EPFL
ENAC TRANSP-OR
Prof. M. Bierlaire

Mathematical Modeling of Behavior
Fall 2020

LAB SESSION 12

This session focuses on *mixture models*. In the context of discrete choice models, mixture models can be used to capture correlation among alternatives, alternative specific variances, taste heterogeneity, etc. In the following, you will see different specifications addressing them.

First, download the files from the folder *Case study Lab 12*. It contains:

1. the model specification files (as both script files `.py` and Jupyter notebooks `.ipynb`):

   - `Base_Model`,
   - `Mixture_Heteroskedastic`,
   - `Random_Coefficients`, and
   - `Mixed_GEV`;

2. the description file `12Lab2020_solution.pdf` containing the description and interpretation of the different mixture models.

Those models are tested with the data from the *Swissmetro* case study `swissmetro.dat`. To obtain the dataset, jump to the link under **Datasets** in Moodle. You can also find the dataset description and go through it to get insights into the choice problem.

Base model   The corresponding files are provided as a benchmark for comparison.

Heteroskedastic model   In this specification, we assume that the ASCs (ASC_{car} and ASC_{SM}) are randomly distributed with mean $\bar{\alpha}_{car}$ and $\bar{\alpha}_{SM}$ and standard deviation σ_{car} and σ_{SM}, respectively.

Error component model   Now, copy the `Base_Model` file and use it as a template to perform the following tasks. Get inspiration from the heteroskedastic model to define the random terms.

1. Estimate an error component model in which the train and SM modes share the random term ζ_{rail}, which is assumed to be normally distributed. Fix the mean m_{rail} to zero and estimate the standard deviation σ_{rail}. You can call this file `Error_Component_01`.

2. Estimate an error component model in which car and train share the random term $\zeta_{existing}$, and train and SM share the random term ζ_{rail}. Both are assumed to be normally distributed. As before, the standard deviations $\sigma_{existing}$ and σ_{rail} need to be estimated, while the means $m_{existing}$ and m_{rail} are fixed to zero. You can call this file `Error_Component_02`.

Random coefficients model For this specification the base model is modified by defining alternative-specific coefficients for the cost of all alternatives. The model in which the parameters β_{car_cost}, β_{train_cost}, β_{SM_cost} and β_{he} are assumed to be randomly distributed over the population is provided in the `Random_Coefficients` file.

Mixed GEV model In this example we capture the substitution patterns by means of a nested logit model. We consider the model delevoped in `Random_Coefficients` in order to define a nested logit model. The resulting model is included in the `Mixed_GEV` file.

---

th / rk / no / jp / mw / mpp