic downturn.

This type of unemployment is observed at the stage of the crisis (recession) of the economic cycle when the aggregate demand for labor is reduced. During this period, there is an excess aggregate labor supply, and there is no equilibrium on the labor market. Production is below its potential volume.

Neo-classical and Keynesian economists disagree about the cyclical unemployment. Neo-classical economists recognize the existence of only frictional and structural unemployment, but they do not recognize cyclical unemployment. Keynesians consider cyclical unemployment to be the result of aggregate demand shortage in the economy.

- ✓ *Natural unemployment* – the rate of unemployment corresponding to general equilibrium in the labor market, where there is no upward or downward pressure on the general price level. Also it is called the non-accelerating inflation rate of unemployment (NAIRU) and the lowest sustainable unemployment rate (LSUR).

The notion of "natural unemployment" was introduced in economics by monetarist Milton Friedman. *Natural unemployment* consists of frictional and structural unemployment.

Okun's law is an empirically proved ("rule of thumb") negative relationship between cyclical unemployment and relative output gap:

$$\frac{Y - Y_f}{Y_f} = \gamma \times (u - u_n),$$

where $Y -$ real GDP, Y_f – potential GDP, u – actual rate of unemployment, u_n – natural rate of unemployment, $\gamma -$ Okun's coefficient, demonstrating the relative losses in GDP compared to its potential level when the actual rate of unemployment exceeds its natural rate by 1%. For the United States since 1955 this coefficient was estimated to be the range 2 to 3.

✓ *Voluntary unemployment* is connected to the concept of the marginal disutility of labor and refers to the personal decisions not to work for too low wages.

Neoclassical economists believe that in long–run there is always a balance of macroeconomic labor market, and unemployment is strictly voluntary. Merely some people overestimate themselves: the demand price for their labor is less than the supply price of it.

✓ *Involuntary unemployment* suggests that working conditions suit a potential employee, and it meets employers' requirements, but cannot find a job because of the crisis and bankruptcies.

In the view of the Keynesians, namely cyclical unemployment is an involuntary.
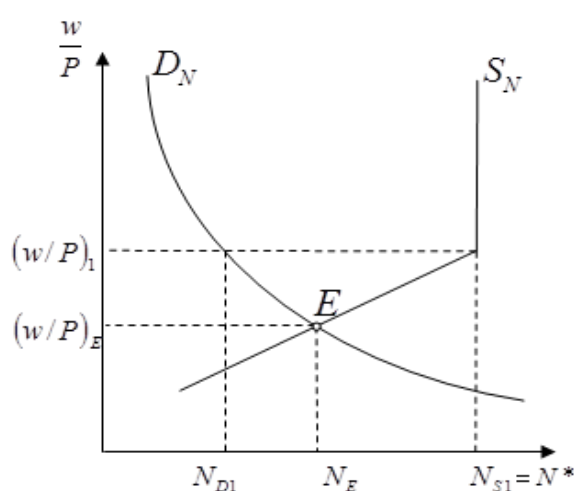
The demand for labor D_N is an inverse relationship of the number of hours or workers the firms want to hire (N) of the real wage rate ($\frac{w}{P}$). Labor supply S_N is a direct relationship of the number of hours or workers wanted to be hired of the real wage rate. $N*$ – number of employees in the state of full employment. The figure 11 shows that the equilibrium in the labor market occurs when there is unemployment, $N*-N_E$. Activation of these people is possible by increase the wage rate from $(w/P)_E$ to $(w/P)_1$. But this results in short-term involuntary unemployment ($N_{S1} - N_{D1}$). Automatic market mechanisms under perfect competition will reduce wages and restore equilibrium in the long run. There are two ways to achieve full employment: 1) an increase in aggregate demand and the demand for labor in short run (Keynesian approach); 2) technical progress and increase in labor productivity in the long run (Neoclassical approach). In this cases, the demand curve shifts to the right-up.

Figure 11. Equilibrium on the labor market

Inequality in income distribution

This problem concerns: the measuring the degree of inequality in income distribution; the determining the causes of inequality and its macroeconomic consequences; the working out effective ways to reduce inequality.

- **The Lorenz curve** – a graphical representation of the cumulative distribution function of income.

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Table 5

Information for the construction of the Lorenz curve

Quintiles of the population (20%)	Percentage of the total income earned	The cumulative percentage of the population	The cumulative percentage of income
1-st	5	20	5
2-nd	10	40	15
3-rd	15	60	30
4-th	25	80	55
5-th	45	100	100
Total	100	-	-
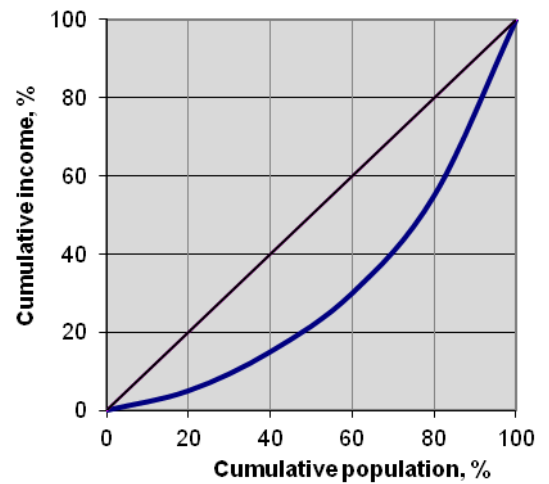
Figure 12. Lorenz curve

- *The Gini coefficient* – relative index of inequality in income distribution calculated based on the Lorenz curve as the ratio:

$$G = \frac{\text{the area between the line of perfect equality and the observed Lorenz curve}}{\text{the area between the line of perfect equality and the line of perfect inequality}}.$$

The larger the inequality, the closer the Gini coefficient to 1. The smaller the inequality, the closer its meaning to zero.
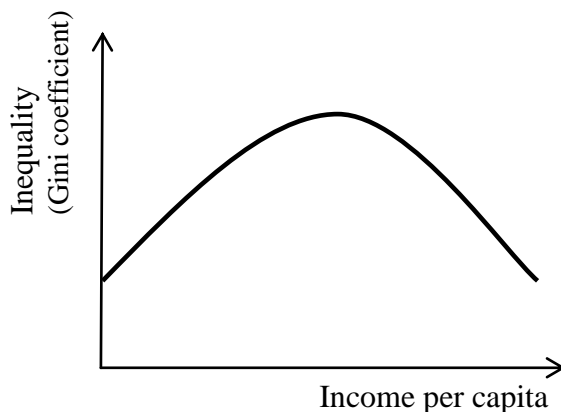

Figure 13. The Kuznets curve

- *The coefficient of funds* – the ratio of total income of the richest 10% of the population to the total income of the poorest 10% of the population.
- *The Kuznets curve* – graphic hypothesis asserting that as the economy develops the inequality at first increases and then declines.
- *Social policy* – a system of government measures involving the distribution and redistribution of income. It is aimed at reducing inequality in income distribution, maintaining social justice and stability, improving the welfare and living conditions of the poor, reducing poverty and ensuring the availability of vital benefits for all groups of population.

Problems

Problem 5.1. In some country with a population of 250 million people, the level of economic activity is 48%, and the unemployment rate is 7.5%. What is the number of people employed in this country?

Problem 5.2. It is known the time average person spend unemployed is 1.5 months, and the time average person spend employed is 3 years. Determine the natural rate of unemployment.

Problem 5.3. In a country during every month 2% of employees are losing their jobs, and 40% of the unemployed finding work. What is the natural rate of unemployment in this country?

Problem 5.4. A certain country is inhabited of 150 million people, one third of which is economically inactive. And 88 million of population are employed. The friction unemployment rate is 2.5%, and structural unemployment rate is 3.8%. Determine the rate of cyclical unemployment in given country.

Problem 5.5. In a certain country, 25% of the population is not included into the labor force, and 70% of the population is employed. The level of natural unemployment rate is 4%, while the Okun's coefficient is 3. Current GDP amounted to 6.9 trillion units. By using the Okun's law equation, determine potential GDP in this country.

Problem 5.6. The potential GDP of a certain country is estimated at 6,000 billion dollars, and the natural unemployment rate is 5%. The real GDP in the current year amounted to 4.8 trillion. The A. Okun's coefficient is 2.5. Determine the actual unemployment rate of current year.

Problem 5.7. The entire population of the country is divided into 30 income groups. The average yearly income of the first group is equal to 1, the second group – 2, and every next group earns per capita by 1 unit more than the previous group. So their per capita incomes are: 1, 2, 3, 4,…., 30. Calculate: a) the coefficient of funds; b) the quintile coefficient; c) the Gini coefficient. Construct a Lorenz curve.

Answers to the problems

Problem 5.1: 111 million people.
Problem 5.2: 4%.
Problem 5.3: ≈4.8%.

Problem 5.4: 5.7%.

Problem 5.5: $Y_F = 7.5$ trillion units.

Problem 5.6: 13%.

Problem 5.7: a) the coefficient of funds is equal to 14.5; b) the quintile coefficient = 7.86; c) the Gini coefficient = 0.32.

Unit 6. **Inflation, its mechanisms and effects**

> Inflation: forms, types and mechanisms. Social costs and distributive effects of inflation. Theories, causes and consequences of inflation. Trade-off between inflation and unemployment: Phillips curve and its interpretation in Keynesian approach, theories of adaptive and rational expectations.

Inflation – a steady growth of the general price level of goods and services in an economy over a certain period of time, accompanied by a decrease in the purchasing power of money.

In modern macroeconomics **two forms** of inflation are considered.

✓ *open inflation* – an explicit rise in the general level of goods and commodities prices in an economy over a period of time.

It can be measured on the basis of changes of consumer price index using the following formula:

$$\pi_t = \left(\frac{CPI_t}{CPI_{t-1}} - 1 \right) \cdot 100\% \ ,$$

where CPI_t – is consumer price index in period t by which we mean rise in price for a basket of consumer goods and services purchased by average household. Please, notice that CPI_t is calculated on the basis of the Laspeyres price index:

$$CPI_t = \frac{\sum_{i=1}^{m} P_{it} \cdot Q_{it-1}}{\sum_{i=1}^{m} P_{it-1} Q_{it-1}} \ .$$

In this formula the denominator is cost of consumer basket referring to the previous period of time and the numerator is cost of the same basket related to the current period of time.

✓ *repressed (suppressed) inflation* – inflation disguised by the government policy of prices, wages or exchange rate control or other interferences in the economy such as subsidies.

Notice, the theory of repressed inflation was developed by the Stockholm school of economic thought after the Second World War when governments interfered in the market economy seeking to regulate prices directly or indirectly. It was very important to stabilize the

situation in the short run in the conditions of the commodity shortage but such a policy also caused accumulation of disequilibrium in the long run.

Types of inflation distinguished by a number of criteria

Criteria 1. The rate of increase in prices:

✓ *Creeping inflation* – the total price growth does not exceed 10 percent per year. Inflation of this type is considered to be a positive phenomenon in the economy since it enhances economic growth;

✓ *Galloping inflation* – growth in the general price level of twenty percent to 2 hundred percent per year. For this type of inflation spurts in prices are observed;

✓ *Hyperinflation* – over 50 percent **i**ncrease in prices per month. This type of inflation is characterized by enormous budget deficit which is financed through Central Bank loans to the government, that is, through credit money emission. Besides, this inflation is heated up by the inflationary behavior of the population: under the influence of inflationary expectations people try to dispose of the money they have.

Criteria 2. The connection of inflation to structural changes in an economy.

✓ *Balanced inflation* – prices for all goods and services and factors of production grow simultaneously and to the same extent. Such a situation is hypothetical, it is very unlikely to be found in a real economy;

✓ *Unbalanced inflation* – uneven growth in prices accompanied by structural changes in an economy. Since different markets respond to economic instability to different extent and at different rates, prices change accordingly, some of them reacting with a delay.

Criteria 3. Failing or meeting inflationary expectations of economic players (agents).

✓ *Expected inflation* – inflation that accompanied by in average perfect ability of economic agents to forecast prices, their so-called rational expectations.

✓ *Unexpected inflation* – accompanied by imperfect ability of economic agents to forecast prices, not sufficient to adapt to inflation completely.

In research literature an *anticipated* and *unanticipated* types of inflation are also distinguished. Apparently, banks make it much easier to protect themselves from inflation just by including its rate in nominal interest, in comparison with households, which have to suffer from inflation even though they forecast it properly.

Mechanisms of inflation

✓ *Demand-pull inflation* is inflation caused by aggregate demand pressure on an economy (Figure 14).

Aggregate demand increase leads to rise in prices and at the same time it is followed by growth in production. Such inflation is seen as a by-product of heating the economy. Demand-pull inflation can result from excessive money emission, state budget deficit coverage, and unsecured loans to economy and inflationary expectations of economic players. Recently in the Russian economy demand-pull inflation has been caused by export revenue inflows due to a favorable state of foreign markets for oil and gas industries. Another reason for DPI in the Russian economy is **i**ncrease in foreign loans by corporate sector of the economy. In advanced economies the recent strengthening of the demand-pull inflation is due to monetization of supernormal state debt and the expansion of mortgage borrowing.
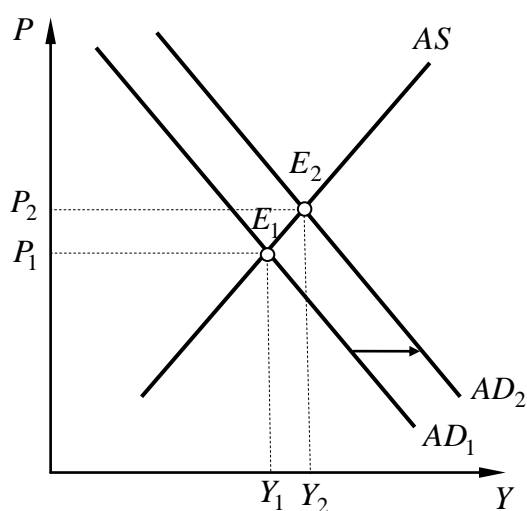
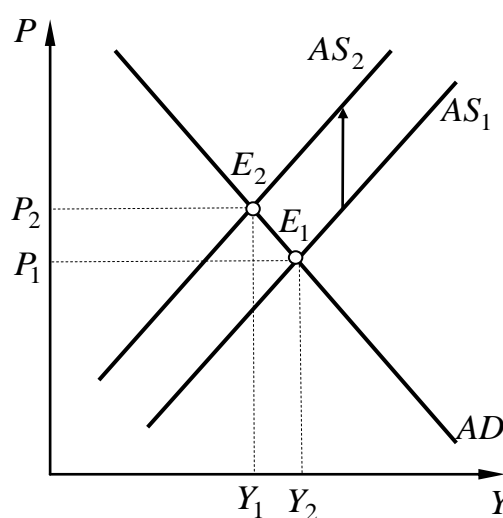

Figure 14. Demand-pull inflation

Figure. 15. Cost-push inflation

✓ *Cost-push inflation* is inflation caused by a substantial increase in production costs. This happens because of the rise in the prices of production factors where no suitable alternative is available or due to so-called "supply shocks": crop failures, worldwide drought, oil price hike etc. (Figure 15).

Such inflation leads to simultaneous growth in prices and decrease in output. Both results are considered as negative, so cost-push inflation is worse than demand-push inflation. According to Keynesians, cost-push inflation may result from trade-union struggle for pay increase. Some modern economists generally connect it with monopolistic behavior, and it is natural monopolies like gas, electricity and rail-way companies that demonstrate such behavior. Other reasons of cost-push inflation are external, namely the rise in prices of imported goods (so-called imported inflation) or decline in exchange rate of national currency.

Social costs of inflation

a) "shoe leather cost" – costs associated with adaptation to inflation, mainly involving the change in patterns and types of savings of current income and accumulated property. Shoe leather cost includes spending of time and effort to convert the money into real assets and back to counteract the negative consequences of inflation;

b) "menu cost" – enterprise costs associated with frequent changes in prices in the face of inflation. They include the cost of new prices calculating, printing and distributing of new catalogs, hiring consultants to develop new pricing strategies, updating computer systems and vending machines, re-tagging items, concluding a new contracts etc.

c) "relative-price variability and the misallocation of resources": due to the constantly changing prices agents weakly distinguish local relative price signals from price changes due to general inflation, so they are slow to respond to them. This impedes a Pareto-efficient allocation of resources;

d) "inflation-induced tax distortions" – costs associated with the unjustified increase in taxation while inflation;

e) "confusions and inconvenience" – different time value of money complicates the calculating of the costs and making up the balances.

Distributive effects of unpredicted raise in inflation: a) distribution of incomes between capital and labor as factors of production; b) distribution of incomes between persons with flexible (or indexed) and rigid (non-indexed) salaries; c) distribution of incomes between creditors and debtors.

Positive effects of inflation: a) labor market adjustment; b) Central Bank maneuver with liquidity; c) Mundell-Tobin effect.

Inflation impacts on the state budget condition: a) Olivera-Tanzi effect – deterioration of real taxes proceeds (negative effect); b) Patinkin effect – diminishing a real value of the part of budget expenditures that is nominally expressed (positive effect); c) economic growth suppression (negative effect); d) decrease in real cost of the public debt service (positive effect).

Nominal interest – the amount by which the unit of currency lent or borrowed increases over time (typically for the year). *Real interest* – the amount by which the purchasing power of the unit of currency lent or borrowed increases over time. Real interest rate *(r)* is equal to nominal interest *rate (n)* minus rate of inflation (π). The Fisher equation allows us to calculate the real interest rate more accurately: $r = \dfrac{i-\pi}{1+\pi}$. *The Fisher hypothesis*: monetary policy does not affect the real interest rate, when inflation rate rises the nominal interest rate rises by the same amount (Note: this is Neoclassical approach!).

Trade-off between inflation and unemployment: Phillips curve

Phillips curve is an inverse relationship between rates of unemployment and corresponding rates of inflation. It is an instrument of the Keynesian approach. According to this approach, the higher the unemployment rate, the lower the wage rate and the lower the cost-push inflation.

Modified Phillips equation considering inflation expectations (π_t^e) and the external price shock (η) takes the form:

$$\pi_t = \pi_t^e - \beta \times (u_t - u_n) + \eta.$$

When the actual unemployment rate is equal to its natural rate ($u_t = u_n$), inflation is just determined by the expected changes in prices and unexpected external shock ($\pi_t = \pi_t^e + \eta$). The presence of cyclical unemployment curb inflation. At the same time, over employment pulls prices up.

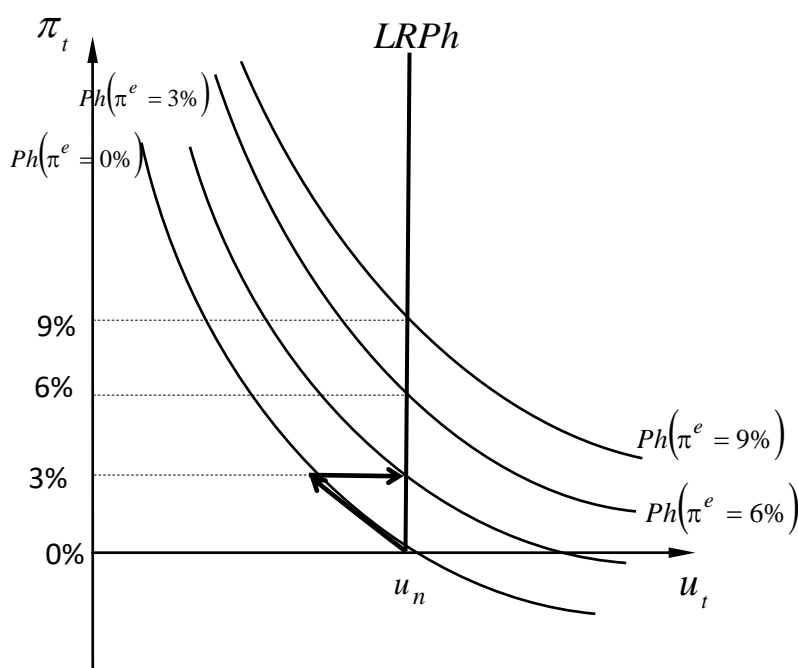There are three approaches to Phillips curve (Figure 16):

Figure 16. Family of short-run Phillips curves at different levels of expected inflation (Keynesian view) and long-run Phillips curve (Neoclassical view)

✓ *Keynesians* – recognize the dependence of the short-run Phillips and propose to use it as a tool of economic policy.

- ✓ *Monetarists* (after M. Friedman) – recognize the Phillips curve in the short run as a result of "adaptive expectations". They believe that in the long run Phillips curve becomes vertical, that is, different levels of inflation correspond to the natural rate of unemployment. The transition from short-term to long-term equilibrium in monetarists approach is shown on the Figure 16 by the bold arrows.
- ✓ *New Classical Macroeconomists (R. Lucas, T. Sargent)* – suggested the hypothesis of "rational expectations", according to which the Phillips curve is vertical, not only in the long term, but in the short term.

Problems

Problem 6.1. In a certain country in the current year the average nominal wage increased by 1.15 times. The inflation rate for the year was 24%. How much has the average real wage changed?

Problem 6.2. In a certain country in 2009 the inflation rate was 13%, in 2010 it was 8.5% and in 2011 − 6%. How much have prices changed in three years?

Problem 6.3. Consumer price index in Russia in 2004 amounted to 1.117 relative to 2003; in 2005 it was 1.109 as compared with 2004; in 2006 it was 1.09 to the 2005. The experts of the "First Credit " bank expected that an average inflation rate will not change over the next three years.

Tasks: a) Determine at which interest rate the bank "First Credit" issued 3-year loan for the reconstruction of "Agromashservis" if the board of directors of the bank aimed to get the average real interest rate on loans at a rate of 6%; b) In 2007 consumer prices rose by 11.9%, in 2008 − by 13.3%, in 2009 − by 8.8%. Determine the actual real interest rate, obtained by the " First Credit" bank for each year and in total for three years. Whether has the bank managed to achieve the set goal?

Problem 6.4. The Phillips curve equation is: $\pi = \pi^e - 0{,}4 \cdot (u - u_n) + \eta$. In current year the inflation rate was at 4% higher than forecast, and the actual unemployment rate exceeds the natural rate of 2%. Natural rate of unemployment remained unchanged. Determine which rate of inflation was caused by unpredictable external shock.

Problem 6.5. The Phillips curve equation is: $\pi_t = \pi_{t-1} - 0{,}4 \cdot (u - 0{,}05)$. Inflation expectations are adaptive and formed on the level of the last year inflation, which amounted to 2%. The Okun's coefficient is 2.5. If the Government pursues an expansionary policy aimed at

increase in GDP by 5% compared to its potential level, what the rate of inflation should we expect?

Answers to the problems

Problem 6.1: The average real wage fell by 7.3%.

Problem 6.2: Prices have risen by 30%.

Problem 6.3: A) the bank issued a loan at 17.16% per annum; b) the bank has received the actual real interest rate of 4.7% in 2007, 3.4% in 2008, 7.7% in 2009. The real compound interest for three years is 16.6%. Since the bank planned to get 19.1%, the target is not reached.

Problem 6.4. Inflation caused by unpredictable external shock was 4.8%.

Problem 6.5. We should expect inflation of 2.8%.

Unit 7. **Macroeconomic Dynamics. Fluctuations and Growth**

Economic cycle, its parameters and types, theories of macroeconomic cyclicality, Samuelson – Hicks model of economic fluctuations. Economic Growth: definition, measurement and the factors. Solow-Swan model of economic growth.

Economic fluctuations

The business cycle is periodical fluctuations in business activity, repeated regularly and characterized with the simultaneous changes in real GDP and other macroeconomic parameters.

1. *Business* (*economic*) *cycle* consists of economy-wide fluctuations of the real GDP and economic activity around a long-term growth trend that last over several months or years. Its increasing wave includes: recovery (below the trend), expansion (above the trend) and boom, or peak (the highest point of the cycle). Its diminishing wave includes: recession (above the trend), depression (below the trend) and bottom (the lowest point of the cycle).

2. *The variables (parameters)* in the business cycle may be: procyclical, countercyclical, and acyclical; leading, lagging, and coincident.
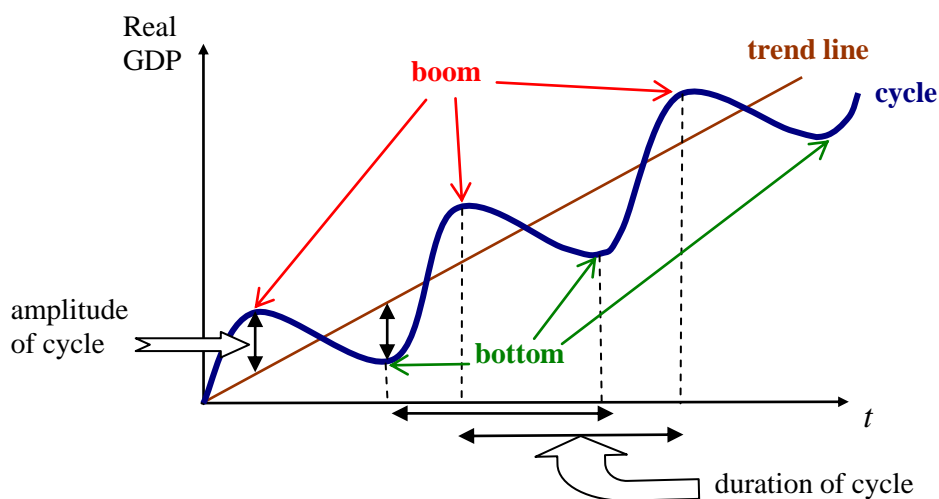

Figure 17. Business cycle

✓ *Procyclical variables* – which are changing in the same direction as real GDP, i.e. increasing in the recovery and expansion stages of cycle and decreasing during a recession and depression. These variables are the total output, the capacity utilization, the

money supply, the velocity of money, the short-term interest rates, the general level of prices, the corporate profits;

✓ *Countercyclical variables* – which are changing in opposite direction to the real GDP: while economic growth they are coming down, and vice versa. These variables are the unemployment rate, the number of bankruptcies, the size of inventories;

✓ *Acyclical variables* – for which the direction of change does not depend on the stage of cycle.

✓ *Leading variables* – which are changing prior to the GDP changing. These variables are the stock indices which considered as barometers of economic activity, the inventories, the capacity utilization, and, according to economists who share the views of monetarism, the change in money supply.

✓ *Lagging variables* – which are changing after a while the real GDP changing. These variables are the unemployment rate, the wage per unit of labor, the average interest rate of commercial banks, the spending for new building and equipment. The labor market adapts to economic shocks with a minimum speed, due to the long-term contracts on wages and employment. Response delay of individual indicators in economics is called *the hysteresis*.

✓ *Coincident variables* – which are changing simultaneously with the real GDP changing. These variables are the industrial production, the rate of inflation.

3. Main types of cycles according to their causes and periodicity (the first four are from the classification by Joseph Alois Schumpeter)[3]:

- the Kitchin inventory cycle of 3–5 years (after Joseph Kitchin);

- the Juglar fixed investment cycle of 7–11 years (often identified as 'the' business cycle);

- the Kuznets infrastructural investment cycle of 15–25 years (after Simon Kuznets also called building cycle);

- the Kondratiev wave or long technological cycle of 45–60 years (after Nikolai Kondratiev);

- the Forrester energy supply and used materials cycles of 200 years (after Jay Wright Forrester);

- the Toffler civilization cycles of 1000-2000 years (after Alvin Toffler).

4. Main theories of economic cyclicality: endogenous vs. exogenous.

- Overinvestment theory (Thomas Robert Malthus);

- Underconsumption theory (Jean Charles Léonard Simonde de Sismondi);

- Outside factors theory, or sunspot theory (William Stanley Jevons, Henry Ludwell Moore);

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[3] http://en.wikipedia.org/wiki/Business_cycle.

- Psychological theories (William Stanley Jevons, John Maynard Keynes);
- The Marxist theory and the Goodwin model (after Richard M. Goodwin) ;
- Innovative theory of economic development (Joseph Alois Schumpeter);
- New Keynesian theories (John R. Hicks and Paul A. Samuelson);
- Monetarist theory of business cycle (Milton Friedman and Edmund Phelps);
- Real business cycle theory (Finn E. Kydland and Edward C. Prescott);
- Politically-based business cycle theories (William Nordhaus).

The Samuelson-Hicks multiplier-accelerator model

Main model. Investment multiplier: $k = \dfrac{1}{1 - c_Y}$, where c_Y – marginal propensity to consume. Accelerator of investment: $v = \dfrac{I_t}{(Y_{t-1} - Y_{t-2})}$.

Earned income (Y) in closed economy is spent to:

- consumption: $C_t = C_a + c_Y \times Y_{t-1}$, where C_a - autonomous consumption, that does not depend on income, because it depends on other factors;

- investment: $I_t = I_a + v \times (Y_{t-1} - Y_{t-2})$, where I_a - autonomous investment;

- autonomous government purchases: $G_t = G_a$.

Put $C_a + I_a + G_a = A_a$ - the sum of autonomous expenditures. So we get the income function in dynamic form: $Y_t = C_t + I_t + G_t = A_a + (c_Y + v) \times Y_{t-1} - v \times Y_{t-2}$

When A_a is constant, income will attain some invariable level: $\bar{Y} = \dfrac{\bar{A_a}}{1 - c_Y}$. So an income function takes the form: $Y_t = (1 - c_Y) \times \bar{Y} + (c_Y + v) \times Y_{t-1} - v \times Y_{t-2}$.

When A_a changes, Y_t will also change gradually approaching its new steady level $\bar{Y}$. We can express deviation from it for each period of time: $\Delta Y_t = Y_t - \bar{Y}$; $\Delta Y_{t-1} = Y_{t-1} - \bar{Y}$; $\Delta Y_{t-2} = Y_{t-2} - \bar{Y}$.

After substitution of Y_t, Y_{t-1} and Y_{t-2} we receive *main equation of the model*:

$$\boxed{\Delta Y_t = (c_Y + v) \times \Delta Y_{t-1} - v \times \Delta Y_{t-2}}$$

By using the finite difference method for solving the differential equation, we can determine the value of the Discriminant: $d = b^2 - 4ac \rightarrow$

$$d = (c_Y + v)^2 - 4 \times v.$$

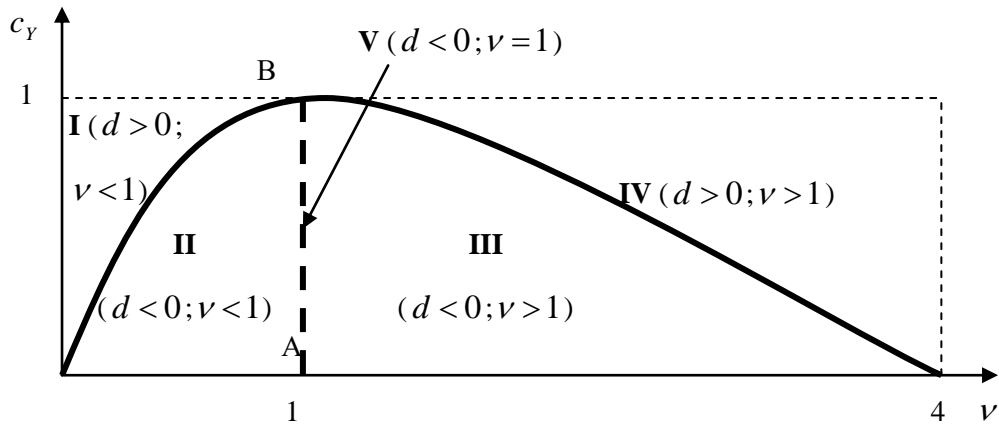Figure 18 represents the function for $d = 0$: $c_Y = -v + 2\sqrt{v}$.

Figure 18. Function d=0 and the areas of monotonic and oscillatory changes

When $d \geq 0$, alteration of Y_t will be monotonic.

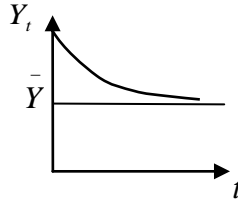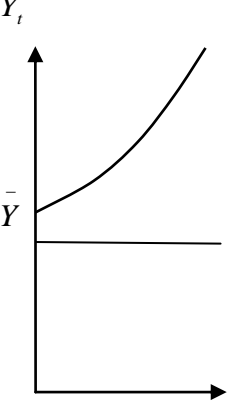When $d < 0$, alteration of Y_t will be oscillatory.

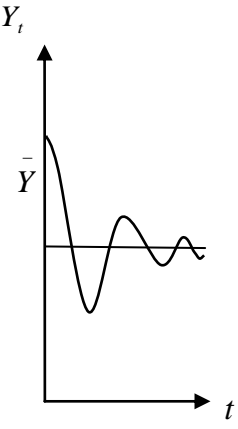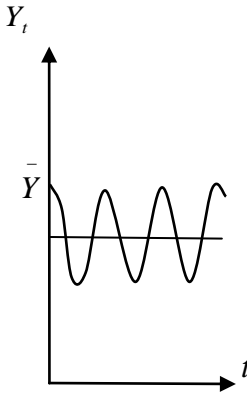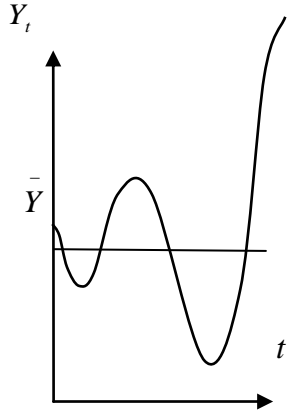When $v < 1$, Y_t approaches the new stable level.

When $v > 1$, Y_t deviates from the new stable level all the more.

When $v = 1$, Y_t oscillates around $\bar{Y}$ with a constant amplitude.

Table 6

Types of Y_t alteration relative to $\bar{Y}$

	$v < 1$	$v = 1$	$v > 1$
$d \geq 0$	Monotonic convergence	*Impossible situation* ($d = 0 \rightarrow c_Y = 1 \rightarrow$ $\bar{Y} = \infty$)	Monotonic divergence Unreal situation!

$d<0$	Convergent oscilations	Oscillations of a constant amplitude	Divergent oscilations

Fluctuations would be bounded above and below! |

Economic Growth

Economic growth − an upward trend in the real GDP for any period of time. The rate of economic growth is determined as relative change in the real GDP (Y_{Rt}):

$$g_t = \frac{Y_{Rt} - Y_{Rt-1}}{Y_{Rt-1}} \times 100\% .$$

Economic growth can be represented in three ways:

✓ as a shift of the production frontier built in the national scale (see Fig. 19a);

✓ based on the aggregate demand-aggregate supple model:

− as a shift of the AD curve to the right – short-run growth according to the Keynesian approach (see Fig. 19b);

− as a shift of the vertical segment of the AS curve − long-run growth according to the Neoclassical approach (see Fig. 19c);

✓ as a positive slope of the trend line (see Fig. 19d). The dashed line means the trend of potential GDP according to the Keynesian approach. The arrow line is the potential GDP tendency according to the Neoclassical approach.
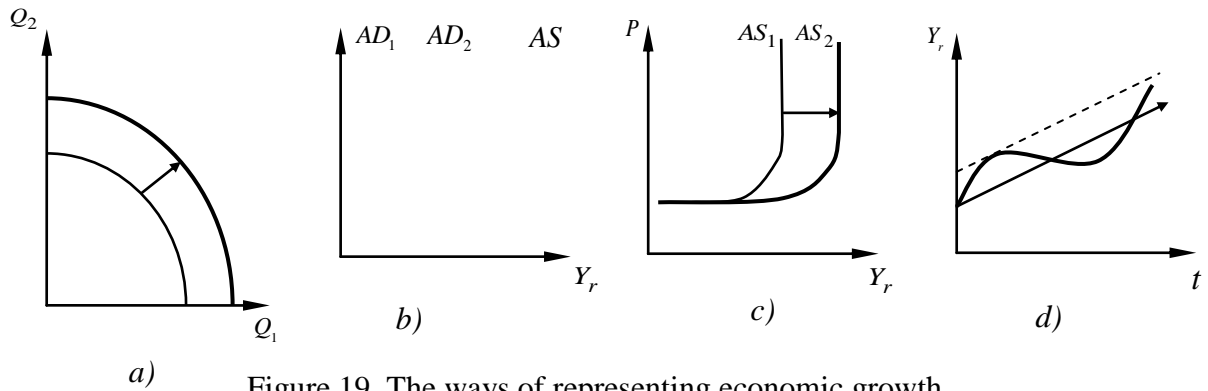
Figure 19. The ways of representing economic growth

In an open economy is also distinguished:

✓ *Export-oriented economic growth* – supported by increasing external demand.

✓ *import-substituting economic growth* – supported by replacement of foreign goods and services on the domestic markets with the national goods and services.

There are many models of economic growth. The most important of them:

1. Keynesian models (the models by E. Domar and R. Harrod).

2 Neoclassical growth model (the model by R. Solow and T.W. Swan).

3 Post-Keynesian theory of economic growth.

4 The theories of Economic Development.

The Solow Growth Model

This model was developed by Robert Solow and T.W. Swan in 1956.

1. It is based on following *production function* (PF):

$$Y(t) = F(K(t), A(t) \times L(t)) \tag{1},$$

where Y – output, K – capital, L – labor, A – knowledge or the «effectiveness of labor», t – time. $A(t) \times L(t)$ is so called «effective labor», and the technical progress here is «labor augmenting» or Harrod-neutral.

2. There are some *assumptions* concerning production function:

• *homogeneous character*;

• *constant returns to scale*:

$$\forall c \geq 0, \ F(cK, cAL) = cF(K, AL). \tag{2}$$

It means that: a) the advantages of specialization are exhausted, and the economy is sufficiently big; b) other factors, such as natural resources and land, have no impact on output.

By dividing both parts of the equation (1) by AL, we get the expression:

$$\frac{Y}{AL} = \frac{1}{AL} F(K, AL) = F\left(\frac{K}{AL}, 1\right), \tag{3}$$

that can be interpreted as follows: output per unit of effective labor ($y = \dfrac{Y}{AL}$) is a function of

capital per unit of effective labor ($k = \dfrac{K}{AL}$). And the equation (3) takes the intensive form:

$$y = f(k). \tag{4}$$

- *declining but positive returns to capital* (and to «capital per unit of effective labor») as capital rises:

$$f(0) = 0, \; MP_k = f'(k) > 0, \; f''(k) < 0, \tag{5}$$

where $MP_k = \dfrac{\partial Y}{\partial K} = \dfrac{\partial y \cdot AL}{\partial k \cdot AL} = \dfrac{\partial y}{\partial k}$ is the marginal product of capital.

- *production function satisfies the Inada conditions:* $\lim_{k \to 0} f'(k) = \infty$, $\lim_{k \to \infty} f'(k) = 0$.

3. Cobb-Douglas function might be considered as an appropriate case of PF:

$$F(K, AL) = K^\alpha (AL)^{1-\alpha}, \; 0 < \alpha < 1. \tag{6}$$

In intensive form:

$$f(k) = k^\alpha. \tag{7}$$

Marginal product of capital:

$$MP_k = f'(k) = \alpha k^{\alpha - 1} = \alpha \times f(k)^{\frac{\alpha - 1}{\alpha}}. \tag{8}$$

All the above-listed requirements are satisfied.

4. *Dynamics of the model with constant inputs*:

$$\dot{k}(t) = s \times f(k(t)) - \delta \times k(t), \tag{9}$$

where $\dot{k}(t)$ – time rate change of the capital stock per unit of effective labor; s – saving rate, i.e. average part of output that householders and firms intend to propose as a source for investment; δ – depreciation rate, the part of capital that wears out; both parameters are exogenous and constant.

Equilibrium in the model:

$$s \times f(k^*) = \delta \times k^*, \tag{10}$$

k^* *is steady level of* k, under which *actual investment is equal to break-even investment.*

Parameters of equilibrium for Cobb-Douglas function: $k^* = \left(\dfrac{s}{\delta}\right)^{\frac{1}{1-\alpha}}$; $y^* = \left(\dfrac{s}{\delta}\right)^{\frac{\alpha}{1-\alpha}}$.

5. *Factors of economic growth*:

- growth in labor: $\dot{L} = n \times L(t)$, $n = \dot{L}(t) \big/ L = d \ln L(t) \big/ dt$;

- growth in knowledge: $\dot{A} = g \times A(t)$, $g = \dot{A}(t) \big/ A = d \ln A(t) \big/ dt$.

Parameters n and g are considered exogenous.

Dynamics of the model with growing inputs:

$$\boxed{\dot{k}(t) = s \times f(k(t)) - (n + g + \delta) \times k(t)}. \qquad (11)$$

Equilibrium in the model: $s \times f(k^*) = (n + g + \delta) \times k^*$.

Parameters of equilibrium for Cobb-Douglas function: $k^* = \left(\dfrac{s}{n + g + \delta} \right)^{\frac{1}{1-\alpha}}$; $y^* = \left(\dfrac{s}{n + g + \delta} \right)^{\frac{\alpha}{1-\alpha}}$.

6. *Balanced growth path* – a situation of constant rate growth of each variable in the model (Table 7).

Table 7

Rates of growth of main variables on «balanced growth path»

Variables	Rate of Growth
Capital per unit of effective labor ($k = K \big/ AL$)	0
Capital per worker ($k = K \big/ L$)	g
Stock of capital ($K = k \times (AL)$)	$n + g$
Output per unit of effective labor ($y = f(k) = Y \big/ AL$)	0
Output per worker ($Y \big/ L = y \times A$)	g
Stock of effective labor (AL)	$n + g$
Output ($Y = y \times (AL)$)	$n + g$

7. *Shifts in equilibrium under the impact of s and δ changes* are presented in Figure 20.
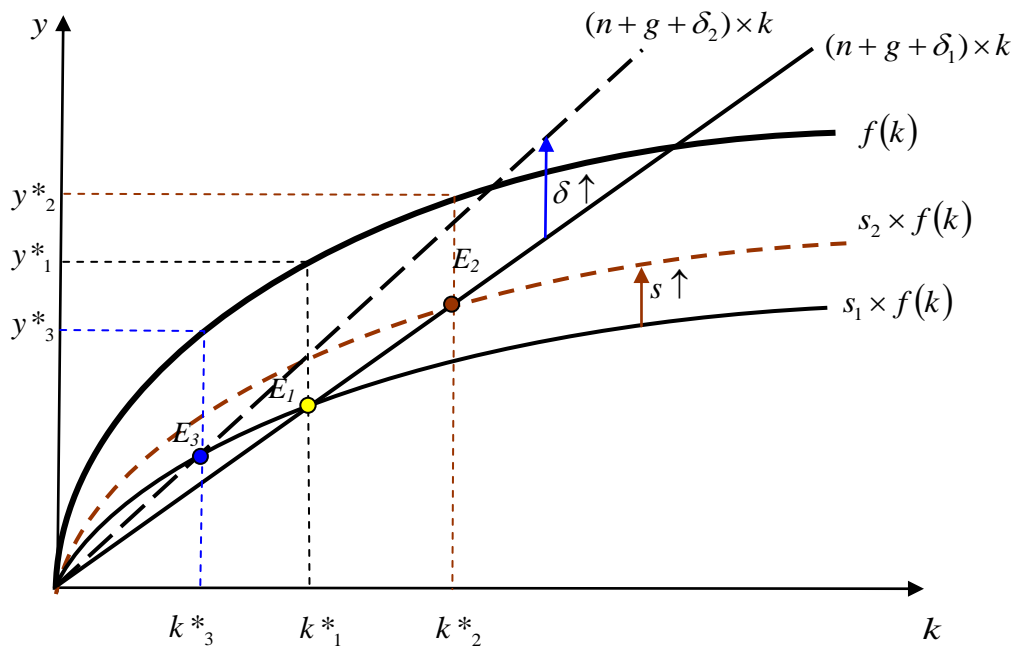
Figure 20. The Solow growth model: equilibrium and its change

8. *Golden rule level of capital stock by E. Phelps* affirms that a steady level of capital per unit for effective labor should ensure maximum consumption. Consumption per unit of effective labor: $c(k) = (1-s) \times f(k) = f(k) - (n+g+\delta) \times k \rightarrow \max$. $c'(k) = 0$, $c''(k) < 0$.

$$f'(k^{**}) = n + g + \delta \ , \qquad (12)$$

or the same: $\boxed{MP_K = n + g + \delta}$. $\qquad (13)$
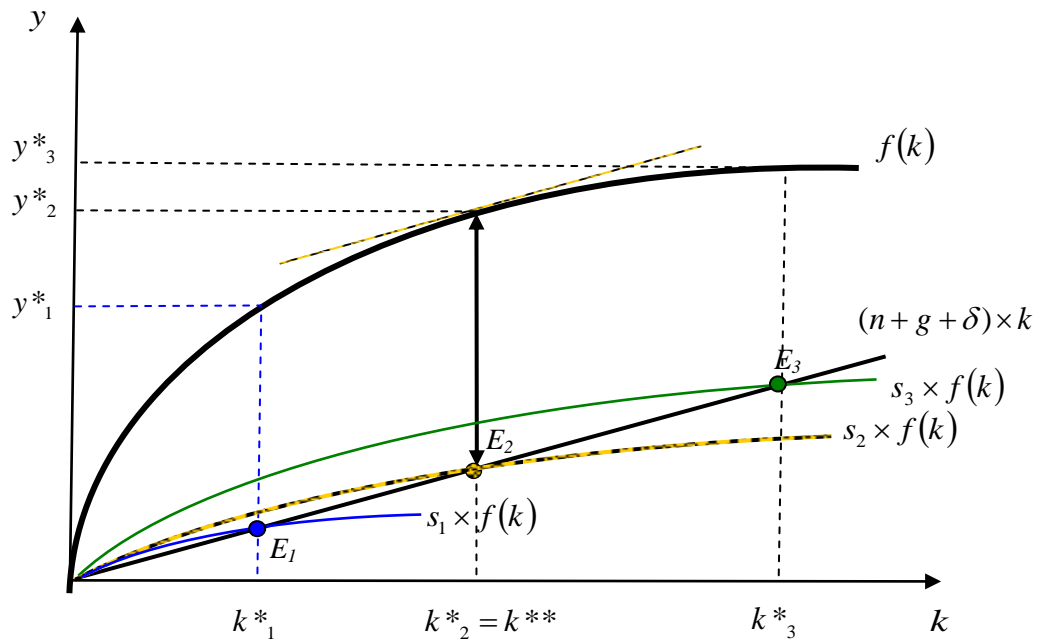
It is represented on the figure 21.

Figure 21. The Steady and the Golden levels of capital per unit for effective labor

For: $k^* = k^{**}$:

$$\begin{cases} s \times f(k) = (n + g + \delta) \times k; \\ f'(k) = n + g + \delta . \end{cases} \Rightarrow \quad s = \frac{f'(k) \times k}{f(k)}.$$

Golden rule: *optimal saving rate is equal to elasticity of output with respect to capital*. For Cobb-Douglas function: $s = \alpha$.

When $k^* < k^{**}$ (the steady level is less that the golden level), the state should conduct an economic policy aimed at increasing the saving rate ($s \uparrow$).

When $k^* > k^{**}$ (the steady level is more that the golden level), the state should conduct an economic policy aimed at decreasing the saving rate ($s \downarrow$).

9. *Convergence* («catch-up effect») – tendency of a more rapid economic growth in developing (poor) countries than in developed (rich) countries because of the smaller initial rate of return on capital in the former ones and their tendency to get a balanced growth path. Moreover, poor countries can replicate available technologies from rich countries thus gaining time. As a result, all economies will eventually converge in terms of per capita income.

Problems

Problem 7.1. (*Samuelson-Hicks model*). Suppose some economy in which the level of autonomous expenditures has increased from 100 to 200 units. For different cases presented in the table below, calculate the old and the new equilibrium level of income. Fill in the table. Define the character of income alteration for each case.

Definition of the type of income alteration for different cases

	Marginal propensity to consume c_Y	Accelerator v	Discriminant $d = (c_Y + v)^2 - 4 \times v$	Type of Y changes
Case 1	0,9	0,3		
Case 2	0,7	0,8		
Case 3	0,7	1,0		
Case 4	0,7	1,05		
Case 5	0,8	2,4		

Problem 7.2. (*Solow growth model*). Suppose some country with the production function $Y = K^{1/2} \times (AL)^{1/2}$, and other parameters of the economy are: $n = 2\%$, $g = 6\%$, $\delta = 7\%$, $s = 0,45$.

Determine: a) the steady and the golden levels of capital per unit of effective labor ($k* = ?$ $k** = ?$); b) speed of convergence and half-life of it.

Problem 7.3. Suppose some country with production function like $Y = K^{2/3} \times (AL)^{1/3}$, and other parameters of economy are: $n = 1\%$, $g_1 = 4\%$, $g_2 = 6\%$, $\delta = 5\%$, $s = 0,30$.

Determine: a) the steady and the golden level of capital per unit of effective labor ($k* = ?$ $k** = ?$); b) speed of convergence and half-life of it.

Answers to the problems

Problem 7.1: 1) $Y_{E1} = 1000$; $Y_{E1} = 2000$; $d = 0,24$; monotonic convergence; 2) $Y_{E1} = 333.(3)$ $Y_{E1} = 666.(6)$; $d = -0,95$; convergent oscillations; 3) $Y_{E1} = 333.(3)$ $Y_{E1} = 666.(6)$; $d = -1,11$; oscillations of a constant amplitude; 4) $Y_{E1} = 333.(3)$ $Y_{E1} = 666.(6)$; $d = -1,1375$; divergent oscilations; 5) $Y_{E1} = 500$; $Y_{E1} = 1000$; $d = 0,64$; monotonic divergence.

Problem 7.2: Answer: a) $k* = 9$, $k** = 11,(1)$; b) $\lambda = 7,5\%$, $t* \approx 9,2$.

Problem 7.3: Answer: a) $k* = 27$, $k** = 15,625$; b) $\lambda = 4\%$, $t* \approx 17,3$.

Unit 8. **Macroeconomic Equilibrium in Open Economy**

> Balance of Payments equilibrium under flexible and fixed exchange rate. Consequences of monetary and fiscal policy in IS-LM-BP model

- *Balance of Payments* – a table reflecting the results of the trade and financial transactions of given country with other countries, leading to cash flows from this country abroad and from other countries to this country.

Balance of payments consists of two accounts: 1) the current account; 2) the capital account or financial account.

The main component of the current account is the country's trade balance (net flows of money as a results of the country's foreign trade with other countries). Two other components of it are the factor incomes (earnings on foreign investments minus payments made to foreign investors) and net cash transfers.

The capital account reflects net change in foreign ownership of national assets. A surplus in the capital account derives from money flows into country through net borrowings or sales of assets. The deficit of capital account means outflows of money by means of net lending to other countries or increase in ownership of foreign assets.

Macroeconomics examines rough goods presentation of balance of payments, which includes two important components: the trade balance (NX) and capital account (which is the difference between the investment and the budget deficit and savings: $I + BD - S$). In sum, they are equal to the change in foreign exchange reserves (ΔR):

$$NX + (I + BD - S) = \Delta R.$$

When the change in reserves is zero: $NX + (I + BD - S) = 0$.

Balance of payments as well can be presented as equality of net goods exports and net capital exports, $NX = S - (I + BD)$.

- ✓ *Nominal exchange rate* - the amount of foreign currency that can be obtained for 1 unit of the national currency in exchange.
- ✓ *Real exchange rate* - the number of foreign goods that can be purchased instead of 1 unit of domestic goods under the current price level in the country and abroad, and actual nominal exchange rate. When we calculate the relative price of representative market basket in two countries, the real exchange rate is called purchasing power parity (PPP).

The real exchange rate (ε_r) can be calculated using the formula:

$$\varepsilon_r = \varepsilon_n \cdot \frac{P}{P*},$$

where ε_n − nominal exchange rate, P − general price level in the domestic country, $P*$ − price level abroad.

"Terms of trade" – is an inverse indicator to the real exchange rate:

$$\theta = \frac{\text{The average price of foreign goods}}{\text{the average price of domestic goods}} = \frac{P*}{\varepsilon_n \cdot P} \ .$$

If $\theta > 1$, foreign substitutes are more expensive than domestic goods when their prices converted into foreign currency on the basis of the nominal exchange rate. This means that the demand for domestic goods will increase and the demand for foreign goods will decline in both domestic and foreign markets. When $\theta > 1$ terms of foreign trade are favorable for national country. In such circumstances net exports (exports minus imports) will increase, that will cause net inflows of foreign currency and decline in its exchange rate. The national currency exchange rate will rise, and θ will decline, tending to 1.

If $\theta < 1$, foreign substitutes are less expensive than domestic goods. The terms of foreign trade are unfavorable for national country. Net exports will decline, outflows of foreign currency will take place, and foreign currency exchange rate will increase while reducing national currency exchange rate. θ will grow, tending to 1.

- *"The law of one price"*: when institutional constraints are absent and there exists the perfect cross-border mobility of resources and goods, uniform prices for all tradable goods and services are installed on the domestic and international markets. Under these conditions real exchange rate equals to nominal exchange rate.

Limitations for the law of one price: 1) imperfect mobility of goods and resources; 2) tradable and non-tradable goods.

Model of balance of payments in a small open economy with perfect capital mobility

In such an economy, due to the perfect mobility of capital, the real interest rate is set at the level of the world rate: $r = r*$. National currency market equilibrium takes the form:

$$S - I(r*) - BD = NX(\varepsilon_r),$$

where investment (I) is an inversely related to the real interest rate (r), and net exports (NX) is inversely related to the real exchange rate (ε_r). Equilibrium on national currency market is established due to adjustment of real exchange rate ($\varepsilon*_r$).
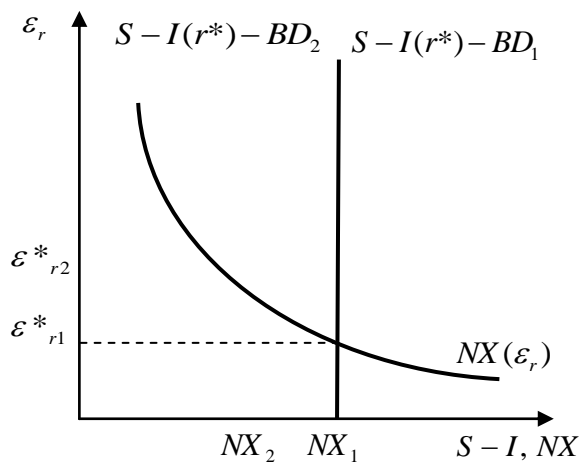
Figure. 22. The currency market equilibrium and its change under expansionary fiscal policy

In this model *expansionary fiscal policy* leads to an increase in the budget deficit and shifts the $S - I(r^*) - BD$ curve to the left. The domestic currency supply is reducing, and the exchange rate of the national currency is rising. This causes a reduction in net exports - $NX(\bar{\varepsilon_r})$. Thus additional government spending crowd out the same amount of net exports.

Expansionary monetary policy doesn't affect the equilibrium in this model, because fall of the internal interest rate leads to an outflow of money to other countries. Capital rushes into other countries in search of the "interest arbitrage", and its perfect mobility contributes to this. As a result, emitted money is distributed evenly between countries. So as domestic country is relatively small in the large competitive environment, its emission policy is unlikely to have a significant impact on the global interest rate and, accordingly, does not affect the level of domestic investment and the domestic currency supply in the currency market.

R. Mundell – M. Fleming model for a small open economy (IS-LM-BP model)

This model is an extended version of the IS-LM model. In this model, balance of payments equilibrium is added to the equilibrium of commodity and money markets, and the BP curve represents it.

The BP curve brings together different combinations of real income and real interest rate under which the net exports of goods and services equals to net capital outflow in given country: $NX = NEK$. Exports of goods and services is directly related to the real income in foreign countries and inversely related to the real exchange rate of the national currency: $X(\overset{+}{Y^*}, \overset{-}{\varepsilon_r})$. Imports of goods and services is directly related to the domestic real income and to the real exchange rate: $Z(\overset{+}{Y_r}, \overset{+}{\varepsilon_r})$. Thus, the function of net exports, which is the difference between exports and imports ($NX = X - Z$), takes the form: $NX(\overset{-}{Y_r}, \overset{-}{\varepsilon_r}, \overset{+}{Y^*})$.

Net capital outflow responds to the difference in interest rates in different countries and takes into account the expected changes in the exchange rate: $r*-(r+\overset{\wedge}{\varepsilon_e})$. The higher the real exchange rate the less its expected changes are. So net export of capital is directly related to the foreign real interest rate ($r*$) and to the real exchange rate (ε_r) and it is inversely related to the domestic interest rate (r): $NEK(\overset{-}{r},\overset{+}{r*},\overset{+}{\varepsilon_r})$.

When we take into account only the income and the interest rate in the domestic country, the balance of payments takes the form: $NX(\overset{-}{Y_r})=NEK(\overset{-}{r})$. And the BP curve has a positive slope (Figure 23).
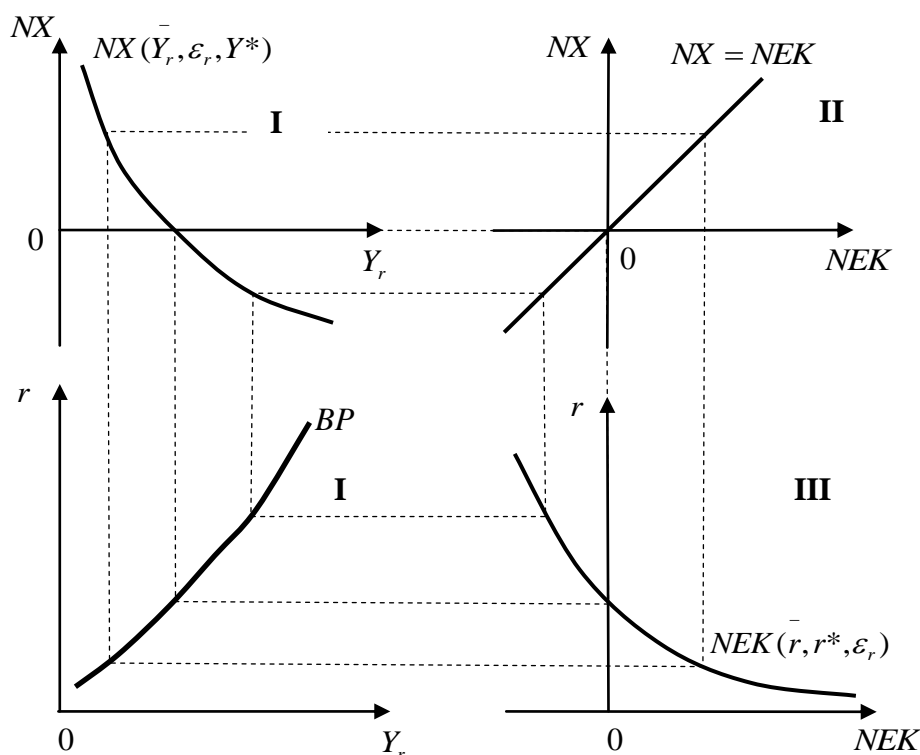

Figure 23. Equilibrium in balance of payments, deriving the BP curve

Properties of the curve BP:

✓ The slope of the BP curve is inversely related to the degree of capital mobility: the higher the mobility of capital, the flatter the BP curve. With perfect capital mobility, the curve becomes horizontal.

✓ The curve shifts to the right–down when the income in other countries increases and vice versa. The curve shifts to the left–up when the exchange rate or the world interest rate increases and vice versa.

The demand managing in a small open economy with complete mobility of capital: short-term balance change in the IS-LM-BP model

Assumptions of the model: 1) perfect capital mobility; 2) general price level rigidity (short term Keynesian equilibrium); 3) the deviation of the economy from the state of full employment calls the management of aggregate demand; 4) the effects of monetary and fiscal policy depend on the exchange rate regime.

1. *Expansive fiscal policy under a floating exchange rate* (Figure 24):

- As a result of increase in government expenditures or decrease in taxes the *IS* curve shifts to the right ($IS_1 \rightarrow IS_2$);

- an increase in the demand for money, when the money supply is constant, will cause the rise of the internal interest rate from $r*$ to r', and income will grow from Y_{r1} to Y_r';

- while the domestic interest rate is higher the foreign interest rate ($r' > r*$), the capital will flow into the domestic country from abroad;

- capital inflows will result in growth of foreign currency supply, and foreign currency will depreciate, while national currency appreciate ($\varepsilon \uparrow$);

- an increase in the exchange rate will lead to a deterioration of "the terms of trade" and negative impact on the net exports ($NX \downarrow$). Ultimately the IS curve shifts to the former position IS_1. Income returns to the former level Y_{r1}.
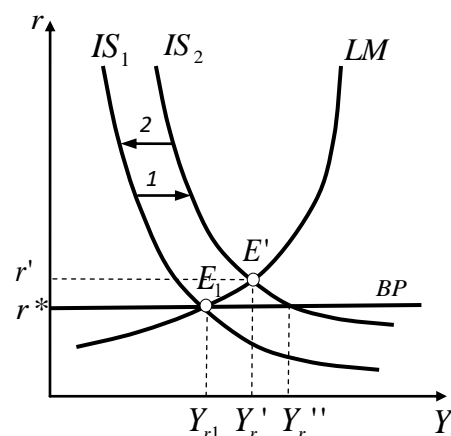

Figure 24. The consequences of the fiscal shock under a floating exchange rate

Thus, in an economy with perfect capital mobility and a floating exchange rate regime, fiscal policy is ineffective.

2. *Expansive monetary policy under a floating exchange rate* (Figure 25):

- As a result of increase in money supply the *LM* curve shifts to the right ($LM_1 \rightarrow LM_2$);

- an increase in the money supply, when the demand for money is constant, will cause lowering the internal interest rate from $r*$ to r', and income will grow from Y_{r1} to Y_r' due to an increase in domestic investment;

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- while the domestic interest rate is below the foreign interest rate ($r' < r *$), the capital will flow out of the country abroad;

- capital outflows will result in declining the foreign currency supply, and foreign currency will appreciate, while national currency depreciates ($\varepsilon \downarrow$). The central bank in a floating exchange rate regime doesn't prevent the establishment of the new equilibrium exchange rate;

- reducing the exchange rate will lead to an improvement in "the terms of trade", which will result in ascending the net exports ($NX \uparrow$).This causes a shift of the IS curve to the right ($IS_1 \rightarrow IS_2$). As a result, the interest rate returns to the foreign level – $r *$, and income grows up to Y_{r2}.
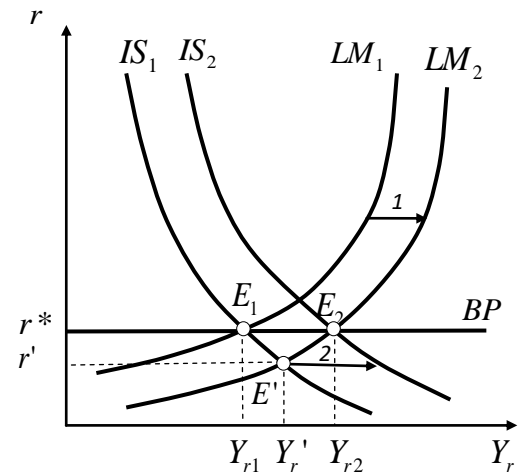
Figure 25. The consequences of the monetary shock under a floating exchange rate

Thus, in an economy with perfect capital mobility and a floating exchange rate regime, monetary policy is highly effective.

3. *Expansive fiscal policy under a fixed exchange rate* (Figure 26):

- increase in government expenditures or decrease in taxes shifts the *IS* curve to the right ($IS_1 \rightarrow IS_2$);

- the domestic interest rate grows from $r *$ to r', and the income grows up to Y_r';

- foreign capital rushes to the domestic economy in search of interest arbitrage ($r' > r *$);

- foreign currency inflow causes a rise in the exchange rate ($\varepsilon \uparrow$);

- since the central bank pursues a regime of fixed exchange rate, it will buy foreign currency in the foreign exchange market impeding the national currency
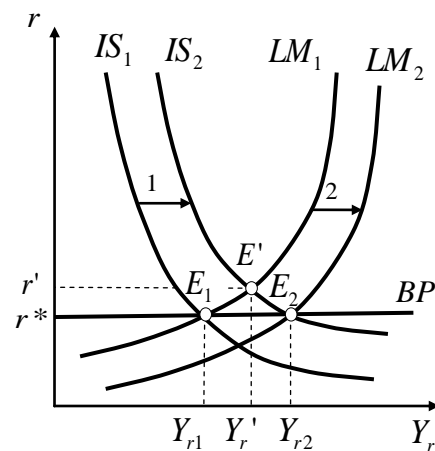
Figure 26. The consequences of the fiscal shock under a fixed exchange rate

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appreciation. Such a policy leads to increase in the money supply within the country;

- the LM curve shifts to the right ($LM_1 \rightarrow LM_2$. The interest rate returns to its previous level. The income grows up to Y_{r2}.

Thus, in an economy with perfect capital mobility and a fixed exchange rate regime, fiscal policy is highly effective.

4. *Expansive monetary policy under a fixed exchange rate* (Figure 27):

- money supply increase shifts the LM curve shifts to the right ($LM_1 \rightarrow LM_2$);

- lowering the internal interest rate from $r*$ to r' causes the domestic investment rise and income enlargement to Y_r';

- the internal interest rate reduction compared to the world interest rate ($r' < r*$) induce the capital to flee the country;

- demand for foreign currency grows and it appreciates while national currency depreciates ($\varepsilon \downarrow$). For stabilizing the situation the central bank under the fixed exchange regime will sell foreign currency, withdrawing money from circulation;

- reduction of the national money supply shifts the LM curve to the left to its former state ($LM_2 \rightarrow LM_1$), the interest rate and income return to their previous level. The exchange rate remains unchanged.
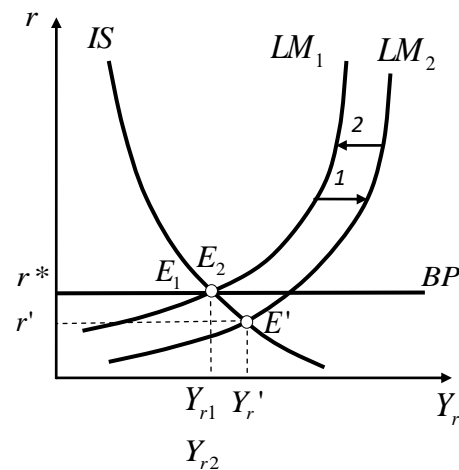

Figure 27. The consequences of the monetary shock under a fixed exchange rate

Thus, in an economy with perfect capital mobility and a fixed exchange rate regime, monetary policy is ineffective.

Problems

Problem 8.1. In some small country with complete mobility of capital the function of consumer demand for domestic goods is given by: $C = 100 + 0,7 \cdot (Y - T)$, and the function of demand for imported goods: $Z = 300 + 0,3 \cdot Y + 2 \cdot \varepsilon_r$ (where ε_r − real exchange rate). The investment function: $I = 600 - 40 \cdot r*$ (where $r*$ − the world real interest rate), the function of

exports: $X = 500 + 0{,}1 \cdot Y - 3 \cdot \varepsilon_r$. Autonomous taxes are 100, and the income tax rate is 20%. The government adheres to the policy of a balanced budget. The real interest rate on world capital markets is 5%.

Tasks: A) Let the potential income in given country equals 1000 in real terms. Determine the equilibrium real exchange rate, the state of the current account and the capital account of the balance of payments in long run. B) Let the government took the course of expansionary fiscal policy and increased government purchases by 50 units. How will the equilibrium real exchange rate and the state of balance of payments accounts change? C) Let the government instead of p."b" has imposed imports quotas, that resulted in decrease in the value of imports by 50 units. How will the equilibrium real exchange rate and the state of balance of payments change? All answers provide graphic illustrations.

Problem 8.2. *Mundell-Fleming model with perfect capital mobility.* In some small country with perfect capital mobility the function of consumer demand for domestic goods is given by: $C = 120 + 0{,}76 \cdot (Y - T)$, and the function of demand for imported goods: $Z = 0{,}17 \cdot Y$. The investment demand of domestic entrepreneurs is given by: $I = 200 - 7{,}2 \cdot r$ (where r − domestic real interest rate). The government purchases of goods and services are 360 units. The budget revenues are formed by a 25% income tax. Goods exports are 220 units. Money demand for transactions is 25% of income, assets demand for money is given as function: $L_{sp} = 60 - 2 \cdot r$. Real money supply is 400 units. The real interest rate on world capital markets is $r^* = 6\%$.

Tasks: A) Derive equations of the IS, LM и BP curves, construct them on chart. Determine the equilibrium level of income, the domestic interest rates, the state of government budget and the state of trade balance; B) What changes will occur in the economy under floating and fixed exchange rates? What equilibrium parameters will be established?

Answers to the problems

Problem 8.1: A) $\varepsilon_r = 58$, current account: $NX = -290$ units, capital account: $NK = 290$ units; b) $\varepsilon_r = 68$, current account: $NX = -340$ units, capital account: $NK = 340$ units; c) $\varepsilon_r = 68$, current account: $NX = -290$ units, capital account: $NK = 290$ units.

Problem 8.2: A) $Y_{IS} = 1500 - 12 \cdot r$; $Y_{LM} = 1360 + 8 \cdot r$; BP: $r^* = 6\%$. $Y_E = 1416$ units; $r = 7\%$. $BD = -6$ units, $NX = -20{,}72$ units; b) because of capital inflows in economy exchange rate will rise. Under floating exchange rate net exports will decrease by 12 units, the IS curve will shift to the left by 20 units ($\Delta Y_{IS} = m_{NX} \cdot \Delta NX = 1{.}(6) \cdot 12$), the equilibrium income will decrease by 8

units and will amount to 1408 units, the interest rate will reach the world level (6%). Under a fixed exchange rate the central bank will increase the money supply by 5 units by restraining the growth of the national currency exchange rate. The LM curve will shift to the right by 20 units, the equilibrium income will increase by 12 units and will reach 1428 units, the domestic interest rate will be equal to the world interest rate (6%).

APPENDIX

(definitions are quoted from Macroeconomics by G. Mankiw)

Effects of economic policy

⇒ *Multiplier effect* – the additional shifts in aggregate demand that result when expansionary fiscal policy increases income and thereby increases consumer spending.

⇒ *Automatic stabilizers* – changes in fiscal policy that stimulate aggregate demand when the economy goes into a recession without policymakers having to take any deliberate action.

⇒ *Catch-up effect* – the property whereby countries that start off poor tend to grow more rapidly than countries that start off rich.

⇒ *Natural-rate hypothesis* – the claim that unemployment eventually returns to its normal, or natural, rate, regardless of the rate of inflation.

⇒ *Sacrifice ratio* – the number of percentage of annual output lost in the process of reducing inflation by 1 percentage point.

⇒ *Rational expectations* – the theory according to which people optimally use all the information they have, including information about government policies, when forecasting the future.

Main problems of economic policy

Five debates over macroeconomic policy (by G. Mankiw):

1. Consider whether policymakers should try to stabilize the economy.
2. Consider whether monetary policy should be made by rule rather than by discretion.
3. Consider whether the central bank should aim for zero inflation.
4. Consider whether the government should balance its budget.
5. Consider whether the tax laws should be reformed to encourage saving.

Glossary

⇒ *Nominal GDP* – the production of goods and services valued at current prices.

⇒ *Real GDP* – the production of goods and services valued at constant prices.

⇒ *GDP deflator* – a measure of the price level calculated as the ratio of nominal GDP to real GDP times 100.

⇒ *Consumer price index* (CPI) – a measure of the overall cost of the goods and services bought by a typical consumer. (The basket of goods and services).

⇒ *Inflation rate* – the percentage change in the price index from the preceding period.

⇒ *Producer price index* – a measure of the cost of a basket of goods and services bought by firms.

⇒ *Nominal interest rate* – the interest rate as usually reported without a correction for the effects of inflation.

⇒ *Real interest rate* – the interest rate corrected for the effects of inflation.

⇒ *Productivity* – the amount of goods and services produced from each hour of a worker's time.

⇒ *Physical capital* – the stock of equipment and structures that are used to produce goods and services.

⇒ *Human capital* – the knowledge and skills that workers acquire through education, training and experience.

⇒ *Natural resources* – the inputs into the production of goods and services that are provided by nature, such as land, rivers, and mineral deposits.

⇒ *Technological knowledge* – society's understanding of the best ways to produce goods and services.

⇒ *Financial markets* – financial institutions through which savers can directly provide funds to borrowers.

⇒ *Bond* – a certificate of indebtedness.

⇒ *Stock* – a claim to partial ownership in a firm.

⇒ *Financial intermediaries* – financial institutions through which savers can indirectly provide funds to borrowers.

⇒ *Mutual fund* – an institution that sells shares to the public and uses the proceeds to buy a portfolio of stocks and bonds.

⇒ *Market for loanable funds* – the market in which those who want to save supply funds those who want to borrow to invest demand funds.

⇒ *Labor force* – the total number of workers, including both the employed and the unemployed.

⇒ *Unemployment rate* – the percentage of the labor force that is unemployed.

⇒ *Labor-force participation rate* – the percentage of the adult population that is in the labor force.

⇒ *Natural rate of unemployment* – the normal rate of unemployment around which the unemployment rates fluctuate.

⇒ *Cyclical unemployment* – the deviation of unemployment from its natural level.

⇒ *Discouraged workers* – individuals who like to work but have given up looking for a job.

⇒ *Union* – a worker association that bargains with employers over wages and working conditions.

⇒ *Collective bargaining* – the process by which unions and firms agree on the terms of employment.

⇒ *Unemployment insurance* – a government program that partially protects worker's incomes when they become unemployed.

⇒ *Money* – the set of assets in an economy that people regularly use to buy goods and services from other people.

⇒ *Medium of exchange* – an item that buyers give to sellers when they want to purchase goods and services.

⇒ *Unit of account* – the yardstick people use to post prices and record debts.

⇒ *Store of value* – an item that people can use to transfer purchasing power from the present to the future.

⇒ *Liquidity* – the ease with which an asset can be converted into the economy's medium of exchange.

⇒ *Commodity money* – money that takes the form of commodity with intrinsic value.

⇒ *Fiat money* – money without intrinsic value that is used as money because of government decree.

⇒ *Currency* – the paper bills and coins in the hands of the public.

⇒ *Demand deposits* – balances in bank accounts that depositors can access on demand by writing a check.

⇒ *Central bank* – an institution designed to oversee the banking system and regulate the quantity of money in the economy.

⇒ *Money supply* – the quantity of money available in the economy.

⇒ *Monetary policy* – the setting of the money supply by policymakers in the central bank.

⇒ *Reserves* – deposits that banks have received but have not loaned out.

⇒ *Fractional-reserve banking* – a banking system in which banks hold only a fraction of deposits as reserves.

⇒ *Reserve ratio* – the fraction of deposits the banks hold as reserves.

⇒ *Money multiplier* – the amount of money the banking system generates with each dollar of reserves.

⇒ *Open-market operations* – the purchase and sale of the government bonds by the central bank.

⇒ *Reserve requirements* – regulations on the minimum amount of reserves that banks must hold against deposits.

⇒ *Discount rate* – the interest rate on the loans that the central bank makes to banks.

⇒ *Quantity theory of money* – a theory asserting that the quantity of money available determines the price level and the growth rate in the quantity of money available determines the inflation rate.

⇒ *Nominal variables* – variables measured in monetary units.

⇒ *Real variables* – variables measured in physical units.

⇒ *Classical dichotomy* – the theoretical separation of nominal and real variables.

⇒ *Monetary neutrality* – the proposition that changes in the money supply do not affect real variables.

⇒ *Velocity of money* – the rate at which money changes hands.

⇒ *Fisher effect* – the one-for-one adjustment of the nominal interest rate to the inflation rate.

⇒ *Shoeleather costs* – the resources wasted when inflation encourages people to reduce their money holdings.

⇒ *Menu costs* – the costs of changing prices.

⇒ *Net exports* – the value of a nation's exports minus the value of its imports, also called the trade balance.

⇒ *Net foreign investment* – the purchase of foreign assets by domestic residents minus the purchase of domestic assets by foreigners.

⇒ *Nominal exchange rate* – the rate at which a person can trade the currency of one country for the currency of another.

⇒ *Appreciation* – an increase in the value of a currency as measured by the amount of a foreign currency it can buy.

⇒ *Depreciation* – a decrease in the value of a currency as measured by the amount of a foreign currency it can buy.

⇒ *Real exchange rate* – the rate at which a person can trade the goods and services of one country for the goods and services of another.

⇒ *Purchasing-power parity* – a theory of exchange rates whereby a unit of any given currency should be able to buy the same quantity of goods in all countries.

⇒ *Aggregate-demand curve* – a curve that shows the quantity of goods and services that households, firms, and the government want to buy at any price level.

⇒ *Aggregate-supply curve* – a curve that shows the quantity of goods and services that firms choose to produce and sell at any price level.

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МАКРОЭКОНОМИКА

Учебно-методическое пособие