Econometrics 3 PPD: Multiple Discrete Outcomes

Problem Set 2

Exercises labeled with (*) are optional

1 Holidays with classmates

Some classmates are willing to go on holidays together in South of France. They have three different options in terms of housing: (1) sleeping in tents for free in the garden of the grandmother of one of them; (2) going in a youth hostel for 18 euros per person a night; (3) renting a big private house for 50 euros per person a night.

Along with the prices of each option, you have another explanatory variable in your data set which tells you the need for privacy of each student.

1. What are some unobserved determinants of the choice of alternative ?
2. Assuming IIA, write down a statistical model (conditional choice probabilities) of the student's choice allowing for alternative specific intercepts.
3. Is the IIA assumption plausible? Explain.
4. Now consider an ordered probit model, ordering the three choices as 1=tents, 2=youth hostel, 3=house. Suppose students make their choice a few days before the trip, so they approximately know what the weather will be. And, it might be rainy, which makes sleeping in a tent harder. What is the issue with introducing the expected weather in such a model. Can you think of an alternative model that may be more appropriate?

2 Going to the gym

Your friend *randomly* goes to the gym twice a week. When she does, she likes trying out as many weight machines as she can. When the gym is too crowded, she sometimes cannot try any machine. On days where she is almost alone at the gym, she can try more machines. Which distribution would you pick to model the number of weight machines she trains on as a function of attendance and her physical shape on a given day? Write down a statistical model, i.e., the (conditional) log-likelihood, for the number of weight machines she uses on a sample of n random days (suppose for simplicity that all weight machines she tries out are different). [Hint: Remember that if your friend does not go to the gym, she will not train on any machine.]

3 Nested logit

Read the introduction and section IIA of the following article: Berry, Steven, and Panle Jia. "Tracing the woes: An empirical analysis of the airline industry." American Economic Journal: Microeconomics 2.3 (2010): 1-43. Answer the questions that follow.

1. Let's first assume that $\lambda = 1$. What non-parametric assumptions do we require on ϵ_{ijt} to generate the purchase probabilities of the type described in equation (3)? Explain the assumptions in the specific context of this paper. Do you think that these assumptions are plausible ? Can they be tested ?

2. Let's now assume that $\lambda = 0$. What non-parametric assumptions do you now need to estimate purchase probabilities ?

   For the remaining questions, let's simplify notation by assuming that there is only one type of consumers (so that the subscript r can be dropped) and only one origin-destination market (so that the subscript t can also be dropped). Let's also abstract away from ξ_{jt} which denoted unobserved characteristics of flight j.

3. The objective of this question is to derive the log likelihood function of the aforementioned simplified model. The sub-questions are meant to walk you through the steps of doing so.

   - What is the probability of choosing the outside option?
   - What is the unconditional probability of choosing airline product j?
   - Using the previous two probabilities, come up with an expression for an individual i's probability to choose option j, conditional on x_i and p_i. Remember that this option j can either be some airline product or the outside option.
   - Write down the log-likelihood function.
   - How does this compare to the log-likelihood function of a simple logit where $\lambda = 1$?

4. What parameters are the marginal effects functions of ? How is this different from the marginal effects in the simple logit model ?

5. Do you think that modeling this problem as a nested logit has advantages over the simple multinomial model ?