Направление: Экономика

Профили

«Прикладная экономика»

«Экономика: исследовательская программа»

Время выполнения задания – 180 мин.

Решите все три задачи

Веса задач приведены в скобках

Инструкции

- Решение может быть представлено как на русском, так и на английском языке. Никаких дополнительных баллов, впрочем, как и штрафов, за решение на английском языке не предусмотрено.
- Решение должно быть хорошо структурированным, изложено грамотным языком, а почерк – распознаваемым. Ответы на качественные вопросы должны быть убедительно аргументированы, но длинные рассуждения, не относящиеся к сути дела, могут негативно повлиять на оценку.
- Все шаги в решении должны быть обоснованы, все вычисления должны присутствовать в работе. Калькуляторами пользоваться запрещено.
- Черновики не предусмотрены, решение сразу оформляется на чистовик.
- Если приведенное решение является неверным, перечеркните его (перечеркнутое решение не проверяется) и приведите корректную версию.
- При наличии нескольких вариантов решения одного и того же задания, проверяющий сам определяет, какое из решений подлежит проверке, а апелляции с просьбой проверить другой вариант решения не принимаются.

1. [48 points] Answer the following short questions:

(a) [8 p.] 'International trade can contribute to the spread of economic recession all over the world'. True or false? Explain.

True.

Economic recession in an economy means a decrease in output and total income. **[2 p.]**

The decrease in total income leads to a drop in total expenditures. If the economy trades with the other world, this also means the drop in demand for foreign goods and services **[2 p.]** and a decrease in export for other countries which used to supply these goods and services **[2 p.]**.

A decrease in export leads to a decrease in output in these countries and may push them into recession **[2p.]**. Thus, international trade links constitute a channel though which recession can spread from country to country.

(b) [8 p.] Rupee demonetization. On November 8 2016 the Indian Prime-Minister announced that starting from November 9, all the 500 and 1000 rupee notes stop to serve as a medium of payment. These banknotes can be either exchanged for the new banknotes up to some limit or put on bank deposits. Which consequences of this reform do you expect in the short and long run, if the 500 and 1000 rupees notes constituted around 90% of all money in circulation, more than 90% of deals have been made in cash and 80% of population do not have bank accounts?

Short-run consequences **[2 p. per each but no more than 4 p. total]**
(1) The demonetization leads to a drop in money supply.
(2) As most of deals used to be made in cash and most of cash has been destroyed, the demonetization could lead to a drastic drop in expenditures and output.
(3) The rapid demonetization would lead to a panic and an increase in demand for foreign currency. This would cause a currency crisis.
Long-run consequences **[2 p. per each but no more than 4 p. total]**
(1) The sudden demonetization destroys the trust of international investors. This would lead to a decrease in foreign investments and capital inflow, which lowers investments and output growth rates.
(2) The demonetization raises the rate of population which uses bank accounts. This, in turn, may trigger higher money multiplication and lead to an increase in money supply.

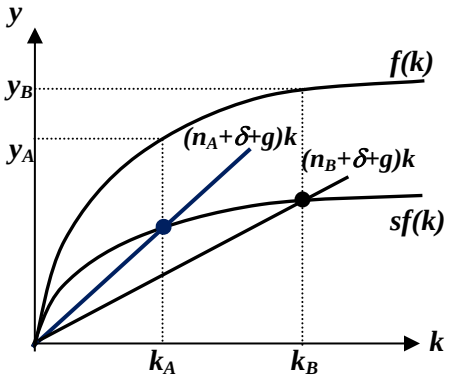
(c) [8 p.] Solow model. Suppose that in country A the rate of population growth is higher than in the country B. All other parameters are identical for both countries. (i) Do you expect that countries will converge to the same level of GDP per capita if both economies are closed? (ii) Does your answer to the previous question change if both countries become open to international capital flows? Explain and illustrate your answers.

For closed economies countries will not converge in the level of output per capita as in the country B the level of capital per efficient labor and output per efficient labor is higher (see diagram)

[2 p. + 2 p.]

The interest rates are different in two countries. In country A the interest rate is higher as the level of capital per efficient labor is lower. **[1 p.]**

International capital flows will be directed from the country B to country A because of interest rate differentials. **[1 p.]** It leads to the



convergence of output per capita in both countries (but not of GNI per capita). **[2 p.]**

(d) [8 p.] Comment on the following statement: 'When a distortion cannot be removed from one market, it is not generally efficient to ensure that all other markets are distortion-free'.

The idea of second best **[4 p.]**

In presence of distortion the equilibrium is usually inefficient (assumptions of the first fundamental welfare theorem are violated). The second distortion might balance the first one (i.e. give a second-best).

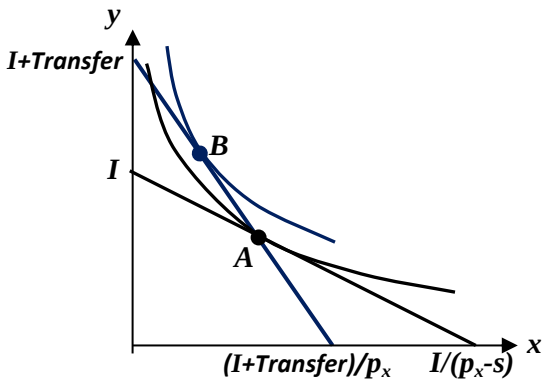
Example **[4 p.]**

For example, if production results in negative external effect, then under perfect competition we overproduce as MB=P=PMC<SMC. If this market is monopolized (the second distortion is introduced) then monopoly will produce less than perfectly competitive industry as P>MR=PMC and it might produce the socially efficient level of output.

(e) [8 p.] Comment on the following statement: "Per unit subsidy on good X can never be better for an individual than a monetary transfer of the same value but can be worse."

An analysis under assumption 'other things equal' **[6 p.]**

If a per unit subsidy is replaced by the monetary transfer of the same value AND all other prices and income are unaffected then consumer can still afford the initial bundle and so he cannot be worse off. Algebraically, the bundle $A=(x^0,y^0)$ which is chosen under per unit subsidy lies along the initial budget line: $(p_x-s)x^0+y^0=I$ (y - spending on all other goods). This bundle is still affordable with cash transfer of the same value $p_x x^0+y^0=I+sx^0=I+Transfer$. It means that individual can always choose this bundle under cash transfer and be at least as well off.



Moreover, some new bundles become affordable and consumer might benefit by substituting the more expensive good X by some other goods, the prices of which stay constant. As the relative price of X under cash transfer is higher, he can substitute away from X in case of smooth indifference curve and be better off (move from A to B due to Slutsky substitution effect).

The possibility of adverse impact that comes from the violation of the assumption 'other things equal' **[2 p.]**

If we use a general equilibrium approach then, with the new income and prices, the market demand may change and result in adjustment of relative prices. It might happen that the relative price of some good for which this consumer is a net buyer goes up and as a result he becomes worse off.

(f) [8 p.] One well-known empirical study demonstrates that US power plants that were strategically located near coal mines to benefit from low transportation costs have contracts with their coal suppliers that cover significantly longer time span that contracts of other power plants. How would you explain this observation?

When deciding where to build a coal-fired power plant (and also what kind of technology and capacity to choose), an important factor is where the coal is supposed to be mainly bought. By locating near the supplier the power plant owner reduces transportation costs of buying coal from this supplier, but also typically increases costs of buying coal

from other suppliers. Therefore, the coal supplier gains a strong bargaining position since other alternatives become more expensive. **[4 p.]**

To protect her *specific investment* (location), the power plant owner wants to conclude a long-term contract that would protect her from the supplier's opportunistic and unjustified raising of coal price. An alternative to long-term contracts is creating a vertically integrated company, which is also shown to happen more often for closely located mines and power plants. **[4 p.]**

2. [26 p.] Consider an economy with fixed stock of capital equal to 4. There are two regions $(i = 1, 2)$ in this economy and the capital tax rates t_i are set by the regional authorities. Capital is fully mobile and the capital owners allocate the capital between the regions on the basis of after-tax returns given by $R_i = 5 - b_i K_i - t_i$ where $0 < b_1 \le b_2 = 0{,}5$ and K_i is the capital allocated to region i. The total capital supplied will be equal to 0 if the after-tax returns are negative in both regions.

(a) [5 p.] Suppose that the tax rates are fixed, find the allocation of capital between the two regions, assuming that tax rates are small enough and both regions attract some capital.

AS K is perfectly mobile the after-tax returns have to be equal **[1 p.]:** $R_1(K_1) = R_2(K_2)$

Derivation of capital allocation **[4 p.]**

$R_1 = 5 - b_1 K_1 - t_1 = R_2 = 5 - 0{,}5K_2 - t_2 = 5 - 0{,}5(4 - K_1) - t_2 = 3 + 0.5K_1 - t_2.$

$K_1 = \frac{2 + t_2 - t_1}{0.5 + b_1}$ and $K_2 = \frac{4b_1 - t_2 + t_1}{0.5 + b_1}$

(b) [9 p.] Suppose that regional authorities choose the tax rate that maximises the regional tax revenue. Consider a game, where at the first stage the local (regional) authorities simultaneously and independently decide on the tax rates and then capital owners observe these rates and choose the capital location.

(i) Find the equilibrium tax rates.

Find equilibrium via backward induction. As the second stage was solved in (a) we will deal with the first stage only.

Derivation of best response of region 1: **[2 p.]** $TaxR_1 = t_1 K_1(t_1, t_2) = t_1 \frac{2 + t_2 - t_1}{0.5 + b_1} \xrightarrow[t_1]{} \max$

FOC: $2 + t_2 - 2t_1 = 0 \Rightarrow 2 + t_2 = 2t_1$

Derivation of best response of region 2: **[2 p.]** $TaxR_2 = t_2 K_2(t_1, t_2) = t_2 \frac{4b_1 - t_2 + t_1}{0.5 + b_1} \xrightarrow[t_2]{} \max$

FOC: $4b_1 - 2t_2 + t_1 = 0$

Derivation of equilibrium **[2 p.]** $8b_1 - 4t_2 + 2 + t_2 = 0 \Rightarrow t_2 = (8b_1 + 2)/3$ and $t_1 = (4b_1 + 4)/3$

(ii) Compare the equilibrium tax rates and explain the result.

Comparison **[1 p.]** $t_2 - t_1 = (4b_1 - 2)/3 < 0$ as $b_1 < 0.5$

Explanation **[2 p.]** Lower value of b implies higher return on capital under the same tax rates, which results in more aggressive strategic behaviour as even with slightly higher tax rate investment in the first region is more profitable.

(c) [5 p.] Find the effect of increasing b_1 on equilibrium tax rates and explain the results.

Calculation of the effects **[1 p.]** $\frac{dt_1}{db_1}=\frac{4}{3}$ and $\frac{dt_2}{db_1}=\frac{8}{3}$

Explanation for t2 **[2 p.]** An increase in b reduces return on K of region 1 and, under the previous tax rates, brings some reallocation of K in favour of region 2 by increasing its tax base. Increased tax base (supply of K) in region 2 makes tax rate increase profitable.

Explanation for t1 **[2 p.]** Under increased tax rate in region 2, if t_1 is constant then net return in 1 goes up and there is some reallocation of K in favour of 1 which allows some increase in its tax rate as well but this change is smaller as it comes from induced reallocation of capital supply.

(d) [6 p.] Let $b_1=0.5$ and suppose that the tax policy is centralised. These tax rates are set by the federal government that maximises the sum of tax revenue of both regions.

(i) Find the resulting tax rates which are identical for both regions.

Calculation of the tax rate **[4 p.].** Identical tax rates $t_2=t_1=t$. First, note that the allocation of capital is necessarily symmetric. If it is not the case and $K_i>K_j$ then $R_i=5-0.5K_i-t<5-0.5K_j-t=R_j$, which means that owner of the last unit allocated to j would gain by reallocating this unit in favour of i. Thus total capital supplied is $K=K_1+K_2=2K_1$. As $K\le 4$ and we need $\max(R_i,R_j)=R_i=5-0.5K_i-t\ge 0$ then due to the established symmetry all the capital will be used if the tax rate is not high, i.e. if $5-0.5K/2-t=4-t\ge 0 \Leftrightarrow t\le 4$. If $t>4$, then the total capital used is such that $5-0.5K/2-t=0$, that is $K=20-4t$. Finally

$TR=\begin{cases}4t, t\le 4\\ t(20-4t), t\ge 4\end{cases}$. At the first segment function is increasing and so max is attained at t=4. For the second one the maximum is attained at corner solution with t=4 as well. Thus the best tax rate is t=4 with tax revenue of 16.

(ii) Compare the tax rates with equilibrium ones (for $b_1=0.5$) and explain the result.

Comparison. **[1 p.]** In (a) under b=0,5 we have $t_2=t_1=t=2<3$

Explanation **[2 p.]** In equilibrium the tax rates are too low as each region uses its tax rate as a strategic instrument and tries to increase the tax base (attract more capital) by reducing the tax rate (which increases the after-tax return). But the maximum tax base for the overall economy is fixed exogenously, which means that in centralized case tax reduction results in pure loss for the overall tax revenue.

3. [26 p.] A small open economy (Home country) can be described by the Mundell-Fleming model (IS-LM-BP model) with the following equations:

$$\boldsymbol{Y=a_0+a_2r+a_3Q}$$

$$\frac{M}{P} = b_0 + b_1 Y + b_2 R$$

$$c_0 + c_1 Y + c_2(r - r^*) + c_3 Q = 0,$$

where Y is the real output, r is the real interest rate, Q is the real exchange rate (real depreciation is an increase of Q), M is the nominal money supply, P is the price index, R is the nominal interest rate, $r^*$is the real interest rate of the Rest of the world, price indices are constant both in the Home country and in the Rest of the world, $a_0, a_2, a_3, b_0, b_1, b_2, c_0, c_1, c_2, c_3$ are non-zero real numbers and $b_1/b_2 < c_1/c_2$. The Marshall-Lerner condition is satisfied.

(a) Give the economic interpretation of the equations of the model and title them. What signs of parameters (if any) are implied by the macroeconomic theory?

(b) What are the endogenous variables of the model in case of the free floating exchange rate regime? Draw the effect of a change of the foreign interest rate (r^*) on all endogenous variables of the model under the free floating exchange rate regime. Explain your answer.

(c) What are the endogenous variables of the model in case of the fixed exchange rate regime? Draw the effect of a change of the foreign interest rate (r^*) on all endogenous variables of the model under the fixed floating exchange rate regime. Explain your answer.

(d) It is known that a change of the foreign interest rate affects the domestic interest rate (r) equally in free floating and fixed exchange rate regimes. Derive necessary and sufficient parameters condition(s) for the equal effect.

(a) [4p] Equation (1) is an IS curve, it reflects the goods market equilibrium: $Y = C(Y - T) + I(r) + G + Xn(Y, Q)$. Equation (2) is an LM curve, it reflects the money market equilibrium: $\frac{M^S}{P} = l(Y, R)$. Equation (3) is a BP curve reflecting the balance-of-payment equilibrium[1]: $CA(Y, Q) + CF(r - r^*) = 0$. Taking into account that macroeconomic theory implies the following inequalities: $0 < C'_{Y-T} < 1$, $I'_r < 0$, $Xn'_Y < 0$, $Xn'_Q > 0$, $l'_Y > 0$, $l'_R < 0$, $CA'_Y < 0$, $CA'_Q > 0$, $CF'_{r-r^*} \geq 0$ and the non-zero condition for all the parameters, the sign of parameters a_3, b_1, c_2 and c_3 should be positive, the sign of parameters a_2, b_2, c_1 should be negative, and macroeconomic theory tells nothing about the sign of parameters a_0, b_0 and c_0 (usually in aplications a_0 is positive). Multiplying the last equation by (-1) does not change the system. Therefore, the answer telling that c_2 and c_3 should be negative and c_1 positive is considered as the right one.

(b) [6p] In case of a flexible exchange rate regime the set of endogenous variables contains the output (Y), the real interest rate (r) and the real exchange rate (Q). As Home price indice is constant, the inflation rate is zero and so is the expected inflation rate. Therefore, the nominal interest rate is equal to real one. To draw the three curves on $Y - r$ diagram we take into account that:

$$\frac{dr}{dY}|_{IS} = \frac{1}{a_2} < 0 \qquad (1)$$

[1] Usually in macroeconomic problems $CA = Xn$.

$$\frac{dr}{dY}|_{LM} = -\frac{b_1}{b_2} > 0 \quad (2)$$

$$\frac{dr}{dY}|_{BP} = -\frac{c_1}{c_2} > 0 \quad (3)$$

As $b_1/b_2 < c_1/c_2 \Rightarrow -b_1/b_2 > -c_1/c_2$, and so the LM curve is steeper than the BP curve. As c_2 is finite, a possibility of a horizontal BP-curve is ruled out.

Figure 1

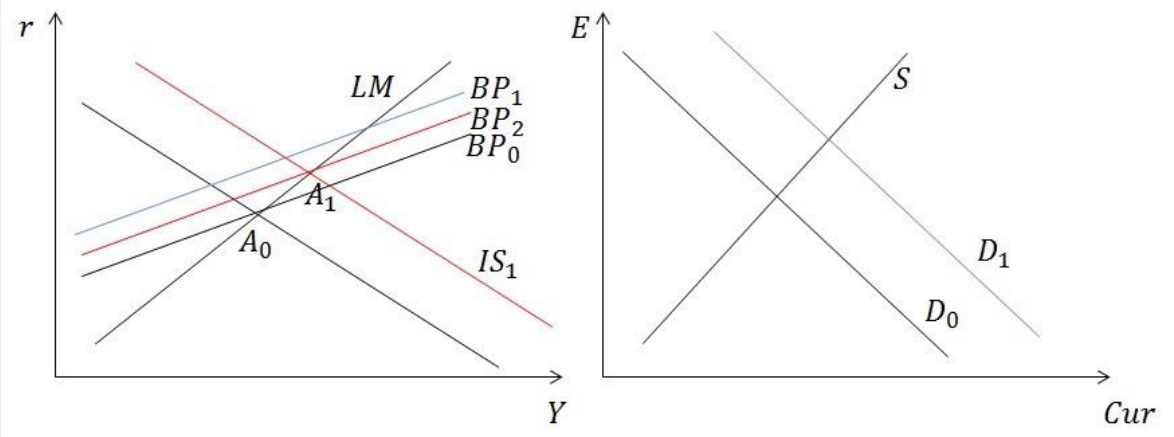
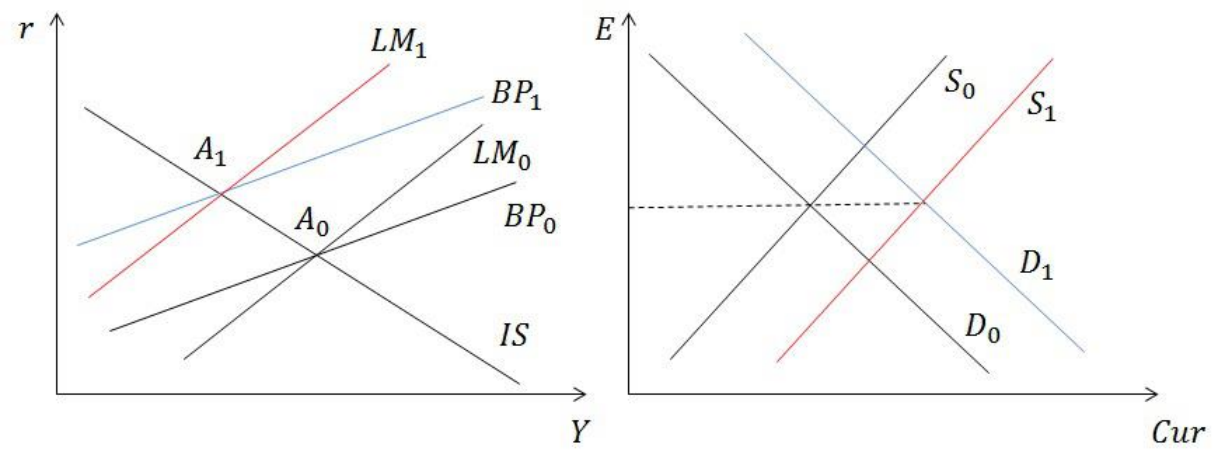


Figure 1 shows the effect of the foreign exchange rate on all endogenous variables of the model. Let $\Delta r^* > 0$ so the BP curve shifts up. The point of the intersection of the IS and LM curves is below BP curve, capital outflow increases the demand for the Rest of the world (RoW) currency (righthand part of Figure 1), and national currency depreciates (S is the price of the RoW currency in terms of the Home currency). As Home and RoW price indices are constant, Q increases as well (Home currency depreciates) and the IS and BP curves shift rightward. The point A_1 is a new equilibrium, it lies on the LM-curve that does not shift at all, so in the new equilibrium the output, real interest rate and real exchange rate are bigger than in the previous one.

(c) [6p] In case of the fixed exchange rate the set of endogenous variables contains the output (Y), the real interest rate (r) and the nominal money supply (M^s).

Figure 2 shows the effect of the foreign exchange rate on all endogenous variables of the model. If r^* increases, the BP curve shifts up. The point of the intersection of the IS and LM curves is below the BP curve, capital outflow increases the demand for the RoW currency. The central bank increases the supply of the foreign currency to hold the nominal exchange rate fixed. Therefore, international reserves decrease and so does the money supply. The LM curve shifts upward. The new equilibrium point (A_1) lies on the IS-curve that does not shift at all, so in the new equilibrium the output and the money supply are smaller, and the real interest rate is bigger than in the previous one.

Figure 2



(d) [10p] To determine the effect of the foreign interest change on the national interest rate in case of the flexible exchange rate regime the system of equations may be rewritten in the difference form:

$$\begin{cases} \boldsymbol{dY - a_2 dr - a_3 dQ = 0} \\ \boldsymbol{b_1 dY + b_2 dr = 0} \\ \boldsymbol{c_1 dY + c_2 dr + c_3 dQ = c_2 dr^*} \end{cases} \quad (4)$$

The solution for $\boldsymbol{dr}$ is as follows:

$$\boldsymbol{dr^{flex} = \frac{b_1 a_3 c_2 dr^*}{a_3 b_1 c_2 - b_2 c_3 - a_3 b_2 c_1 - a_2 b_1 c_3}}$$

In case of the fixed exchange regime the system may be written as:

$$\begin{cases} \boldsymbol{dY - a_2 dr = 0} \\ \boldsymbol{b_1 dY + b_2 dr - \frac{1}{P} dM = 0} \\ \boldsymbol{c_1 dY + c_2 dr = c_2 dr^*} \end{cases} \quad (5)$$

The solution for $\boldsymbol{dr}$ is as follows:

$$\boldsymbol{dr^{fix} = \frac{c_2 dr^*}{c_1 a_2 + c_2}}$$

Therefore, a change of the foreign interest rate affects equally the domestic interest rate in flexible and fixed exchange rate regimes if and only if:

$$\boldsymbol{\frac{b_1 a_3 c_2}{a_3 b_1 c_2 - b_2 c_3 - a_3 b_2 c_1 - a_2 b_1 c_3} = \frac{c_2}{c_1 a_2 + c_2} \Rightarrow}$$

$$\boldsymbol{-a_2 a_3 b_1 c_1 = b_2 c_3 + a_3 b_2 c_1 + a_2 b_1 c_3}$$