

EC6322 Advanced Industrial Organization

Semester 2, 2018/19

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Assignment: **Demand estimation** and **horizontal merger evaluation**

Due date: February 15, 2019

Note 1: This problem set is based on a problem set originally prepared by Allan Collard-Wexler, Matt Grennan, Aviv Nevo and Vishal Singh. **I am grateful for their generosity.**

Note 2: It is fine that you work in small groups to tackle these computational problem sets. However, you as an individual should ultimately **understand the code** and hand your results in individually. Please name your group members. Your answers, including any tables you use to present results, should be **easy to locate** and **not be buried in the middle of code**. You should submit your code (and data files) by email and it **should run at the prompt when saved into a folder**.

Looking at code written by others outside your small group, including former students or suggested code provided by me to former students, is a **violation of our honor code (i.e., this is considered cheating).**

Consider the text file OTC_Data_forStata.csv. It contains aggregate panel data on over-the-counter (OTC) pain medication brands sold in Chicago. **The panel is balanced:** 73 stores over 48 weeks. There are 11 brand-size products (3 sizes for each of Tylenol, Advil and Bayer, and 2 sizes of generics). Variables include:

- **Store** and **Week** are the market identifiers. A store-week pair characterizes a market.
- **Count**: Number of consumers who visit each store each week.
- **Quantity** and **Price**: Quantity sold and price for each product, respectively, in number of cartons and \$/carton. A brand-package pair characterizes a product.
- **Promotion**: An indicator variable for whether a product is on promotion in a store-week market.
- **Cost**: The wholesale price of the product, in \$/carton, i.e., the price the retailer pays to the manufacturer for the product.

You should begin by converting quantities and prices (costs included) to 50-tab-equivalent quantities and prices (e.g., to compare 25-count cartons and 50-count cartons). For example, 10 cartons of Tylenol 25 are quantity-equivalent to 5 cartons of Tylenol 50. To obtain the 50-tab-equivalent price for Tylenol 25 multiply the price of the carton by 2 (note that p_{jt} below denote these comparable prices).

You should assume that the potential size of the market is the number of shoppers visiting a store in a week: implicitly, each buying one 50-count carton.

Question 1 (Summary statistics)

生成产品份额
Generate product shares s_{jt} by dividing the quantity sold in each market (a store-week pair) by market size. You should also compute the different products' "market shares," as conventionally defined, which ignore the share of the outside good and thus sum to one across products. You should obtain the following means across markets.

Brand-size (tab)	Price/ carton	Price/50-tab equivalent	批发		Share of potent.mkt	Proportion promotion
			Wholes. Price/ 50-tab-equiv.	"Market Share"		
1 (Tylenol 25)	3.42	6.84	4.36	.066	.00039	.032
2 (Tylenol 50)	4.94	4.94	3.67	.156	.00095	.076
3 (Tylenol 100)	7.02	3.51	2.88	.201	.00125	.104
4 (Advil 25)	2.96	5.93	4.06	.053	.00032	.084
5 (Advil 50)	5.15	5.15	3.62	.068	.00042	.080
6 (Advil 100)	8.16	4.08	3.05	.062	.00389	.094
7 (Bayer 25)	2.67	5.35	3.69	.019	.00011	.151
8 (Bayer 50)	3.61	3.61	2.42	.030	.00018	.165
9 (Bayer 100)	3.97	1.98	1.86	.141	.00086	.235
10 (Store Brand 50)	1.93	1.93	0.91	.083	.00051	.138
11 (Store Brand 100)	4.45	2.22	0.96	.120	.00078	.117

Question 2 (Logit demand – OLS and IV – interpretation)

Consider consumer i 's indirect utility for product $j \in \mathcal{J}$ (each of the 11 inside goods) in store-week t :

$$V_{ijt} = X_{jt}\beta + \alpha p_{jt} + \xi_{jt} + \epsilon_{ijt} \quad (1)$$

where ϵ_{ijt} is an i.i.d. draw from the EVT1 distribution, X_{jt} are non-price product characteristics observed by us researchers, and ξ_{jt} are unobserved product characteristics (but observed by consumers and firms). The utility from the outside good is $V_{i0t} = \epsilon_{i0t}$. Estimate the model:

- Using OLS with price and promotion as product characteristics.
- Using OLS with price, promotion and product fixed effects as product characteristics.
- Using OLS with price, promotion and store-product (the interaction of store and product) fixed effects as product characteristics.

Hint: Recall that in the logit model the mean utility δ_{jt} is a simple function of observed shares s_{jt} and $s_{0t} = 1 - \sum_{j \in \mathcal{J}} s_{jt}$ (Berry 1994). This mean utility can then be regressed linearly on X_{jt} and p_{jt} , with ξ_{jt} as the error term.

- Reestimate the model progressively adding controls as in (i), (ii) and (iii) above, but this time use instrumental variables estimation, specifying, as instruments for p_{jt} : (a) the wholesale price, and (b) product j 's mean price in other stores in the same week (this is usually referred to as a Hausman price following Jerry Hausman's advocacy for their use, e.g., see his heated exchange with Tim Bresnahan in the reading list). Repeat with only other-store mean price as an instrument.

- Using the analytical formula for price elasticities of demand, compute the own-price elasticities from the IV estimates with mean other-store prices as excluded instruments and product fixed effects. Report the median across markets. Also compute the cross-price elasticities of demand for Tylenol 50 with respect to the prices of Tylenol 25, Tylenol 100, Advil 25, Advil 50 and Advil 100 (again the median across markets for each cross elasticity).