

**ALL-RUSSIAN OLYMPIAD FOR STUDENTS AND GRADUATES**

**“MASTERS MAGIC. CONNECT SCIENCE AND PRACTICE!”**

**FIELD OF STUDY: “ECONOMY AND MANAGEMENT”**

**VARIANT 1**

**Task 1 (20 marks maximum)**

Consider a closed economy with fixed prices and wages. Suppose the consumption function takes the form  $C = 25 + 0.6(Y - T)$ , where  $C$  is consumption,  $Y$  is income, and  $T$  is taxes. The investment function is  $I = 65 - r$ , where  $I$  is investment and  $r$  is the interest rate. The demand for money is given by  $M / P = 4Y - 15r$ , where  $M$  is the amount of money demanded and  $P$  is the price level. Assume that the price level is fixed at  $P = 1$ . Government spending is  $G = 50$ , and taxes are  $T = 50$ , and the money supply is  $M = 850$ .

**Required:**

(a) Derive the functions of IS and LM curves and find equilibrium  $Y^e$  and  $r^e$ . Find the levels of consumption  $C$  and investment  $I$  in equilibrium. (5 marks)

(b) Suppose that government spending increases by 100 to  $G = 150$ , with this extra spending financed by borrowing so there is no change in taxes or the money supply. Find new equilibrium level of output and interest rate. Find the new levels of consumption  $C$  and investment  $I$  in equilibrium. What is the deficit-financed government expenditure multiplier in this case? (5 marks)

(c) Now suppose that the same increase in government spending occurs, but this time it is financed by an increase in taxes so that the budget remains balanced. Compute the new equilibrium level of output and interest rate and hence the balanced-budget government expenditure multiplier. Find the levels of consumption  $C$  and investment  $I$  in equilibrium. (5 marks)

(d) Suppose instead that the extra spending is financed by the central bank printing money for the government (seigniorage). Compute the new equilibrium level of output and interest rate in this case and the associated government

expenditure multiplier. Find the levels of consumption  $C$  and investment  $I$  in equilibrium. (5 marks)

**Task 2 (35 marks maximum)**

The Litex corporation is producing batteries and it owns several factories supplying batteries for laptops, smartphones and domestic appliances. The present value of the net profits from the factories depends on long term corporation prospects. Two equally likely scenarios are possible: optimistic or pessimistic. In the case of the optimistic scenario the present value of the profits is equal to \$500 mln and it is equal to \$300 mln in the pessimistic scenario.

The Litex is considering an opportunity of investing in electric cars battery production. The required investment is \$100 mln. The net present value of the investment project also depends on the scenario and equals \$20 mln in the pessimistic case and \$70 mln otherwise. Two options of raising external funds are considered: bond issuance and equity issuance. The shareholders and outside investors are risk neutral.

**Required:**

(a) Assume that the shareholders do not possess their own estimates of what the scenario is going to realize, so they just as the outside investors take as given that both scenarios happen with equal probabilities.

- i. What is the fair market company value?
- ii. What share of the company equity should the current owners sell in order to raise funds from the outside investors sufficient for launching the investment project?
- iii. What is the optimal choice: raise funds by selling equity, by selling bonds or reject the project? Justify. (9 marks)

(b) Now assume that the company knows perfectly which scenario happens. On the contrary the market doesn't know this and even doesn't know that the company shareholders have information about future scenario.

- i. What would the current shareholders payoff be if they decide to sell equity under assumption that the pessimistic scenario realizes in the future? What would the payoff be if they sell bonds instead? Which way of raising external funds is optimal in the current shareholders perspective in the case of pessimistic scenario is going to happen?
  - ii. Perform the same analysis for the case when the shareholders know that the optimistic scenario happens. Conclude on the optimal capital raising strategy depending on the company prospects. (9 marks)
- (c) Assume that outside investors do not know which scenario will happen, but they know that the current owners of the company have such information
- i. How would the market value of the firm be affected by the announcement of the choice of the capital rising strategy? Will the announcement of the equity issuance lead to the company market value increase? What about debt issuance?
  - ii. What share of the company equity should the current owners sell in order to raise funds from the outside investors sufficient for launching the investment project? Compare with (a). What would the current company owners' payoff be in that case? (9 marks)
- (d) Based on the result obtained in (c) draw conclusions on the role that information asymmetry between company and outside investors plays in the cost of funding determination and the choice of capital structure. (8 marks)

### **Task 3 (45 marks maximum)**

ABC Co is considering a contract to develop and operate a waste disposal scheme for the local municipal government contract. The contract specifies that waste would be disposed of by means of incineration and through a landfill site.

Initial development of the landfill site and the building of the incinerator would require significant investment. It is assumed that in year 4 those facilities would have to be expanded to reflect the planned growth in the local population and the local economy. The local municipal formation would pay a constant annual fee

for the five years of the contract. The estimated cash flows are as shown in the table below (all figures in \$millions). Assume that all cash flows take place at the end of the respective year:

<i>Year</i>	<i>Investment in facilities</i>	<i>Operating costs</i>	<i>Fees received from government contract</i>
	\$mln	\$mln	\$mln
1	(2.4)	(1.1)	2.3
2	(0.7)	(1.2)	2.3
3		(1.3)	2.3
4	(1.2)	(1.5)	2.3
5		(0.7)	2.3

Additionally, and not reflected in this table of figures, at the end of the contract, ABC Co would have to seal the landfill site and dispose of the incinerator, which is estimated to cost an additional \$0.8m. The cost of capital for ABC Co is 10%.

**Required:**

- (a) Calculate the project's net present value. (11 marks)
- (b) What is the project's internal rate of return? (9 marks)
- (c) Calculate the project's payback period, assuming the cash flows arise evenly throughout each year. (5 marks)
- (d) Should the company accept this project? Explain your answer. (7 marks)
- (e) If different methods of capital investment appraisal give conflicting evaluations of a project, how should a decision-maker use such conflicting information? (13 marks)