Олимпиада для студентов и выпускников вузов – 2015 г.

Демонстрационный вариант и методические рекомендации по направлению «Финансовая экономика»

Профиль:
«Финансовая экономика»

ДЕМОНСТРАЦИОННЫЙ ВАРИАНТ

Время выполнения задания – 180 мин.

Examination Guidelines

- The exam consists of 5 questions. Answer all questions. Time 180 minutes.
- The exam is graded on a 100-point scale. The marks awarded for each problem are shown in brackets.
- Write your answers to 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 the sheets.
- Answer all questions in English. Any Russian text will be ignored by the graders.
- You may use the last page of your sheet as scrap paper.
- Crossed out writing will not be considered by the grader.
- You are kindly requested to 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.
- 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.

I have read and understood the examination rules. I will not cheat, copy or use unauthorized materials or devices.

Signed: _____

Национальный исследовательский университет «Высшая школа экономики»

Question 1 [20 pts]

You observe three exercise (strike) prices of stock options on the same underlying stock. Exercise price X_1 is less than X_2, and X_2 is less than X_3 by equal amounts, and all options have the same expiration date.

a) You are asked to execute a butterfly spread option strategy. This strategy involves the purchase of one call option at exercise price X_1, the sale of two calls at exercise price X_2 and the purchase of one call at exercise price X_3. Create a table with the payoffs of this strategy at the options expiration date as a function of the underlying stock price at that time. Graph the payoff diagram of this strategy.
b) You are asked to execute a vertical combination option strategy. This strategy involves a purchase of a call option with exercise price X_2 and of a put with exercise price X_1. Create a table with the payoffs of this strategy at the options expiration date as a function of the underlying stock price at that time. Graph the payoff diagram of this strategy.

Question 2 [20pts]

Consider an economy with two goods/industries, guns (G) and roses (R), and three factors of production, labor, land, and capital. While labor (L) is perfectly mobile between the two industries, capital (K) is used only for guns, while land (T) is used only for production of roses. The two production functions are $q_G = K^{0.5}L_G^{0.5}$ and $q_R = T^{0.5}L_R^{0.5}$, where L_G (L_R) is labor employed in the production of guns (roses). The size of the labor force is $L_G + L_R = L = 40$; other factor endowments are $K = 8$ and $T = 8$. The economy is open to the world; the world prices are $p_G = 1$ and $p_R = 2$.

a) Calculate the equilibrium in the production market: the quantity of production of each good, the distribution of the labor force, and returns per unit of each factor of production.
b) Suppose that preferences are Leontief: $u_i = min(q_{iG}, q_{iR})$, where i is consumer i. In other words, one gun is valuable only if bundled with one rose, and vice versa. Find the total consumption of each good (guns and roses). Show that guns will be imported. What is the quantity of imports? What is the aggregate welfare (sum of utility functions) of all workers, W_L? All land owners, W_T? All capital owners, W_K?
c) Suppose the guns-and-rose economy described above is governed by a bureaucrat who can impose an import tariff t on guns, such that the price of guns becomes $1 + t$. All import tariff revenue is redistributed to workers, land and capital owners, proportionately to their income. Repeat the steps you've done in (a) and (b) to find the new production quantities, distribution of labor force, and aggregate welfare $W_L(t)$, $W_K(t)$, $W_T(t)$ of each income group as a function of the import tariff.
d) What is the amount of prohibitive tariff t_{max}, i.e. the one that results in zero import volume?
e) Show that for t between 0 and t_{max}, only capital owners benefit from a tariff. Which tariff maximizes total welfare, $W_L(t) + W_K(t) + W_T(t)$?

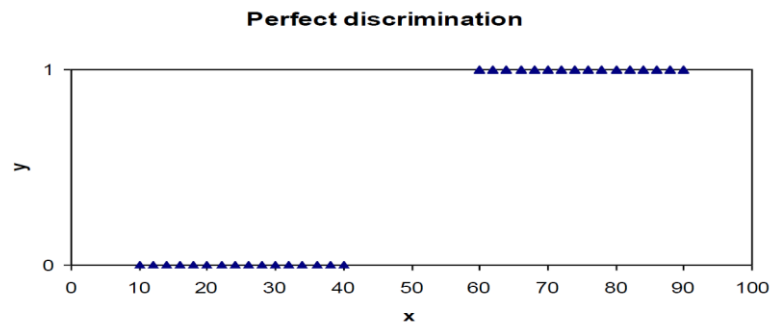
Question 3 [20pts]

Consider a discrete-choice model (such as a logit or a probit) to be estimated by maximum likelihood.

a) $L(M_\alpha)$ is the likelihood of the model estimated with an intercept only, without any explanatory variables; $L(M_\beta)$ is the likelihood of the model estimated with both the intercept and the explanatory variables. How does $R^2_{McF} = 1 - \ln(L(M_\beta)/L(M_\alpha))$ change if one adds extra explanatory variables to the model?

b) If you add new observations to your sample, how will log likelihood of your logit/probit model change? Explain why.

c) Consider the case, called a *perfect discrimination*, with a binary response variable y and a single explanatory variable x, when there is no overlap in the sets of explanatory variable values having $y = 0$ and having $y = 1$; that is, when x is smaller than 40, y is always 0, but when x is greater than 60, y is always 1 (see figure below).



You estimate logit model. $Pr(y = 1|x) = exp(\alpha + \beta x)/[1 + exp(\alpha + \beta x)]$. Do you see any problems with estimation? What estimates of α and β should you anticipate from your software?

Question 4 [20pts]

To stay competitive on the labor market a fast growing IT company Brainiacs Corp. decides to offer workers a subsidy for lunches in the local canteen. Workers utility function is $U(x, y) = \log x + \frac{y^2}{2}$, where x is the quantity of lunches per month and y is a composite good that represents consumption of all other goods, including lunches at restaurants situated nearby. Assuming that $p_x = 1$, $p_y = 2$ and monthly income of a worker is $M = 5$ answer the following questions:

a) Find the quantity of lunches that workers have at the canteen before the change and after if subsidy $s = 0.9$?

b) The recent decline in economic activity put the company on the edge of bankruptcy. In desperate attempt to cut the losses a new CEO proposes to cancel lunch subsidy. The company's employees were very unhappy about this idea and threatened the company with strikes. After a brainstorm the CEO proposes to increase workers wage by introducing income supplement S as the only way to reduce company's costs. Does it make sense? Explain.

c) Find the optimal income supplement S^* that minimizes company's costs.

Question 5 [20pts]

Consider an economy that lasts for 2 periods, $t = 0, 1$. There is a representative household who is endowed with a single good at $t = 0$, $e^h(0)$. Of this, the household must decide how much to consume today ($t = 0$) and how much to save for tomorrow ($t = 1$). Let consumption in each period be denoted by $c(t)$ and savings by $s(0)$. For every unit of the good saved today, there will be a unit of the good available tomorrow. In the second, and terminal, period the household consumes any available resources. Assume markets are competitive and prices are flexible. Finally, assume that the household has the following preferences over consumption today and tomorrow:

$$U\big(c(0), c(1)\big) = \log\big(c(0)\big) + \beta \log(c(1))$$

where $\beta = 1$.

a) How much will the household consume today and tomorrow?

b) Suppose that there exists a government that is concerned about the level of saving in the economy and imposes a lump sum tax of $T(0)$ at $t = 0$ and returns this amount back to the household as a lump sum transfer at $t = 1$. That is, $T(1) + T(0) = 0$. How does this affect the level of savings in the economy? Why?

c) Now assume that, rather than lump sum tax as in (b), the government levies a tax of $\tau(0)$ per unit of consumption. In other words, if the household wishes to consume $c(0)$, they must set aside $c(0) + \tau(0)c(0)$. The government collects revenue of $T(0) = \tau(0)c(0)$ and saves it till $t = 1$ and returns this amount back to the household as a lump sum transfer $T(1) = \tau(0)c(0)$. How does this policy affect the total level of savings in the economy? Why?

End of questions - Good luck!