Structural Estimation in Applied Microeconomics
Problem Set on Demand Estimation
[Due at hh:mm on xx/xx/yyyy]

This problem set is designed to give you practical knowledge of the economic models and econometric methods discussed in our lectures on demand estimation. You will have the option to do a referee report or answer to the questions in Section 2.

1 Referee Report

Select one of the papers from the syllabus section on demand estimation, excluding the ones explained in class. Write a referee report of at most 1,500 words.

2 Demand Estimation

Download from the course website the file "Data.csv". There are 11 variables in the dataset in the following order: market identifier, product identifier, product market share, product attributes (3 variables), price, cost shifters (3 variables), and a group variable. Note that this is an unbalanced panel, so different markets have different numbers of products, and that products have different characteristics in different markets. Do the whole problem set in Matlab.

2.1 Logit Demand

- Estimate an aggregate Logit model using OLS based on the following utility function that individual i derives from buying product j in market n:

$$u_{ijn} = \alpha p_{jn} + x_{jn}\beta + \xi_{jn} + \varepsilon_{ijn}$$

  Make sure that you generate the appropriate dependent variable for the estimation, and that you include a constant term. Let the utility from choosing the outside good be normalized to $u_{i0n} = \varepsilon_{i0n}$.

- Estimate the same Logit model using Instrumental Variables (IV). Use the cost shifters as instruments, providing the results also for the 1^{st} stage. How do your results change compared to the OLS case? Provide an intuition for the endogeneity bias. Calculate the mean across markets of own and cross price elasticities.

- Estimate the same Logit model using both IV and the supply side. Assume firms compete Bertrand-Nash on prices and have the following profit function for product j in market n:

$$\Pi_{jn} = (p_{jn} - mc_{jn})s_{jn}$$

where s_{jn} is the market share and p_{jn} is the price. Calculate the first oder condition with respect to prices and use it to construct the supply side moment, where you estimate both the parameters of the marginal costs (use the cost shifters and a constant) and the α in the markup term, using prices and market shares from the data. This gives the following supply side equation:

$$p_{jn} = c_{jn}\gamma - \frac{1}{\alpha(1 - s_{jn})} + \omega_{jn}$$

where c_{jn} are cost shifters (make sure you include a constant term) and ω_{jn} are the residuals. You will need to construct a GMM objective function with both demand and supply moments, with the price coefficient α entering in both moments (cross-equation restriction). How do your results change compared to the case with just IV?

- Simulate a merger between the two products with the highest market share in each market. Based on your estimates of the demand and supply in the previous point, you will now need to construct a profit function and maximize it with respect to prices in the new counterfactual scenario. Allow merged firms to still charge separate prices, but also to internalize each others' profits. What is the effect of the merger on prices and market shares?

2.2 Nested Logit Demand

- Estimate a Nested Logit model using IV based on the following utility function that individual i derives from buying product j in group g in market n:

$$u_{ijn} = \alpha p_{jn} + x_{jn}\beta + \xi_{jn} + \zeta_{ign} + (1 - \sigma)\varepsilon_{ijn}$$

Use as nests the group variable provided in the data. Use the same instruments as before. How do your results change compared to the Logit case? What do you conclude about the correlation in tastes across products within groups? Calculate the mean across markets of own and cross price elasticities.

2.3 Random Coefficients Logit Demand

- Estimate a Random Coefficient Logit model based on the following utility function that individual i derives from buying product j in market n:

$$\begin{aligned} u_{ijn} &= \alpha_{in} p_{jn} + x_{jn}\beta_{in} + \xi_{jn} + \varepsilon_{ijn} \\ &= \underbrace{\alpha p_{jn} + x_{jn}\beta + \xi_{jn}}_{\delta_{jn}} + \underbrace{\sigma_0 \nu_{0in} p_{jn} + \sum_{k=1}^{3} \sigma_k \nu_{kin} x_{kjn} + \varepsilon_{ijn}}_{\mu_{ijn}} \end{aligned}$$

allow for random coefficients on all variables except the constant, and use the same instruments as above plus the square of all product characteristics and the square of all cost shifters. The estimation routine should be based on a nested fixed point algorithm with an outer loop and an inner loop. The outer loop consists of the maximization of the GMM objective function with respect to the four σ coefficients. The inner loop consists of a contraction mapping, for each fixed set of σ parameters, to find the δ_{jn} such that model market shares equate the market shares in the data. How do your results vary compared to the previous models? What do you conclude about heterogeneity in preferences? Calculate the mean across markets of own and cross price elasticities.