CERGE-EI
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ECONOMETRICS II

Exercise session #7
(Ordered Probit and Logit)

Problem 1. Write down the log-likelihood function of ordered probit/logit models.

Problem 2. In an ordered probit model with four outcomes, you obtain the following results:

$$\hat{y}_i^* = 10 + 60x_1 - 70x_2$$

where $\sigma = 100$, with thresholds $\mu_0 = -\infty$, $\mu_1 = 0$, $\mu_2 = 100$, $\mu_3 = 200$, $\mu_4 = +\infty$.

(a) Evaluate $\frac{\partial \mathbb{P}(100<y_i^*\leq 200)}{\partial x_1}$ at $x_1 = x_2 = 1$ and at $x_1 = 2$ and $x_2 = 1$. What is the effect of corresponding unit increase in x_1 (treating x_1 as discrete) on $\mathbb{P}(100 < y_i^* \leq 200)$?

(b) Evaluate $\frac{\partial \mathbb{P}(y_i^*<0)}{\partial x_2}$ at $x_1 = x_2 = 1$ and at $x_1 = 1$ and $x_2 = 2$. What is the effect of corresponding unit increase in x_2 (treating x_2 as discrete) on $\mathbb{P}((y_i^* > 100)$?

Problem 3. You are interested in the effect of monthly income on monthly food expenditure in the following model:

$$\ln(foodexp_i) = \alpha + \beta \ln(income_i) + \epsilon_i$$

where ϵ_i is distributed $N(0, \sigma^2)$.
However, instead of observing the actual value of food expenditure, you only observe whether the given individual's food expenditure falls into one of the following brackets: $\langle 0, 5000]$, $\langle 5000, 15000]$, and more than 15000.

(a) Given the distributional assumption, how would you estimate the model? Write down the likelihood function and determine which parameters can be estimated.

(b) What is the effect of a 1% increase in income on the probability of having food expenditure above 15000 CZK?

Problem 4. You are asked to estimate the effect of preventive health expenditure on the number of days an individual is ill in a given year. However, instead of observing the actual number of days of illness, you only observe whether the number of days falls into one of the following categories: $[0, 7]$ days, $\langle 7, 14]$ days, and more than 14 days.
Assume that there are no or only few individuals who are not ill at all in a given year.

(a) Propose a model of the number of days of illness per year as a function of preventive health expenditure. State any assumptions you make and write down the log-likelihood function. Which parameters of the models are identified?

(b) Derive the effect of preventive health expenditure on the probability of being ill for more than two weeks. How would you summarize this effect for the whole sample?