

Вопрос **Инфо**

Уважаемые участники!

Олимпиадное задание по направлению «Экономика» состоит из двух частей:

**Инвариантная часть** представлена заданиями № 1-2. Их нужно выполнить всем участникам.

**Вариативная часть** разделена на треки:

- Трек «Финансовая экономика»: задания № 3-5.
- Трек «Экономика»: задания № 6-9.

Вы можете сосредоточиться на выполнении заданий одного трека (чтобы претендовать на статус дипломанта I, II, III степени) или постараться успешно решить задачи двух треков, чтобы претендовать на статус медалиста.

**Работа оформляется в письменном виде на чистых листах А4.** Полученный ответ выписывается в конце решения и отдельно обводится в рамку. Ответ засчитывается при наличии верного обоснования. Фото/скан рукописной работы загружается в тестирующую систему в конце состязания (на это у вас будет 15 минут).

Во время выполнения заданий вы можете использовать встроенный в систему калькулятор и черновик (в качестве черновика разрешено использовать чистые листы бумаги), но на проверку он не предъявляется. Использование сторонних ресурсов и справочных материалов строго запрещено.

Верим в ваш успех!

Вопрос **1**

Балл: 25,00

Consider an open economy with sticky prices and sticky nominal wages and imperfect capital mobility, where equilibrium can be described by the IS-LM-BP model, characterized by the following equations:

Consumption function is given by  $C = 40 + 0,8Y^d$ , where  $Y^d$  is the disposable income; net tax revenues are constant,  $T = 25$ ;

Investment function is given by  $I = 20 - 4i$ , where  $i$  is the interest rate. The expected inflation is equal to zero, so nominal interest rate equals real interest rate;

Government purchases  $G = 30$ ;

Export function is given by  $Ex = 20 + 4E$ , where  $E$  is the exchange rate (the price of foreign currency in units of domestic currency);

Import function is given by  $I_m = 10 + 0,2Y$ ;

The demand function for real money balances is given by  $L(Y, i) = 0,5Y - 2i$ , where  $Y$  is output (gross domestic product);

Nominal money supply is equal to  $M^s = 80$ ;

Price level is constant at  $P = 2$ ;

Capital account balance is determined by the equation  $CF = 2(i - \hat{i}) + 2,4$ , where  $\hat{i}$  is the foreign

interest rate,  $\bar{f} = 5$ .

**a) (6 points)** Explain intuitively the following characteristics of the functions given above:

- exports depend positively on the exchange rate;
- imports do not depend on the exchange rate;
- capital account balance depends positively on the interest rate differential  $i - \bar{f}$ .

**b) (5 points)** Write the equations of IS, LM and BP curves. Find equilibrium output, interest rate and exchange rate. Illustrate the equilibrium graphically in  $(Y; i)$  space.

**c) (5 points)** Let's consider a situation, when this economy is in equilibrium and some of its trading partners have stopped trading with it because of economic sanctions, so the import function is now given by  $I_m = 6 + 0,2Y$ . How does this change (all other things being equal) influence the position of IS and BP curves in  $(Y; i)$  space? Illustrate on your graph from b). How does this change influence the equilibrium exchange rate? You are not required to calculate the exact change in the equilibrium exchange rate; just explain intuitively, rely on the mechanisms in this specification of IS-LM-BP model.

**d) (4 points)** Let's suppose that the central bank intervenes and changes money supply for the exchange rate to stay the same, since the change in exchange rate influences inflation. How should the central bank change the money supply? Explain intuitively, rely on the mechanisms in this specification of IS-LM-BP model. Similar to c), you are not required to calculate the exact change in the money supply, just provide an intuitive explanation.

**e) (5 points)** What are the negative effects of the policy that you consider in d), if the central bank follows inflation targeting policy? Provide two explanations. In case more than two explanations are provided, only the first two will be estimated.

Вопрос 2

Балл: 25,00

Consider an economy with one aggregate consumer and two producers. The consumer derives utility from a consumer good,  $c$ , leisure,  $l$ , and another good,  $g$ , that will either be purchased in the market or solely provided by the government:  $u(c, l, g) = clg$ . There are no endowments of consumer goods (or money). The consumer has an endowment of time  $\bar{L}$ , which is allocated between leisure and time to work (labour supply).

The markets are assumed to be competitive. The only factor of production is labour. The production functions for  $c$  and  $g$  are given by:  $C = \sqrt{L_C}$  and  $G = \sqrt{L_G}$ , where  $C$  is the produced amount of good  $c$ ,  $G$  is the produced amount of good  $g$ ,  $L_C$  and  $L_G$  denote the amount of labour used for production of goods  $c$  and  $g$ , respectively. The only tax in this economy is a proportional income tax levied at the rate  $\tau$  on all consumer's incomes (thus leaving the consumer with a share  $(1 - \tau)$  of his income.) The price of  $c$  is normalized to 1. Let  $w$  denote the price of labour, and  $p$  denote the price of good  $g$ .

In a) and b) assume that tax revenue is returned to the consumer as a lump-sum subsidy.

**a) (5 points)** Find the demand function for  $c$ ,  $l$ , and  $g$ . (Hint: pay attention that the firms' profit and the lump-sum subsidy are taken by the consumer as given. So if you get the demand functions that are independent of  $\tau$  that would be a mistake.)

**b) (10 points)** Find a Walrasian equilibrium in the economy in question. Get the tax revenue function (dependence of tax revenue collected by the government on the tax rate  $\tau$ ) and sketch the Laffer curve.

**c) (8 points)** Assume now that the government uses tax revenues to finance the provision of good  $g$ . It means that the product  $pg$  is equal to the tax revenue collected by the government. The consumer takes the consumption of good  $g$  as fixed and maximizes its utility function in this constrained fashion (i.e. the consumer chooses only  $c$  and  $l$ ). Find a Walrasian equilibrium in the economy in question. Get the tax revenue function (dependence of tax revenue collected by the government on

the tax rate  $\tau$ ) and sketch the Laffer curve.

d) (2 points) Compare Laffer curves in b) and c). Give an intuitive explanation for the result you obtained.

Вопрос 3

Балл: 20,00

There are two dates: 0, 1.

At time 1, there are 2 states of the world, high ( $h$ ) and low ( $l$ ).

There are three assets in the market: a risk-free bond (asset 1) that pays one in every state of the world, and two risky assets (asset 2 and asset 3) that have the same payoff in each state of the world at time 1. Specifically, both assets pay  $d^h$  in state  $h$  (with probability  $p$ ) and  $d^l$  in state  $l$ , with probability  $1 - p$ , where  $0 < d^l < d^h$ .

The investor has no pre-existing positions in the assets and no other endowment. To trade the risky assets, the investor needs to satisfy a margin requirement.

The requirement is that the combined value of all long positions in risky assets plus the (possibly negative) value of the riskless bond position must be at least equal to half the total value of all long position in risky assets plus one and a half times the amount raised by short-selling risky assets.

The price of asset  $i$  is denoted  $p_i$ . The position of the investor in asset  $i$  is denoted  $x_i$ .

1. (2 points) Suppose that there is no margin requirement. What should be the relation between the prices of asset 2 and 3?

2. (4 points) Suppose again that there is no margin requirement and that  $p_1 > 0$ ,  $p_2 = 1$ , and  $p_3 = 1 + e$ , where  $e > 0$ . Suppose that  $x_1 = 0$  and  $x_2 = 1$ . What is the range of positions in asset 3 such that there exists an arbitrage of type 1?

*Hint:* an arbitrage of type 1 exists when there exists a portfolio yielding nonnegative cash flow at time 1 with a strictly negative cost at time 0.

3. (6 points) Let  $x_i^+$  and  $x_i^-$  denote respectively the long and short position in asset  $i$  (thus,  $x_i^- = x_i I\{x_i < 0\}$  and  $x_i^+ = x_i I\{x_i \geq 0\}$ ), where  $I$  is the indicator function). Write the constraint on positions  $x_i$  induced by the margin requirement.

4. (8 points) Suppose now that the investor has a preexisting position  $y_1 \geq 0$  in the risk-free asset. As before,  $p_1 > 0$ ,  $p_2 = 1$ , and  $p_3 = 1 + e$ , where  $e > 0$ . Assume that the investor takes offsetting positions in assets 2 and asset 3 and that  $x_2 = 1$ . Derive a condition on  $y_1$  such that there is an arbitrage of type 1 and that the investor can exploit it (i.e., satisfy the margin requirement). Interpret this condition.

Вопрос 4

Балл: 20,00

Imagine a firm that has a zero-coupon debt with face value (promised repayment)  $F < 100$  to be repaid next period. The firm has available cash of 30 and some assets in place. The assets in place generate the cash flow of either 20 or 100 with *equal* probabilities next period.

The CEO of the firm can either pay the available cash to the shareholders as a dividend or invest it in the project. The latter option would add 50 to the firm's next period cash flow, with certainty. Regardless of the CEO's choice, after the firm generates the next period cash flow, it is liquidated with zero salvage value.

For all parts, assume that the CEO *acts in the interest of the firm's shareholders*. The shareholders

have *limited liability* and there are *no costs of bankruptcy*. There is *no discounting* and *everybody is rational and risk-neutral*. The capital market is *perfectly competitive*, meaning that, for any offered security, investors are ready to pay the expected cash flow it generates.

*Note:* When distributing the total cash flow, debtholders have priority over shareholders, and senior debtholders have priority over junior debtholders. Shareholders' limited liability means that if the firm's total cash flow is below the sum of the promised repayments to creditors, the creditors seize the entire firm's cash flow, but the shareholders do not pay anything out of their own pockets.

1. (4 points) Assume that, in case of indifference, the CEO implements the project. Show that the CEO will implement the project if and only if  $F \leq 60$ .
2. (6 points) Suppose now the firm does not have available cash. Hence, if the CEO decides to implement the project, he needs to raise the necessary 30 in the capital market. Suppose he can do it only by issuing debt which is *junior* (i.e., having *lower* priority) to the existing one. Assume that, once the funds are raised, the CEO is *obliged* to invest them. Suppose  $F = 70$ . Will the CEO implement the project?
3. (5 points) Suppose all assumptions of part 2 hold, except that the CEO is now allowed to issue debt which is *senior* (i.e., having *higher* priority) to the existing one. Will the CEO implement the project?
4. (5 points) Return to the initial setting (i.e., the firm has cash of 30 and does not need to raise funds in the market) and assume  $F = 70$ . Show that the debtholders can benefit by *unconditionally* reducing  $F$  today. An example is enough.

Вопрос 5

Балл: 10,00

A company's share is trading at \$100. The stock price follows a binomial process. It can move up by the factor of 1.25 or down by the factor of 0.8. European *call* options with a strike price of \$90 expire in one year. Continuously compounded risk-free interest rate is 5%.

1. (5 points) What is the option price?
2. (5 points) How to arbitrage if you can get a quote from the market which is \$0.5 lower than calculated in a)? Describe all transactions.

Вопрос 6

Балл: 10,00

Theoretically, upward and downward shifts in the monetary policy rate exert symmetrical pressure on economic activity. However, some papers show that monetary policy tends to be asymmetrical: monetary tightening leads to a significant contraction of the economy, while monetary easing does not provide significant stimulus to it. Among potential explanations of this phenomenon researchers mention asymmetrical influence of monetary policy on consumption expenditures and stickiness of prices and wages.

- a) (5 points) Explain intuitively, how liquidity constraints (credit constraints) can lead to an asymmetrical pressure of monetary policy on consumption expenditures. Is there any possibility of credit rationing in this case? How does it affect the effectiveness of monetary policy in case of tightening and in case of easing? Explain.
- b) (3 points) Explain intuitively, how downward price and nominal wage rigidity (prices and nominal wages stick around ceiling, not floor) can lead to an asymmetrical influence of monetary policy on economic activity.
- c) (2 points) Which measures can be taken by the government to compensate for low effectiveness of an expansionary monetary policy?

Вопрос 7

Балл: 15,00

After the end of COVID-19 pandemic many countries faced the need to cut their government spending. However, too rapid government spending contraction can lead to negative consequences for the economy as a whole, and for government debt sustainability in particular.

- a) (5 points) Explain intuitively, how fiscal contraction affects the economy with flexible prices and rigid nominal wages. Use aggregate demand – aggregate supply model. Illustrate your answer with the AD-AS diagram.
- b) (5 points) Explain intuitively, what constitutes the risk of rapid government spending contraction in relation to debt-to-GDP sustainability. Does population ageing worsen the problem? Explain.
- c) (5 points) Is there any scope for an expansionary monetary policy to resolve the problem of debt-to-GDP sustainability in the economy with flexible prices and rigid nominal wages? Use aggregate demand – aggregate supply model. Illustrate your answer with the AD-AS diagram.

Вопрос 8

Балл: 10,00

There is a tariff in Russia on parcels received from abroad. Using a microeconomic approach answer the question: how does the customs duty rate affect willingness to evade taxes?

For this purpose, consider a risk-averse buyer whose preferences are represented by an expected utility function. The buyer, whose wealth is  $w > 0$ , has purchased goods in a foreign online store for the monetary amount of  $d > 0$ . In accordance with the current legislation, they must declare the purchase and pay customs duty at the rate  $t$  for each monetary unit of the purchase,  $0 < t < 1$ . The buyer may want to decrease his duty payments and therefore indicate an undervalued purchase price in the customs declaration (or not submit a customs declaration at all). However, in case the violation is detected, they will not only have to pay the customs duty in full, but also be fined at the rate  $s$  for each undeclared monetary unit of the purchase,  $0 < s < 1$ , and  $0 < t + s < 1$ .

Assume that the buyer has a sufficient income to comply with the legal requirements, i.e.  $w > d(1+t+s)$ . Let the probability of the customs declaration being checked is equal to  $\pi$ ,  $\pi \in (0, 1)$ , and if the check is performed, then the actual amount of the purchase is guaranteed to be revealed. Assume that the buyer understates the purchase price, but not completely. How will the unpaid amount of money (the amount of underpaid duty) change with a small increase in the customs duty rate  $t$ ?

Вопрос 9

Балл: 15,00

Consider a market for a homogeneous good in the home country. There are  $N$  domestic firms and one foreign firm in the market. The foreign firm sells all its product in the market. The inverse demand function is linear and decreasing. All firms (domestic and foreign) have constant equal unit costs. The firms are involved in Cournot competition. The foreign firm's imports to the home country are subject to a specific tariff rate of  $t$  currency units per unit. Suppose that each firm produces a non-zero output. Before Cournot competition starts  $K$  domestic firms involve in a

### Экономика

lobbying activity regarding the tariff rate  $t$ , where  $0 < K < N$ . The firms simultaneously and independently choose their lobbying contributions. The tariff rate  $t$  is taken to be square root of their total contributions. How does the tariff rate  $t$  change as  $K$  increases?