Олимпиада студентов и выпускников «Высшая лига», 2 этап, 2021 г.

Направление: «370. Экономика»

Треки:

«Финансовая экономика» **Код – 370.1**

«Экономика» **Код – 370.2**

Время выполнения – 150 мин.

Максимальный балл – 150.

ИНВАРИАНТНАЯ ЧАСТЬ

Задание 1 (25 баллов).

Consider a benevolent central bank, which minimizes a loss function $L_t = \alpha(\pi_t - \pi^*)^2 + (y_t - y^*)^2$, where $\alpha > 0$; π_t – inflation level; y_t – ouput level; π^* – target level of inflation; y^* – target level of output. Aggregate supply is represented by a function $y_t = \overline{y} + z(\pi_t - \pi_t^e)$, where z > 0; $\overline{y}$ – natural level of output; π_t^e – expected inflation. Suppose $y^* > \overline{y}$ and all economic agents have rational expectations.

a) (4 points) Provide economic interpretation for parameters α and z.

b) (7 points) Find equilibrium inflation and equilibrium output, if central bank conducts discretionary monetary policy. Which parameters affect equilibrium inflation? Explain intuitively.

c) (7 points) Find equilibrium inflation, if central bank conducts discretionary monetary policy and economic agents have expected inflation equal to the target level of inflation $\pi_t^e = \pi^*$. Provide economic intuition for your result, concerning dynamic inconsistency problem.

d) (7 points) Consider a situation, when monetary policy is delegated to the policymaker, which conducts discretionary monetary policy, but has a loss function $\widehat{L_t} = \beta(\pi_t - \pi^*)^2 + (y_t - y^*)^2$, where β > 0. Find equilibrium inflation. Will the value of a society loss function L_t increase or decrease, compared to the result of point b), if β > α? Explain intuitively.

Задание 2 (25 баллов).

Consider an economy with two consumers (A and B) and one producer. Consumers' preferences are represented by the utility functions $u^A(c^A,l^A)=(c^A)^\alpha(l^A)^{1-\alpha}$ and $u^B(c^B,l^B)=(c^B)^\beta(l^B)^{1-\beta}$, where c^k is the money value of consumer k expenditures on goods, l^k denotes consumer k leisure time, k = A, B, $0 < \alpha < 1$, $0 < \beta < 1$. There is no endowment of consumer goods (or money). Each consumer has endowments of time $\overline{L}$, which is allocated between leisure and time to work (labour supply).

The firm production function is given by $c = \sqrt{L}$ where c is the money value of goods produced by the firm (the same value in total is spent by the consumers in equilibrium), L denotes labour used at the wage rate w (so w is money paid to a worker per unit of time).

The share of consumer k in firm profit is θ^k, k = A, B.

Suppose to encourages the firm to increase the output the government subsidizes the firm by paying it a share of firms' profit. s denotes the share of the firm's profit that is paid by the government to the firm. To pay the subsidy to the firm, consumers are subject to the equal lump-sum tax (while their income is still positive).

All components of the Walrasian equilibrium allocation are positive before and after subsidizing.

a) Is the equilibrium allocation in this model Pareto-optimal?

b) Derive the equilibrium wage rate w as a function of the subsidy rate s.

c) Show how the wage rate changes with a small increase in the subsidy rate s. Examine the effect of the increase on the wage rate depending on the model parameters. Will the government achieve its goal (i.e., will the firm produce more)?

d) How would your answer to point (c) change if the technology exhibited constant return to scale?

e) How would your answer to point (c) change if there were the only consumer in the economy (so the only owner of the firm)?

ВАРИАТИВНАЯ ЧАСТЬ

Трек 370.1. «Финансовая экономика»

Задание 3 (25 баллов).

Consider an entrepreneur who has a project that requires an investment I at date t = 0. At date t = 1, the project's cash flow is either low (failure), $X^F = 20$, or high (success), $X^S = 60$. There are no further cash flows. The probability of the high cash flow depends on the effort that the entrepreneur exerts after having invested I. If the entrepreneur exerts an effort level $e \in [0,1]$, the project generates $X^S = 60$ with probability e and $X^F = 20$ with probability $1 - e$. The entrepreneur bears the cost of effort $c(e) = 20e^2$. The entrepreneur has neither own funds no other assets. There is no discounting. Everybody is risk-neutral and fully rational. The financial market is perfectly competitive, meaning that, for any offered security, investors are ready to pay the expected cash flow it generates. The entrepreneur has limited liability.

Definitions:

- An equity share α entitles its holder(s) to the share α of the cash flow at t = 1. If the entrepreneur sells a share α, he is left with share $1 - \alpha$.
- A zero coupon debt with face value K entitles the debtholder to receive the fixed amount K out of the realized cash flow at t=1, and the entrepreneur receives the rest. If the realized cash flow is less than K, the debtholder receives the whole cash flow, and the entrepreneur gets 0 (due to his limited liability).

a) Suppose the entrepreneur decides to finance the project by issuing equity. He sells a share a of equity and retains $1-\alpha$. Which level of effort will he choose for a given α?

b) Find the range of values of I for which the project can be financed with equity.

c) Suppose now that the entrepreneur decides to finance the project by issuing zero coupon debt. Assume the face value of debt is K≤60. Which level of effort will the entrepreneur choose for given K?

d) Find the range of values of I for which the project can be financed with debt.

e) Suppose I<20. Which way of financing, debt or equity, will the entrepreneur choose? (Hint: recall that the financial market is assumed to be perfectly competitive).

Задание 4 (25 баллов).

There are two dates, t = 0, 1. At time 0, an investor chooses a portfolio to maximize her mean-variance objective

$$u(r_P) = E_0(r_P) - \frac{c}{2}V_0(r_P)$$

where r_P is the portfolio return at time 1. The investor has access to a risk-free asset with return r_f and two risky assets A and B that pay off at time 1. The expected returns and standard deviations of the risky assets are denoted $E(r_i)$ and σ_i, for $i \in \{A,B\}$. The correlation between the risky assets is $\rho = 0.5$. The risk aversion parameter is $c = 1$.

1. Let w_A and w_B denote the weights of the risky asset in the portfolio. The weight of the risk-free asset is $w_f = 1 - w_A - w_B$. Write the expected return as a function of the excess returns $R_i = E(r_i) - r_f$. Determine the variance of the portfolio.
2. Write the first-order conditions of the investor's problem.
3. Give an economic interpretation of the first-order conditions and determine the optimal portfolio of the investor.
4. Show that there exists a scalar k such that the weights of the risky assets in the optimal portfolio can be written as $w_A = kx$ and $w_B = k(1 - x)$, where x is the weight of asset A in the tangent portfolio. What does it imply for the construction of the portfolio?

Hint: The tangent portfolio is such that $\frac{R_A}{cov(r_A,\ r_t)} = \frac{R_B}{cov(r_B,\ r_t)}$, where r_t denotes the return of the tangent portfolio.

Трек 370.2. «Экономика»

Задание 5 (10 баллов).

IMF called on the Bank of Russia to decrease the policy rate to less than 4%, so not to allow the inflation rate to fall below 3.5% by the end of 2021. In January 2021 the inflation rate in Russia exceeded 5% due to the ruble depreciation and VAT increase, however these factors have as short run effects only. However, IMF admits that the policy rate cut can lead to a further ruble depreciation and, as a result, to the inflation acceleration.

a) Explain intuitively, how VAT increase and exogenous ruble depreciation affect the inflation rate in Russia. How IMF policy proposition will affect the Russia inflation rate?

b) Explain intuitively, how the policy rate cut can lead to a ruble depreciation.

c) Bank of Russian at a policy meeting on 12 February 2021 decided to leave the policy rate unchanged, in fact ended the monetary policy easing program. Explain intuitively, how this will affect deposit rates and credit volumes in the short and long run.

Задание 6 (10 баллов).

The Herfindahl–Hirschman index (HHI) is a measure of industry concentration which is widely used in antitrust law. The formula for the HHI is as follows:
$HHI = s_1^2 + s_2^2 + \cdots + s_N^2$, where s_i is the market share of firm i in the market, and N is the number of firms. It is considered that the smaller index the more competitive the market is.

Consider a measure of market dominance which is suggested to use instead of HHI. Assume that the firms are indexed in descending order of the market share: $s_1^2 \geq s_2^2 \geq \cdots \geq s_N^2$.

Let the threshold market share s^D by which the dominance is determined is calculated as follows:

$$s^D = \frac{1}{2}\left[1 - (s_1 - s_2)(1 - \sum_{i=3}^{N} s_i)\right]$$

The firm 1 is considered to be dominant if the calculated threshold market share is lower than the market share of the largest firm, i.e. $s^D < s_1$. (Don't confuse the endogenously determined threshold s^D with the actual market share s_1 of the largest firm.)

Discuss distinctions and advantages of the proposed measure compared to HHI.

Задание 7 (15 баллов).

In January 2021 US president Joe Biden presented a draft law for the US economy recovery: 1.9 trillion dollars would be provided to stimulate the economy. Proposed legislation includes direct payments to the households, benefits to the local authorities in the states, allowances to the universities. Also Biden proposed to appropriate money to the programs of COVID-19 mass-testing and mass-immunization (vaccination).

a) Using relevant macroeconomic model explain intuitively, how these fiscal policy measures will affect output, price level and interest rate in the short and long run. Illustrate your answer with the graph.

b) Fed began to cut down the policy rate in March 2020, when the US economy started falling into the crisis. At first, Fed decreased the policy rate from 1.5-1.75 % to 1-1.25%. Now the policy rate is stuck at 0-0.25%.

Using relevant macroeconomic model explain intuitively, how these Fed policy measures would affect output, price level and interest rate in the short run and in the long run. Illustrate your answer with the graph.

c) Consider the risks to the economy of Fed's and Biden's policy. Name them and explain intuitively.

Задание 8 (15 баллов).

Consider a market for a homogeneous good in the home country. There are N domestic firms and M foreign firms in the market. The inverse demand function is $p(Y)$ with $p'(Y) < 0$ and $Yp''(Y) + (N + M + 1)p'(Y) < 0$, where Y is the total output sold in the country by domestic and foreign firms. All firms (domestic and foreign) have constant unit costs. The unit cost of firm i is denoted by c_i. The domestic firms have different unit costs. Foreign firms' exports to the home country are subject to a specific tariff rate of t dollars per unit. Firms are involved in Cournot competition. Suppose that each firm produces a non-zero output. Prove that a small increase in the tariff rate will increase the profit of all domestic firms.