

Assignment 1: Demand Estimation

Due date: Class 5 (Feb 15)

February 3, 2005

For this problem set you should feel free to work in groups but write up your own answers. Please note on your problem set who else you worked with. Also include any code that you used.

For this problem set we will be using data on surfboard sales. The data set was constructed for this exercise and does not reflect reality. It can be downloaded from

<http://pages.stern.nyu.edu/~jasker/PHDteaching.html>.

The data is from 100 markets. In the first 50 markets 3 firms compete with 2 products each. In the last 50 markets only 2 firms are present. In each market the three firms are different from those firms in other markets. A surfboard has four characteristics: length; width; weight and edge curvature. You should also have a constant in the utility function. In the data file the columns are: [Market Indicator, Firm Indicator, Product Indicator, Price, Share, Length, Width, Weight, Edge Curve, Market Size]. The data is saved in ascii format. This is easily loaded into most stats programs. I recommend you use Matlab for this exercise. If you are unfamiliar with matlab a helpful intro can be found at http://www.courses.fas.harvard.edu/~ec2610/Problem_Sets/Notes_on_Matlab.pdf and the online help at <http://www.mathworks.com/access/helpdesk/help/techdoc/matlab.html> is very useful. Of course if you are familiar with Guass, Fortran, etc use them...

1. Consider a model similar to Bresnahan's vertical model of the Auto industry. Each consumer i has utility for product j as a function of price and quality, δ_j , given by

$$u_{ijk} = \delta_{jk} - \alpha_i p_j$$

The distribution of consumer tastes for quality, α_i , is distributed uniformly on the interval $[0, \lambda]$. Assume that $\delta_{jk} = x_j \beta + \xi_{jk}$ and that the marginal cost for supplying each market k is given by $mc_{jk} = x_j \gamma + \eta q_{jk} + \omega_{jk}$. Assume that ξ and ω are uncorrelated with all the characteristics of all the products (except price and quantity of course, for which you will need to instrument appropriately where necessary).

- (a) Is the vertical model a reasonable model for this industry, in your opinion?

- (b) Propose an estimation strategy to estimate all the parameters of the model, including λ , from just demand data. Provide all the necessary details.
- (c) Clearly map out how this model is identified in the data.
- (d) For simplicity assume $\lambda = 1$. Use both the demand system and the pricing equation to estimate the identified parameters of the model under the four following assumptions: i. marginal cost pricing, ii. single product firms setting prices in nash equilibrium, iii. multiproduct firms setting prices in nash equilibrium, iv. perfect collusion. Present the results of your work, discuss them briefly and be sure to articulate any modelling assumptions or decisions you have made along the way.
- (e) You are now asked by the FTC to select amount the different pricing assumptions. Explain what sort of results might help you to decide what model best fits the data. Suggest other possible ways to test among the pricing models. Don't run formal tests, just give a few ideas.
2. Now suppose that the model is a logit model of analogous form. The only difference here is that the error is iid extreme value, as in the lecture notes, and $\alpha_i = \alpha \quad \forall i$. That is,

$$\begin{aligned} U_{ij} &= \widehat{\delta}_j + \varepsilon_{ij} \\ \widehat{\delta}_j &= x\beta_j - \alpha p_j + \xi_j \end{aligned}$$

Estimate the parameters this time, using (i) just the demand system, (ii) Nash pricing with multiproduct firms. What is in the unobserved component ξ ?

- (a) Now assume that the model is a logit model but each individual has a different price coefficient. That is,

$$\begin{aligned} U_{ij} &= \widehat{\delta}_j - \alpha_i p_j + \varepsilon_{ij} \\ \widehat{\delta}_j &= x\beta_j + \xi_j \end{aligned}$$

where $\alpha_i = \frac{500}{y_i}$ and y_i is distributed lognormally. Can you explain how the estimation of coefficients works in this setting (don't actually do it).

- (b) Among the parameters you would have estimated in the last question are the mean and variance of the lognormal distribution. Now assume that you knew that the mean of income was \$38200 and that the standard deviation was \$47600 (in every market). Using only the demand system estimate the β parameters under this assumption. How would estimation have changed if $\alpha_i = \frac{\alpha}{y_i}$ (don't estimate, just explain how to do it)

3. It turns out that the data was generated using the model you estimated in the previous question with multiproduct firms setting prices without taking into account cross-price elasticities in their market. Knowing this, reconcile the differences in the results from the various estimators used in this exercise. Be clear about how identification differs across the estimators.
4. What do you think the outside good would likely be in this example?