

# Empirical IO Homework 2

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## Estimation of the model

Our estimation is done by using Matlab 2020b and you may encounter some dimensional errors with older versions.

### Question 1

As given by question, the utility function of consumer  $i$  for  $j$  goods is

$$U_{ij} = \xi_j - \alpha_i p_j + \epsilon_{ij} \quad (1)$$

with 2000 consumers and 5 goods. Consumer tastes  $\xi_j = 4 + \frac{j}{5}$ , which is homogeneous across consumers for each good  $j$ ,  $\epsilon_{ij}$  is individual taste shock and assumed to be extreme value distributed and  $\alpha_i$  follows log-normal distribution. Also, we know each product is owned by one firm with marginal cost of production  $c_j = 1 + \frac{j}{8}$ .

To compute the Bertrand Nash equilibrium in prices, We firstly assume that we know the  $\alpha_i$  for each consumer that is drawn from the log-normal distribution. And we compute the prices in equilibrium with different initial prices (from 1.1 to 2.0 times marginal costs). The prices in equilibrium are the same across different initial prices. The simulated results are shown below: All the prices are lower than consumer tastes

Table 1: Prices in Bertrand Nash Equilibrium

Products	Simulated Prices
Product 1	1.82
Product 2	1.99
Product 3	2.17
Product 4	2.35
Product 5	2.55

$\xi_j$  and closed to marginal cost of production  $c_j$ .

### Question 2

As we assume the marginal cost of distribution is zero and the wholesale price equals to the marginal cost of production, the firms capture full monopoly rents through fixed fees. The FOCs of Resale Price Maintenance equilibrium are:

$$s_j(\mathbf{p}) + \sum_{k=1}^5 (p_k - c_k) \frac{\partial s_k(\mathbf{p})}{\partial p_j} = 0, \quad \forall j \quad (2)$$

Note that the retailers' products are given by the question; the first retailer sells products 1 and 2, and the second retailer sells products 3, 4 and 5. Consistent with question 1, we compute the prices in equilibrium with different initial prices (from 1.1 to 2.0 times marginal costs). The prices in equilibrium are the same across different initial prices. The simulated results are shown below:

Table 2: Prices in RPM Equilibrium

Products	Simulated Prices
Product 1	4.82
Product 2	5.13
Product 3	5.44
Product 4	5.74
Product 5	6.02

### Question 3

The total welfare and the changes implied by these Vertical Two-part Tariffs contracts are shown below:

Table 3: Welfare and Welfare Changes

	Consumer Surplus	Total Profits	Total Welfare
Bertrand Nash Equilibrium	4443	820	5263
RPM Equilibrium	2321	1627	3948
Changes	-2122	807	-1315

We can see that firms benefits but consumers lose after implementing vertical Two-part Tariffs contracts. The total welfare decreases by 25% due to the vertical Two-part Tariffs contracts.