Problem Set #2
Demand Estimation with BLP Method

2016 S1 Term - Empirical Industrial Organization

Due: On Tuesday, May 31

- You are encouraged to work with your classmates and submit one answer sheet together!

- When you are required to describe an estimation algorithm, you are supposed to give enough details so that your classmates who know how to use MATLAB but do not take this class could use your description to replicate the estimation program. Please attach your programming code to your answer sheet.

Estimation

DataPS2.csv includes three columns: (1) Market ID, (2) Product ID, and (3) the market share for each product. The population for each market is 2,000,000 and there are 100 markets in the data. Moreover, there are 11 choices at maximum, including an outside option, and these 10 products' characteristics are given by

$$X = \begin{bmatrix} 0.01 & 0.02 & 0.03 & 0.04 & 0.05 & 0.06 & 0.07 & 0.08 & 0.09 & 0.10 \\ 0.10 & 0.06 & 0.12 & 0.07 & 0.02 & 0.01 & 0.09 & 0.02 & 0.01 & 0.03 \end{bmatrix}.$$

The data is generated by the following indirect utility function:

$$u_{ijm} = (\beta_0^m + \beta_0^u \nu_{i0}) + x_{1j} \cdot (\beta_1^m + \beta_1^u \nu_{i1}) + x_{2j} \cdot (\beta_2^m + \beta_2^u \nu_{i2}) + xi_j + \varepsilon_{ijt}, \qquad (1)$$

where $\nu_{ik} \sim N(0,1), \forall k$ and each ε_{ijt} follows Type I extreme value distribution. The ultimate goal of this problem set is to estimate the model above, i.e., estimate a set of parameters, $(\beta_0^m, \beta_1^m, \beta_2^m, \beta_0^u, \beta_1^u, \beta_2^u)$.

(a) Estimate a plain logit model assuming that $\beta_0^u = 0, \beta_1^u = 0$, and $\beta_2^u = 0$ (no random coefficients). No need to use instruments.

(b) Using the estimation results from (a), calculate own- and cross-price elasticities and show it in the form of a 10-by-10 matrix. (Please mimic Table VI in Berry, Levinsohn and Pakes (1995)).

(c) Now estimate the random coefficients model above. You can assume that there is no endogeneity issue between product characteristics and the unobserved product characteristics, xi. Thus, you can estimate the model using $E[\xi] = 0$ (no instruments are required).

  - First, you need to obtain δ^* using a contraction mapping.

  - Once you obtain δ^*, you need to obtain xi^* as a OLS residual.

  - Finally, your objective function will be $\xi^{*'} W \xi^*$ where is a weighting matrix. In this problem set, you can use an identity matrix as a weighting matrix.

  - You can limit your search in the non-linear parameters.

(d) Using the estimation results from (c), calculate own- and cross-price elasticities and show it in the form of a 10-by-10 matrix. (Please mimic Table VI in Berry, Levinsohn and Pakes (1995)).

(e) Calculate the differences between substitution between the 11 products and outside option from the logit and the random coefficients models (please mimic Tables VI and VII). Discuss the differences between these two models.