Industrial Organization Field Course
Assignment Demand Estimation for Heterogeneous Demand Models
November 2023

Part 0: Getting started

In this assignment, you will learn how to simulate market data and estimate simple random coefficient demand models. The assignment should serve as an introduction to the structural estimation of demand for hetergenous products.

(a) Model description and slide references

Let's first define the model.

todo: Here you need to insert all the model definiton and reference to the slides

$$u_{ijt} = \beta_{it}^{'} x_j + \alpha_{it} p_{jt} + \xi_{jt} + \varepsilon_{ijt}$$

Where:

$$\alpha_{it} = \mu_\alpha + \sigma_\alpha \nu_{it}^{\alpha}$$
$$\beta_{it} = \mu_\beta + \sigma_\beta \nu_{it}^{\beta}$$

And ν_{it}^{α} and ν_{it}^{β} are standard normally distributed.

TO DO: Define all the other parameters and how they are constructed in the simulation for the students

(b) Opening the assignment file

Maybe it is better to use google colab

You are free to use any IDE (integrated development environment) for accessing the notebook. If you are not familiar with using python notebooks please follow the steps

1. Download and install Anaconda+Python. Follow the steps in this tutorial.

2. Download the code from the git repository and put everything in the same folder. Recall where you saved the folder.

3. Open Anaconda and Jupyter Notebooks like the tutorial in step 1 showed you. Follow the bath to where you saved the folder you just downloaded from git and open the assignment notebook.

4. You will need to install the following packages in order to be able to fully run the assignment. Anaconda already comes with all but PyBLP preinstalled. If you have not been doing this through Anaconda, but rather through a different program you will need to make sure that your system has all these requirements:

   - numpy
   - pandas
   - statsmodels
   - scipy
   - matplotlib
   - pyblp

   All but the pyblp package come preinstalled in Anaconda it you followed step A. You will need to manually install PyBLP using the following steps: tutorial

(c) Scope

To be discussed: decision to make: - how much programming should they do?

- should they simulate data themselves? or just import my module?

- should they write the GMM estimator themselves or just apply pyBLP more times until convergence?

- maybe it is enough for them to write the strucural function parameters?

Part 1: Data Exploration

1. Look into the data characterizing you market. Print the dataframe object. Describe what you see. Is it all realistic? Which values are you likely to not have as an econometrician working on real datasets?

2. Exercise 2: Create a histogram with:

   - The distribution of prices
   - The distribution of market shares

Part 2: Simple Logit Model

Estimate the simple logit model disregarding consumer heterogeneity:

$$\ln(s_j) - \ln(s_0) = \beta' x_j + \alpha p_{jt}$$

Check if this estimation leads to the correct coefficients and discuss what we can do to improve it

Part 3: Estimation with the PyBLP package (without supply side problem)

Here need to discuss if they estimate it themselves with GMM and Monte Carlo or if they should learn to use the package by Colon

Part 4 - Here either writing linear estimation themselves or put in the supply side cost structure and disable optimal instruments

Alternative to these questions:

Part 3 + Part 4: Guided RC estimation

Advantages: Students will not have to read the documentation of the PyBLP package (takes a long time to get it going)