Олимпиада НИУ ВШЭ для студентов и выпускников – 2018 г.

Направление: «Финансы и кредит»

Профиль: «Стратегическое управление финансами фирмы/ Strategic Corporate Finance» **КОД – 181**

Время выполнения задания – 180 мин.

Please, provide answers in **English.**
Possible to use nonfinancial, nonprogrammable calculator

PART 1 Microeconomics, Macroeconomics

Solve the problems 1 and 2 given below

Problem 1 (25 points) - Solution

Consider an economy with the following IS and LM curves: Y = 4400−600r +2G−T (IS) and M/P=0,5Y-200r (LM), where Y - output, G - government purchases of goods and services, T – net tax, r – real interest rate, M - nominal money supply, P - price level.

Question 1.1 (5 points)

Suppose that that the government decides that T = G = 400 and that money supply is equal to 8000. Find an equation for the aggregate demand curve.

ANSWER:

Y=4400-600r+2G-T (IS)
Y=4800-600r
r=8-(Y/600)

M/P=0,5Y-200r (LM)
8000/p=0,5Y-200r
r=(0,5Y)/200-40/p

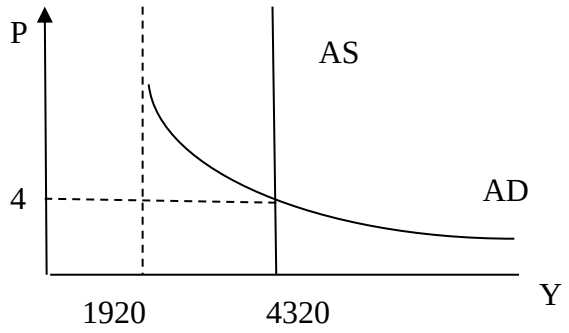
8-(Y/600)=(0,5Y)/200-40/p
Y=1920+9600/p (AD) (5 points)

Question 1.2 (5 points)

If the full-employment level of output is Y_F = 4320, what are the equilibrium values for r and P? Illustrate the long-run equilibrium in the AD-AS diagram.

ANSWER:

4320=1920+9600/p
P=4 (1,5 points)
r=0,8 (1,5 points)



AD-AS diagram (2 points)

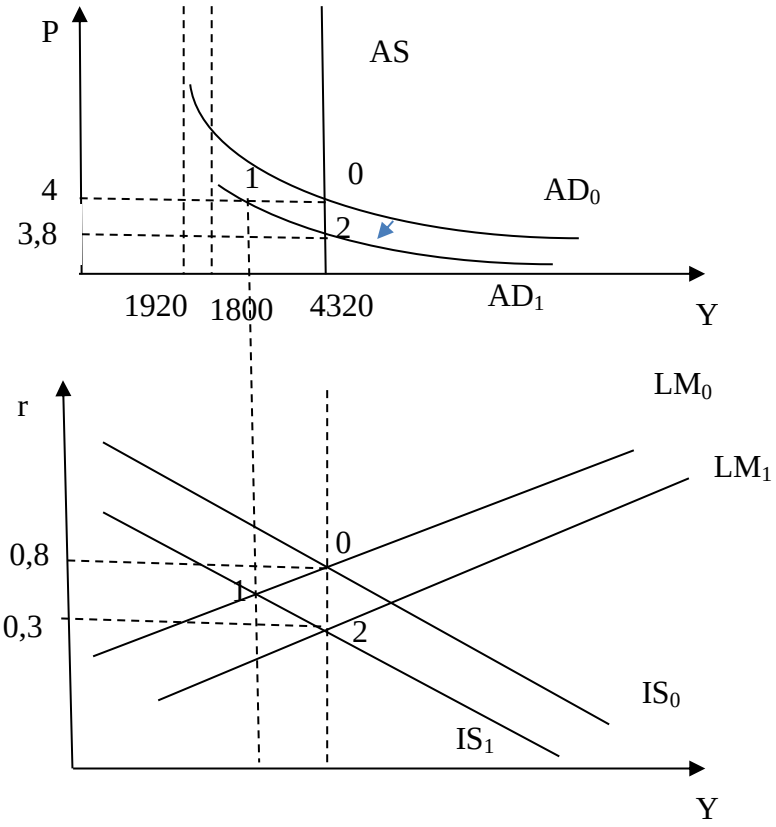
Question 1.3 (5 points)

What does happen if T = G = 100 and money supply is equal to 8000 with Y_F fixed?

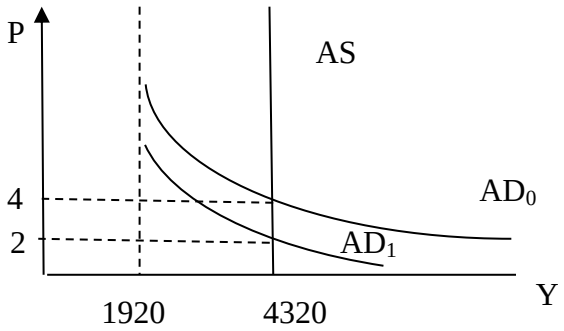
ANSWER:

Y=4400-600r+100=4500-600r

r=7,5-(Y/600)
7,5-(Y/600)=(0,5Y)/200-40/p
p≈3,8 (2 points) r=0,3 (2 points)
AD: Y=1800+9600/p
When T=G=100, then IS curve shifts to the left as well as aggregate demand curve (AD). P will decrease and LM curve shifts to the right. r will decrease. (1 points).



Question 1.4 (5 points)
What does happen if T = G = 400 and money supply is equal 4000 with Y_F fixed?
ANSWER:
r=8-(Y/600)
400/p=0,5Y-200r
r=(0,5Y)/200 – 20/p
8-Y/600=(0,5Y)/200 – 20/p
P=2 (2 points)
r=0,8 (2 points)



When the nominal money supply decrease, LM curve moves down. The aggregate demand curve (AD) shifts down too. Price level decrease. LM curve returns to its previous position. (1 points)

Question 1.5 (5 points)

Compare both equilibrium. What does mean money is neutral in this model?

ANSWER:

Taxes (T) and government purchases (G) decrease, and as a result, the price (P) and interest rate (r) dropped down. Nominal money supply (M) decreases and the interest rate (r) does not change, due to price (P) reduction. (2 points)

Nominal money supply declined 2 times and prices reduced 2 times. As a result, the real money supply remained unchanged (LM curve did not change its position), so the interest rate also remained the same. (3 points)

Problem 2 (25 points) - Solution

Suppose that a firm has two distinguishable customers: students and nonstudents. The total demand for students is $q_s = 100-p$. The total demand for non-students is $q_n = 200-p$. Total costs are $TC=0,5Q^2$ ($Q=q_s+q_n$).

Question 2.1 (5 points)

Suppose that the firm faces a competitive market for its output and can sell as much of its output as it likes at the market price of p. What is the firm's optimal choice of p and q? What are the corresponding profits?

ANSWER:

MC=Q

$$Qd = \begin{cases} 200 - p, & 100 < p < 200 \\ 300 - 2p, & p \leq 100 \end{cases}$$

$$p = \begin{cases} 200 - Q, & Q < 100 \\ 150 - 0,5Q, & Q \geq 100 \end{cases}$$

P=MC
Q=100 (2 points)
P=100 (2 points)
П=100*100-0,5*100*100=5000 (1 point)

Question 2.2 (5 points)

The firm became monopolist. Suppose firm was unable to keep the two types of customers separate. If only a single price is offered, what is the profit-maximizing price? What is the total profit at this price?

ANSWER:

$$Qd = \begin{cases} 200 - p, & 100 < p < 200 \\ 300 - 2p, & p \leq 100 \end{cases}$$

$$p = \begin{cases} 200 - Q, & Q < 100 \\ 150 - 0,5Q, & Q \geq 100 \end{cases}$$

$$TR = \begin{cases} 200Q - Q^2, & Q < 100 \\ 150Q - 0,5Q^2, & Q \geq 100 \end{cases}$$

$$MR = \begin{cases} 200 - 2Q, & Q < 100 \\ 150 - Q, & Q \geq 100 \end{cases}$$

MR=MC

200-2Q=Q
Q=66,7 (2 points)
P=133,3 (2 points)

150-Q=Q
Q=75
P=112,5
False.

П=133,3*66,7-0,5*66,7*66,7=6666,7 (1 points)

Question 2.3 (5 points)

What is the optimal pair of prices, which a 3rd degree price-discriminating monopolist would choose? What are profits?

ANSWER:

$MC=MR_s=MR_n$

$q_s = 100-p$
$p=100-q_s$
$TRs=100q_s-q_s^2$
$MRs=100-2q_s$

$q_n= 200-p$
$p=200-q_n$
$TR_n=200q_n-q_n^2$
$MR_n=200-2q_n$

$$\begin{cases} 200-2q_n = q_n + q_s \\ 100-2q_s = q_n + q_s \end{cases}$$

q_s=12,5 q_n=62,5 (2 points)
ps=87,5 p_n=137,5 (2 points)

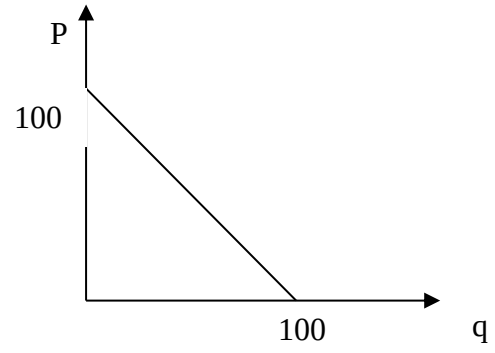
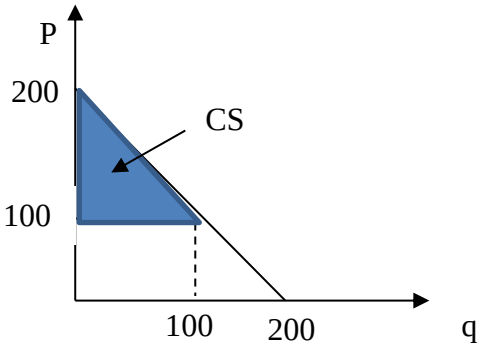
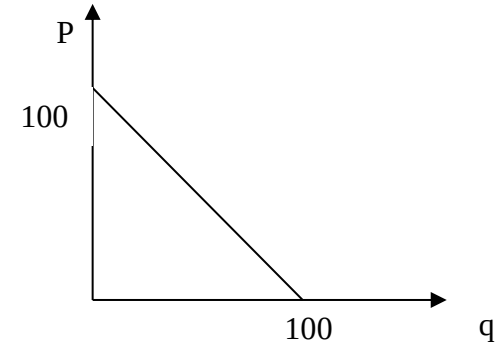
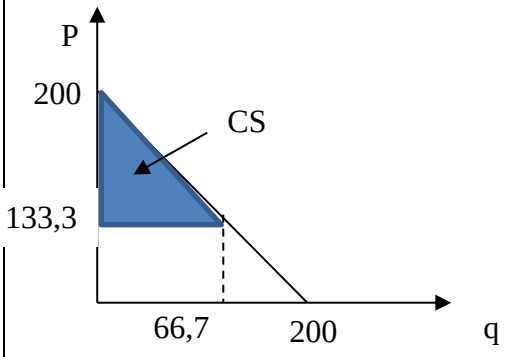
П=12,5*62,5+137,5*62,5-0,5*75*75=6875 (1 points)

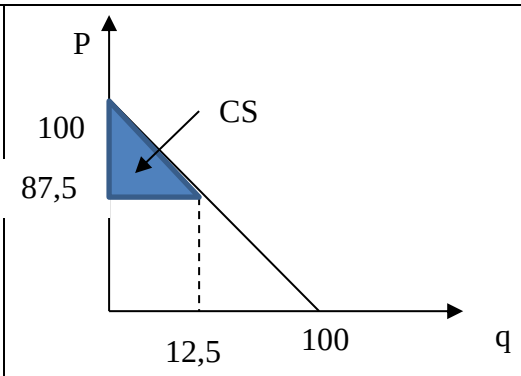
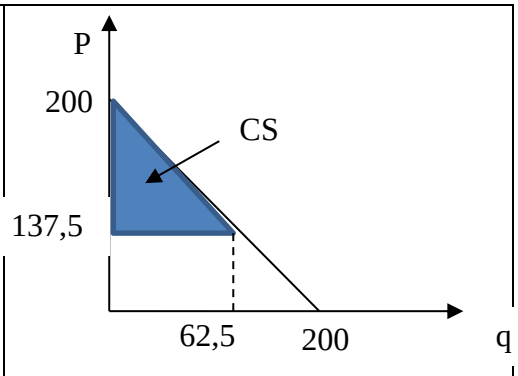
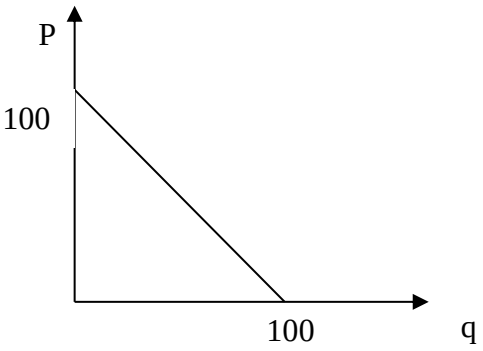
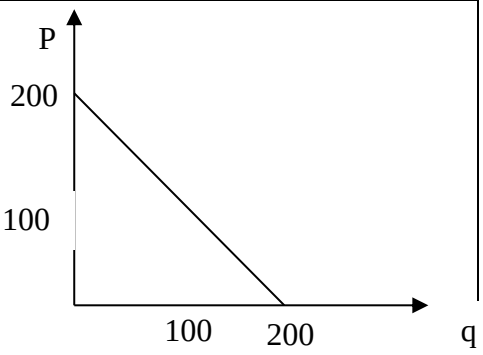
Question 2.4 (5 points)
If the monopolist could perfectly 1st-degree price discriminate, what is the new optimal quantity? What are profits?
ANSWER:

$$Qd = \begin{cases} 200-p, & 100 < p < 200 \\ 300-2p, & p \le 100 \end{cases}$$

The company charges the consumer the maximum price that individual is willing to pay for that product. Q=100 (3 points)
Profit is total surplus.
П=100*100*2*0,5=10000 (2 points)

Question 2.5 (5 points)
Compare results of 2.1-2.4. How much consumer surplus would each group get in each case? Illustrate these cases with graphs, show consumer's surpluses.
ANSWER:

	Student	Nonstudent
Perfect competition (1 point)	 CS=0 (do not buy the product)	 CS=100*100*0,5=5000
Monopolist (1 point)	 CS=0 (do not buy the product)	 CS=66,7*66,7*0,5=2224,4

3rd degree price-discriminating monopolist (1 point)	 CS=66,7*66,7*0,5=78,1	 CS=62,5*62,5*0,5=1953,1
1st-degree price discriminating Monopolist (1 point)	 CS=0 (The firm will not offer the goods, since marginal costs are too high.)	 CS=0 (Monopolist will charge willingness to pay.)

(1 point) Welfare for students is greatest with 3rd degree price-discrimination. Welfare for non-students is greatest with perfect competition.

PART 2. Corporate Finance

Solve the problems 3 and 4 given below

Problem 3 (25 points)

At the end of your internship at a well-known consulting firm you were asked to give a professional opinion on a potential investment opportunity at Zion limited liability company. The project is about producing and selling new keys. Zion management team plans to implement the project that will be financed with debt and equity. Most of Zion's shareholders are individual portfolio investors except the ArchitectFund who owns 20% of equity capital. Zion's equity is represented by 500 common shares. Zion company has a well-established relationship with AgentBank which has long history of providing debt financing. The Zion's management team follows a belief that optimal Debt/Equity ratio should be 0,5. Required rate of return on unlevered Zion's equity capital is 25%. However, the new investment opportunity is about the same level of risk as existing Zion's operations, it was decided to implement the project with a help of creating a new business entity – Keymaker limited liability company. The Keymaker company will be created specifically to realize the project. Shareholder structure of the Keymaker company is supposed to be the same as existing Zion's shareholder structure.

You are given the following info regarding the project:

Project has 4 years maturity. Sales are expected to be 600 mln. cpt. per year for the next four years. (cpt. stands short for "CriPTa" which is the local currency).

COGS (excluding depreciation expense) will comprise 40% of Sales. Capital expenditures will reflect acquisition of equipment for 720 mln. cpt. Newly acquired machinery will be depreciated over 4 years of useful life using straight-line approach to its residual book value of 120 mln. cpt. Net working capital management guidelines require current assets to be at 20% of expected Sales in a corresponding year. Current liabilities are planned to be at 15% of expected COGS in a corresponding year. Corporate income tax rate is 20%. The Keymaker company will be financed with same capital structure as Zion company.

AgentBank as well as other potential debtholders agrees that a fair rate of return on Zion's debt is 10%. The risk free rate is 5%. Suppose there are perfect capital markets. The only imperfection is corporate income tax.

Question 3.1 (15 points)

Is the described above investment opportunity efficient? Formulate your professional opinion using WACC approach (Weighted Average Cost of Capital). Calculate NPV of the project and advise whether the project should be implemented.

Solution 3.1

There were 4 separate parts that were given points. Operating (4 points) and Investment (3 points) flows. WACC calculation (5) and application of NPV criterion (3 points).

FCFF table.

		0	1	2	3	4
Sales			600	600	600	600
COGS			240	240	240	240
EBITDA			360	360	360	360
Depreciation			150	150	150	150
EBIT			210	210	210	210
Interest			0	0	0	0
EBT			210	210	210	210
Tax			42	42	42	42
NI			168	168	168	168
Depreciation			150	150	150	150
Capex		-720				120
Delta CA		-120				120
Delta CL		36				-36
FCFF		-804	318	318	318	522

Calculation of WACC includes calculation of required shareholders' return. Debt is risky! Hamada adjustment is not applicable.

Levered equity return = Relev = Reu + D/E * (Reu – Rd)*(1-Tc) = 0,31

WACC = D/V * Rd * (1-Tc) + E/V*Relev = 0,23

Correct approach would include discounting FCFF with WACC. NPV of the project = 58 mln. cpt.

NPV > 0. The project is efficient and should be implemented.

Question 3.2 (5 points)
Suppose the NPV of the project happened to be positive and Zion's management team decided to implement it. After one year of operations the ArchitechFund which is only strategic Keymaker's investor, offers capital restructuring plan. The plan proposes to decrease the Debt/Equity ratio from existing level of 0,5 to a new lower level. Additional common shares will be issued. The cash proceeds from equity issue will be used to retire half of existing Keymaker's debt. Individual portfolio shareholders of the Keymaker company are concerned with the fact that all shareholders will suffer a decrease in expected dividend payments as result of capital restructuring. Please, provide exactly 2 reasons to explain why individual shareholders are correct about their concern.

Solution 3.2

Mention that the question is about Expected Dividend payment. Not about value of stock.

Reason #1 – decrease of Interest Tax Savings due to decrease of Debt capital (NOT PVTS, but nominal tax savings) (2 points)

Reason #2 – Dilution (increase in number of shares) as many mentioned is not full answer. This is because Net Income of our company also increases with D/E decrease. The easiest way to imagine what happens is to pretend there is no corporate income tax. In other words imagine pure MM. In case of pure MM you will observe decrease in expected dividend payments. This is because of redistribution of cash flows between shareholders and debtholders . (3 points)

Question 3.3 (5 points)

Suppose the capital restructuring plan discussed in previous question was implemented at the beginning of the second year of running the key project. After realizing a decrease in dividend payments the ArchitectFund proposes to double the expected dividend per share amount at the end the third year of operations. Individual portfolio investors don't support that idea because there is no reason to expect the operating cash flow to increase. However, the ArchitectFund offers to ussie new additional shares to finance the proposed one-time increase in dividends. Please, evaluate the ArchitectFund's proposal from shareholders' standpoint.

Solution 3.3

Correct answer to that question was easy if you mention that there is only one market imperfection (corporate income tax) which doesn't influence MM irrelevance conclusions in regards to payout policy decisions. Once you recognize that the answer is obvious: all shareholders should be neutral to ArchitectFund proposal. (5 points).

Problem 4. (25 points)

Company ABC is a mature firm. ABC reported sales of $12 000 million in 2017. In this year ABC had EBITDA margin (EBITDA/Sales) of 25%, operating profit margin (EBIT/Sales) of 16%, and net profit margin (Net Income/Sales) of 10%. The corporate tax rate was 20%. ABC's investments in fixed assets were 11% of sales, investments in net working capital (NWC) were 3% of sales, and the level of depreciation in this year was 9% of sales. Interest expenses were only 3.5% of sales. It is also known, that 20% of investments in fixed assets and NWC were financed with long-term debt. The book value of ABC's long-term debt is $4 200 million, and its market value is $3 700 million. The yield to maturity (YTM) of corporate bonds is 10%. There are 250 million shares outstanding (trading at $46 per share), with a book value of $10 000 million. The unlevered beta coefficient of comparable companies is 0,9. The risk free rate is 5.75%. The market risk premium is 4,95%. It is assumed that long-term debt is risk free.

Question 4.1 (10 points)
Calculate ABC's FCFE and FCFF for the year 2017.
Question 4.2 (10 points)
Calculate the value of equity for ABC Company on the 01.01.2018, using FCFE model.
Question 4.3 (5 points) Taking into account the ABC's perspective in the future, please, justify, whether ABC's long-term debt level will be the same, will decline or will increase. Please, show changes in long-term debt, which ABC attracts to finance its investments in fixed assets and NWC, in next 3 years.

SOLUTION:
Question 4.1
FCFE = NI - (CapEx – D,A)*(1-δ) – ΔNWC*(1-δ) = 1200 – (1320-1080)*0.8 – 360*0.8 = 720 – 6 points
δ – percentage of investments, which is financed with long-term debt. Because 20% of investments are financed with debt, 80% of investments are financed with equity, which reduces FCFE by 80% of (CapEx-D,A) and 80% of investments in NWC.
FCFF = EBIT*(1-t) + D,A – CapEx – ΔNWC = 1920*(1-0.2) + 1080 – 1320 – 360 = 936 - 4 points

Question 4.2
g = RR*ROE = 0.4 * 0.12 = 4.8% - 4 points
RR = (CapEx – D,A + ΔNWC – (CapEx – D,A + ΔNWC)* δ) / NI = (1320 – 1080 + 360 – (1320-1080+360)*0.2) / 1200 = 0.4
ROE = NI / BVequity = 1200 / 10 000 = 12%

$Re = Rf + Beta_{levered}*(Rm-Rf) = 0.0575 + 1.13*0.0495 = 11.35\%$ - 3 points
$Beta_{levered}$ = **$Beta_{unlevered}*(1 + (1-t)*D/E) = 0.9*(1+(1-0.2)*3700/250*46) = 1.13$**

Vequity = FCFE*(1+g) / (Re –g) = 720*(1+0.048) / (0.1135–0.048) = 11 517 - 3 points

Question 4.3 – 5 points

Debt, which is attracted to finance investments = (CapEx – D,A + ΔNWC)* δ = (1320-1080+360)*0.2 = 120
Change in debt in 2018: 120*1.048 = 125.76
Change in debt in 2019: $120*1.048^2$ = 131.80
Change in debt in 2020: $120*1.048^3$ = 138.12