Economics 2610: Industrial Organization I

Harvard University, Fall Semester 2002
Instructor: Professor Gautam Gowrisankaran

Assignment 1
Handed out: October 8, 2002
Due: October 31, 2002

You are encouraged to work on the programming in small groups of two or three. However, you must write up the assignments individually.

I have placed a data set on the web, that contains a cross-section of the automobile industry for 1990. The information includes automobile prices, quantities and characteristics. Assume throughout that market size M=100,000,000, roughly the number of households in the United States. Consider a vertical model of the automobile industry, such as that of Bresnahan. Specifically, let consumer utility satisfy:

$$u_{ij} = \alpha_i \delta_j - p_j ,$$

where consumer tastes α_i are distributed uniform $U(0,\lambda)$ with parameter λ, and where $\delta_j = x_j\beta + \xi_j$. For simplicity, let $\lambda = 10$ instead of estimating λ. Let marginal costs satisfy:

$$mc_j = x_j\gamma + \eta q_j + \omega_j .$$

1) Order the products in increasing quality from 1,…, J. Show by example that there exists an increasing price vector for which some cars receive no sales. Now sketch an argument that we can always find a price vector where every car receives some sales, provided that no two cars have exactly the same quality.

To simplify questions 2 and 3, use the abbreviated data set "assignment1_data_q23.txt."

2) Let us consider Bresnahan's model. Specifically, assume that $\omega_j = \xi_j = \eta = 0$, $\gamma = \beta$, and that there is iid measurement error, so that $p_j^{observed} = p_j + \varepsilon_j^P$ and $q_j^{observed} = q_j + \varepsilon_j^Q$ with $\varepsilon_j^P \sim N(0,\sigma_P^2)$ and $\varepsilon_j^Q \sim N(0,\sigma_Q^2)$. Include weight, horsepower and a constant term in x. Explain how you would estimate the parameters of the model. Estimate the parameters of the model using maximum likelihood. Estimate your parameters for three models: Bertrand competition, single-product Bertrand competition (where each product is owned by a separate firm) and perfect collusion. Report your parameter estimates, standard errors and likelihood for all three models.

3) Consider again Bresnahan's model. Now let us assume that the automobile industry is characterized by Cournot competition. Explain how you would estimate the parameters given the assumption of Cournot competition. Reestimate the parameters for this model. Suppose you had data on the marginal costs of each automobile. How you would compare Cournot and Bertrand competition in this case?

4) Now let's modify utility to assume a logit specification: $u_{ij} = \delta_j - \alpha p_j + \varepsilon_{ij}$, where ε_{ij} is distributed as Type I extreme value. Assume Bertrand competition. Estimate the demand parameters and cost parameters of the model using GMM.

5) Now let's add in a random coefficient to the logit model: $u_{ij} = \delta_j - \alpha_i p_j + \varepsilon_{ij}$. Suppose that you know that α_i is distributed log-normally with unknown mean and variance. Assume Bertrand competition. Explain how you would estimate the parameters of the model. (You do not need to actually estimate this model.)