EPFL
ENAC TRANSP-OR
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Mathematical Modeling of Behavior
Fall 2020

LAB SESSION 6

The topic of this session is *Segmentation and tests*. You will estimate different model specifications for the *Airline Itinerary Choice* (Boeing) case study and you will go through some provided files to see how to test different specifications. The purposes of this lab are the following:

- test models whose hypotheses are non-nested, and
- improve the *Multinomial Logit* model by applying a socioeconomic segmentation.

First, download the files from the folder *Case study* on Moodle. It contains:

1. the description and interpretation of the different models (`06Lab2020_solution.pdf`),
2. a zip file (`06CaseStudy2020.zip`) containing:
   (a) a folder with the non nested specifications (`NonNested`); and
   (b) a folder for the market segmentation test (`MarketSegmentation`).

Non nested specifications
For this part of the lab, we provide all the required `.ipynb` Jupyter notebooks and `.py` Python files. We ask you to perform the following tasks:

1. Estimate the model specifications contained in the following files:
   (a) `MNL_airline_specific` (`Fare` is considered linear);
   (b) `MNL_airline_log` (`Fare` is considered logarithmic).
2. Results for the linear fare are already presented in the description document of the lab. For the logarithmic fare, you should obtain the file `MNL_airline_log.html`.
3. Perform a Cox test between the model where the fare is considered linear and the one where it is considered logarithmic. To do so, run the model included in `MNL_airline_composite`. You should obtain the file `MNL_airline_composite.html`. What is the outcome of the Cox test?

Market Segmentation
For this part of the lab, we provide the `MNL_airline_specific` base model and ask you to perform the following tasks.

1. Estimate the model specification contained in the file `MNL_airline_specific`. You should obtain the file `MNL_airline_specific.html`.
2. To test if there is a taste variation across segments, more precisely across gender, create and estimate the following models:

(a) `MNL_airline_male` (only for male);

(b) `MNL_airline_female` (only for female);

(c) `MNL_airline_GenderNA` (only for no answer for the gender variable).

3. You should obtain the following files:

   (a) `MNL_airline_male.html` ;

   (b) `MNL_airline_female.html`;

   (c) `MNL_airline_GenderNA.html`.

4. Perform a likelihood ratio test between the base model (`MNL_airline_specific`) and the *segmented* models (`MNL_airline_male`, `MNL_airline_female` and `MNL_airline_GenderNA`). What is the outcome of the test?

Create and analyze
You can develop other model specifications using your own hypotheses. We suggest you to take `MNL_airline_specific` as the base model and do the following:

1. Try a socioeconomic segmentation of the alternative specific constant, which is equivalent to adding socioeconomic parameters directly to the utilities. Is this segmentation significant?

2. Try a socioeconomic segmentation of attributes of the alternatives one-by-one. Remember the difference between discrete and continuous segmentation. Is this segmentation significant?

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