Олимпиада для студентов и выпускников – 2017 г.

Направление: «Финансовая экономика»

Профиль: «Финансовая экономика / Financial Economics» **КОД - 130**

Examination Guidelines

- The exam consists of 5 questions. Answer all questions. Time 180 minutes.
- The exam is graded on a 100-point scale. Numbers in brackets indicate the points awarded for each problem.
- Write your answers in the booklet provided to you by the examiners.
- You can solve the problems in any order but you must label each problem and its sub-questions clearly and sufficiently. Use a separate page for each problem. You are not allowed to detach sheets from the booklet.
- Answer all questions in English. Graders will ignore any Russian text.
- You may use the last page of your booklet as scrap paper.
- Crossed out writing will not be considered by the grader.
- Use legible hand writing. The grader will ignore any illegible parts of your paper.

Examination Rules

- You are required to follow all instructions given by the examiners.
- Talking is not allowed under any circumstances.
- During the exam you are allowed to have on your desk two pens (black or blue) and a drink. You are not allowed to bring any written or printed materials into the examination room. Mobile phones and other electronic devices are strictly prohibited in the examination room.
- Detection of any electronic communication device on you will constitute cheating even if the device is off.
- The proctors of the exam are not authorized to answer any questions.
- Exam participants are not allowed to leave the examination room until ready to turn in their work.

Question 1 [20p]

Gerhard can consume two goods, *x* and *y*. His preferences can be described by the following utility function:

$$min(\alpha x, \beta y)$$

where $\alpha > 0$ and $\beta > 0$. He has disposable income $W > 0$ and faces strictly positive prices for x and y that are P_x and P_y.

a) Derive the budget constraint, set up the utility maximization problem and derive the demand for each good, given prices and wealth. [8p]

b) Represent the allocation of consumption in a graph with budget constraint and indifference curves. Indicate on the graph the consumption bundle that you derived in part (a). [4p]

c) Calculate the income elasticity of demand, the own price elasticity of demand and the cross price elasticity of demand. Explain if x and y are *normal goods*. Explain if x and y are *ordinary goods* and if they are *complements* or *substitutes*. [4p]

d) Assume that the government must raise an amount $T < W$ from taxing Gerhard. It can either (i) impose a tax t_x on good x, so that Gerhard will have to pay $P_x + t_x$ for every unit of x; or (ii) impose a tax t_y on good y, so that Gerhard will have to pay $P_y + t_y$ for every unit of y. Explain how the demands for both goods will be affected in (i) and in (ii). Should the government choose (i) or (ii) to minimize Gerhard's discomfort from paying the tax while collecting T? [4p]

Question 2 [20p]

The Phillips curve relation in an economy is $\pi = \alpha + \beta(y - \bar{y})$, where π_t is the rate of inflation, y_t is the output level and $\bar{y}$ is the full employment level of output. There is also a central bank government in this economy. The central bank's loss function is $L = (\pi - \pi^*)^2 + \lambda(y - y^*)^2$, where π^* and y^* are the target inflation rate and target output respectively and $\lambda > 0$.

a) What should be the sign of parameter β and why? [2p]

b) What inflation rate will the central bank choose? [4p]

c) Assume that $\alpha = \pi^*$ in the Phillips curve. Explain if the actual inflation rate coincides with the inflation target. [3p]

Assume now that the Phillips curve is $\pi_t = \pi_t^e + \beta(y_t - \bar{y}) + \varepsilon_t$, where $\pi_t^e = \mathrm{E}_{t-1}(\pi_t)$ is the expected rate of inflation at time t, and the economy is subject to supply side shocks such that there is a random term $\varepsilon_t \sim iid(0, \sigma^2)$. Furthermore, assume that the central bank can observe the realizations of the supply shock before making a policy decision at time t but the public cannot observe it.

d) If the central bank is *myopic*, i.e. cares only about the current period, what is the rational expectation of expected inflation? [4p]

e) Given your result in (d), what is the actual inflation rate? [4p]

f) How do shocks ε_t affect the central bank's choice of inflation rate? [3p]

Question 3 [20p]

a) An analyst has estimated four cross section ordinary least squares regressions trying to model the link between share prices (P) and last reported earnings per share (EPS) for a sample of emerging markets equities. The summary of estimation results are provided in the table below.

	Model	Number of observations	Coefficients		p-values for tests		R-squared
			α	β	H-0: $\alpha = 0$	H-0: $\beta = 0$	
I	$P_i = \alpha + \beta EPS_i + \varepsilon_i$	821	16.8	6.75	0.00	0.00	0.66
II	$P_i = \alpha + \beta \log(EPS_i) + \varepsilon_i$	745	83.2	38.1	0.00	0.00	0.24
III	$\log(P_i) = \alpha + \beta EPS_i + \varepsilon_i$	821	1.32	0.03	0.00	0.00	0.08
IV	$\log(P_i) = \alpha + \beta \log(EPS_i) + \varepsilon_i$	745	2.72	0.92	0.00	0.00	0.85

i) Noting that the share price and EPS data is in US dollar terms, provide an economic interpretation of the β coefficient estimates for each model. [4p]

ii) Which model(s) would you prefer and why? [3p]

b) What are the covariance stationarity conditions of a stochastic process? [6p]

c) Prove that the unconditional variance $\mathrm{V}(y_t)$ is strictly larger than a conditional variance $\mathrm{V}_{t-1}(y_t)$ for the following covariance stationary process: $y_t = \phi_0 + \phi_1 y_{t-1} + \varepsilon_t$, where $\varepsilon_t \sim iid\ WN(0, \sigma^2)$? [7p]

Question 4 [20p]

A movie producer is financing a new film. The main female character, however, decided to quit for unspecified reasons. Without a replacement, the producer estimates that the movie will return \$80m with a probability of 1/3, and \$20m with a probability of 2/3. The producer has financed the movie out of personal equity so far but also had to take some debt. The outstanding face value of debt is \$60m. For simplicity, assume that the discount rate is 0 and that all agents are risk-neutral.

a) The producer can hire a confirmed actress to replace the initial one for a fee of about \$5m. This would increase the chance of success of the movie from 1/3 to 2/3. Is this a positive NPV project? Will the producer undertake it if he has to finance the \$5m out of his pocket? [5p]

b) Suppose the confirmed actress cannot take part in the movie because of an overloaded schedule. The producer can hire a rising star instead, which would bring the probability of success to 1/2 instead of 1/3. The rising star, however, has heard about the fee initially offered to the confirmed actress, and will not take part in the movie for less than \$5m. Explain if this is a positive NPV project. Will the producer undertake it if he is still financing the fee? [3p]

c) The banks who gave the producer a loan are aware of the situation. They offer to renegotiate the face value of debt. What is the maximal amount of debt that ensures that the producer pays for the female role? [6p]

d) Would it help if instead the producer was financing the \$5m by selling some shares to some outside shareholders? Discuss. [6p]

Question 5 [20p]

Consider two investment advisers who are comparing past performances. One averaged a 18.5% rate of return and the other a 15.5% rate of return. However, the beta of the first investor was 1.5, whereas the beta of the second investor was 1.

a) Can you tell which investor was a better selector of individual stocks (aside from the issue of general movements in the market)? Justify your answer. [2p]
b) If the T-bill rate were 6% and the market return during the period were 14%, which investor would be the superior stock selector? Explain why. [3p]

Consider an exchange-traded call option contract to buy 600 shares with a strike price of $30 and maturity in eleven months.

c) How do the terms of the option contract change when there is a 5% stock dividend? And how do they change when there is an 11% cash dividend? [3p]

Consider an economy in which investors expect the market rate of return to be 12% in the coming year. The T-bill rate is 4%. XYZ' stock has a beta of .5. The market value of its outstanding equity is $100 million.

d) What is your best guess currently as to the expected rate of return on XYZ' stock? Assume that the stock is fairly priced. [3p]
e) If the market return in the coming year actually turns out to be 10%, what is your best guess as to the rate of return that will be earned on XYZ' stock? [3p]

Suppose now that XYZ wins a major lawsuit during the year. The settlement is $5 million. XYZ's stock return during the year turns out to be 10%. What is your best guess as to the settlement the market previously expected XYZ to receive from the lawsuit? (Continue to assume that the market return in the year turned out to be 10%.) The magnitude of the settlement is the only unexpected firm-specific event during the year. [6p]

End of questions - Good luck!