Problem Set 4 -Estimation of Demand Models-

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Remarks

1. Use A4 report papers, staple them in the upper left corner.

2. Type your answer.

3. You are allowed (and encouraged) to form a study group up to 3, and hand in one solution per group. If you do this, please put names and student IDs of all members.

4. Attach the print of your programming code for empirical exercise as an appendix.

5. When asked to report results present the answer in a table. Nothing fancy but don't simply attach a printout of the statistical program you used. You should attach the code you used to generate the results as an appendix.

Question 1

Consider a discrete-choice demand model. There exist J products in the market. The utility of consumer i in market t from consuming alternative j is defined as

$$u_{ijt} = \beta_0 + \beta_1 x_{jt} + (\alpha + \pi y_{it})p_{jt} + \epsilon_{ijt}$$

where x_{jt} is a scalar characteristic of product j in market t, p_{jt} is the price, ϵ_{ijt} follows the i.i.d type I extreme value distribution, and y_{it} is the income of consumer i in market t. Note that the utility of outside option is normalized at $u_{i0t} = \epsilon_{i0t}$. Denote the parameter by $\theta \equiv (\beta_0, \beta_1, \alpha, \pi)$.

(a) Write down the choice probability of product j for consumer i in market t: $P(d_{it} = j | \{x_{jt}, p_{jt}\}_{j=1}^{J}, y_{it})$.

(b) Suppose that you have the dataset at individual consumer-level. More specifically, you observe (1) consumer choice and income $\{d_{it}, y_{it}\}$ for $i = 1, \cdots, N_t$ and $t = 1, \cdots, T$, where N_t is the number of consumers in market t in your dataset, and (2) product price and characteristic $\{x_{jt}, p_{jt}\}$ for $j = 1, \cdots, J$ and $t = 1, \cdots, T$. You want to use this dataset to estimate the

model parameters θ, but you do not have enough time to do this. Thus, you hire an RA and ask her to implement the estimation. Your RA understands mathematical notations and is capable of programming mathematical operations using scientific languages. However, your RA did not take the 1st-year coursework (micro, macro, and econometrics) yet, implying that your RA did not know what the maximum likelihood or the GMM mean without any explanation. Write down the memo for your RA to implement this estimation task. (Note: you do not have to worry about obtaining standard errors).

Note: You do not have to worry about price endogeneity in this question.

Question 2

On the course web site you will find a data set WSDR.csv (csv format) and WSDR.dta (stata format). The data come from the Dominick's data base (`http://research.chicagogsb.edu/marketing/databases/dominicks/`), but were slightly cleaned to make them more manageable. The data and variables are described in the readme.txt file

(a) Provide descriptive statistics of the data.

(b) Estimate the following (Logit) model:

$$u_{ijt} = \alpha p_{jt} + \beta X_j + \xi_{jt} + \epsilon_{ijt}, \ \ for \ i = 1, \cdots, I, j = 1, \cdots, J, t = 1, \cdots, T$$

where ϵ_{ijt} is distributed i.i.d. extreme value. The notation follows that used in class. For characteristics X_j use UPC dummy variables. Define market shares as the quantity divided by the number of shoppers that shopped at each store for each week (the *custcoun* variable). Estimate the model using OLS and IV. For an IV use the wholesale price. Explain why this might be a valid IV. To compute the wholesale price use the profit variable in the data. Note that the profit variable is measured as the percentage point. For each specification report the estimated coefficients and their standard errors.

(c) Using the results for the IV specification to compute the own- and cross-price elasticities. Compute these for each of the markets (store-week) and report the median across markets. To save space you can report these for a subset of the products. Are there any particular patterns in the elasticities?

(b) Using the results for the IV specification and the price elasticities, compute the markups predicted by a (i) single-product Nash-Bertrand equilibrium; (ii) a multi-product Nash-Bertrand equilibrium; and (iii) joint pricing of all the brands. For each model report the median of the distribution of the markups and margins. Are there any particular patterns in these numbers?

(e) Using the estimated markups compute the implied marginal costs. Report the median of the implied marginal costs.