ORGANIZACIÓN INDUSTRIAL EMPÍRICA
IN7E0

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Primavera - 2015

Outline

Introduction

Pre-Requisitos: Este curso está diseñado para estudiantes de magister o doctorado en economía o disciplinas afines.

Los contenidos requieren conocimiento previo de organización industrial y teoría de juegos a nivel de pregrado e idealmente haber cursado un curso de posgrado en econometría.

Objetivos

El curso tiene como objetivo que el alumno aprenda los métodos econométricos fundamentales y de frontera utilizados el campo de organización industrial, sea capaz de aplicar estas herramientas y que esté capacitado para realizar un proyecto de investigación en forma autónoma.

Consistentemente, sin perjuicio que se cubrirán algunos tópicos teóricos relevantes, el curso estará enfocado a la aplicación práctica de las herramientas econométricas.

Las tareas aplicadas requerirán el uso intensivo de software apropiado para cada sección, esencialmente MATLAB y STATA.

Evaluación

El curso tiene la siguiente estructura de evaluación: 2 tareas individuales (50% cada una).

Las tareas serán ejercicios computacionales de estimación en directa relación con la materia vista en clases.

Se requiere la entrega del programa y código, además del informe en donde se interpretan los resultados.

La tarea puede ser una réplica parcial de algún paper o bien un ejercicio de estimación de datos generados en forma artificial (datos simulados y luego estimados como un ejercicio de Montecarlo).

Plazos

Los plazos inamovibles de entrega electrónica en U-cursos son:

- T1: Miércoles 2 de Septiembre, 21 hrs.
- T2: Miércoles 30 de Septiembre, 21 hrs.

La asistencia es esencial para aprender. La inasistencia les hará perder un tiempo mayor que 90 minutos.

Modelos Teóricos de IO

- Productos Homogéneos versus Productos Diferenciados
- Competencia en Precio versus Competencia en Cantidad
- Juegos Estáticos versus Juegos Dinámicos

Bertrand Paradox (1883)

Suppose

- Static Model
- Homogenous goods.
- The decision variable is price.
- 2 firms: i and j.
- Same constant Marginal cost c for both firms.
- No capacity constraints: each firm can serve the entire demand without problems. Could be linked to constant marginal costs.

Bertrand Profit Function

$$\max_{p_i} \Pi_i(p_i, p_j) = \max_{p_i} (p_i - c) Q_i(p_i, p_j) \quad (1)$$

Assume the following demand:

$$Q_i(p_i, p_j) = \begin{cases} Q(p_i) & \text{if} \quad p_i < p_j \\ \frac{1}{2} Q(p_i) & \text{if} \quad p_i = p_j \\ 0 & \text{if} \quad p_i > p_j \end{cases}$$

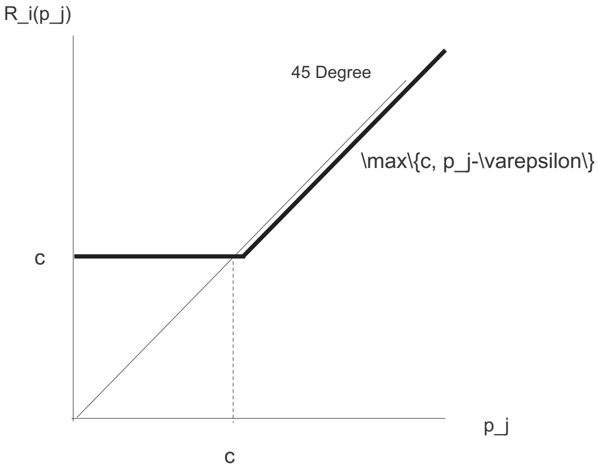
Reaction Function

Reaction function for player i is the best response for given action(s) of other player(s). In this case, $R_i(p_j)$.

$$p_i = R_i(p_j) \quad = \quad \max\{c, p_j - \varepsilon\} \tag{2}$$

For $\varepsilon > 0$, but very small.
Why? You want the highest price, but hopefully all the demand.

Reaction function for firm i



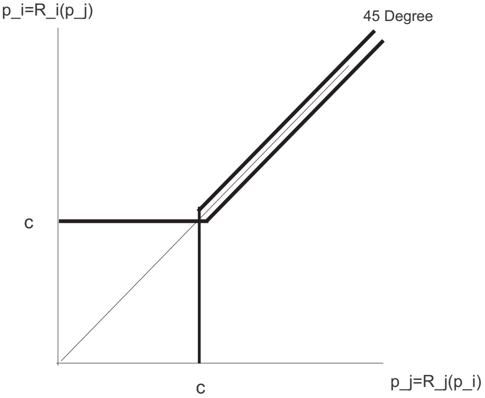
Nash Equilibrium: A pair of prices (p_i^*, p_j^*) is a Nash equilibrium if

$$p_i^* = R_i(p_j^*)$$

and

$$p_j^* = R_j(p_i^*)$$

Both reaction functions



Therefore the Nash equilibrium prices are $p_i^* = p_j^* = c$

Nash equilibrium prices:

$$p_i^* = p_j^* = c \Rightarrow q_i^* = q_j^* = \frac{1}{2}Q(c)$$

Therefore:

$$\Pi_i^* = \Pi_j^* = 0$$

Price equals marginal cost and zero profits for both firms, just like perfect competition.
WTF!?
Way too fantastic.
Extensions regarding the assumptions in cost symmetry, other demand functions, number of firms. Most conclusions remain the same. The most important assumptions are price competition and one-shot game.

Cournot Competition (1838)

Suppose

- The decision variable is *quantity*.
- N fixed number of firms, all symmetric.
- Once the quantities are determined, the market reaches the equilibrium price.

Cournot Profit Function

$$\max_{q_i} \Pi_i(q_i, q_{-i}) \quad = \quad \max_{q_i} q_i P(Q) - C_i(q_i) \qquad (3)$$

where unique price $P(Q)$ is given by the inverse demand that depends on total quantity: $Q = \sum_r q_r = q_i + \sum_{j \neq i} q_j$.

Assuming Π_i is strictly concave in q_i, and twice differentiable, the first order conditions (FOC) are:

$$\frac{\partial \Pi_i(q_i, q_{-i})}{\partial q_i} = 0 \Leftrightarrow P(Q) + q_i \frac{\partial P(Q)}{\partial q_i} - \frac{\partial C_i(q_i)}{\partial q_i} = 0$$

Reaction Function

The same as before, the reaction function for player i is the best response for a given action of the other player. In this case, $q_i = R_i(q_{-i})$ such that:

$$\frac{\partial \Pi_i(R_i(q_{-i}), q_{-i})}{\partial q_i} = 0$$

Some functional forms

Suppose a linear demand and the same constant marginal costs

$$Q(P) = 1 - P \quad \Leftrightarrow \quad P(Q) = 1 - \sum_r q_r$$
$$\frac{\partial C_i(q_i)}{\partial q_i} = c$$

(From demand we know that $c < 1$) Replacing in FOC yields:

$$q_i = R_i(q_{-i}) = \frac{1 - c}{N + 1}$$

Notice that in the symmetric case $q_i = q, \forall i$; hence $Q = Nq$

Solving the equilibrium quantities, prices and profits:

$$
\begin{aligned}
q^* &= \frac{1-c}{N+1} \\
\Rightarrow p^* &= \left(c + \frac{1-c}{N+1}\right) > c \\
\Pi^* &= \left(\frac{1-c}{N+1}\right)^2 > 0
\end{aligned}
$$

Price greater than marginal cost and strictly positive profits for all firms. We lost the benefits of perfect competition.

Any hope? If N goes to infinity we could reach the perfect competition outcome! ($p = c$)

Structure-Conduct-Performance

Competition á la Cournot generates the idea that the number of the firms can give us a sense of how competitive a market is. So the *structure of the market*, will lead to a *conduct*, so we evaluate the *performance*. The main **assumption** is that *a Monopoly is bad and many firms means competition*.
Let's evaluate these arguments. Recall the Cournot FOC:

$$\frac{\partial \Pi_i(q_i, q_{-j})}{\partial q_i} = 0 \quad \Leftrightarrow \quad P(Q) + q_i \frac{\partial P(Q)}{\partial q_i} - \frac{\partial C_i(q_i)}{\partial q_i} = 0$$

$$\Rightarrow \quad P(Q) - \frac{\partial C_i(q_i)}{\partial q_i} = -q_i \frac{\partial P(Q)}{\partial q_i}$$

Cournot Markups

Markup is the gap between the marginal cost and the price. If the markup is zero, then we have a competitive outcome (price=marginal cost). Derive the Lerner Index L_i for firm i

$$L_i \equiv \frac{P - \frac{\partial C_i(q_i)}{\partial q_i}}{P} \quad = \quad -q_i \frac{\partial P}{\partial q_i} \frac{Q}{QP} = -\frac{q_i}{Q} \frac{\partial P}{\partial q_i} \frac{Q}{P} = \frac{s_i}{\varepsilon}$$

where $s_i = \frac{q_i}{Q}$ is the market share and $\varepsilon \equiv -\frac{\partial q_i}{\partial P} \frac{P}{Q}$ is the own price elasticity.

The larger the fraction of the market, the larger the markup.

The less elastic the demand, the larger the markups.

The monopoly case is the worst case, since the share is one.

Perfect competition outcome can be achieved if either i) $s_i \to 0$ (atomistic producers); or ii) $\varepsilon \to +\infty$ (producers are price-takers).

Measures of Market Concentration.

The first indicator is the m-firm concentration ratio, R_m, which adds up the m highest market shares in the industry. The sub-indices increase as the market share decrease.

$$R_m \equiv \sum_{j=1}^{m} \frac{q_j}{Q} = \sum_{j=1}^{m} s_j$$

So $R_m = 1$ for monopoly and $R_m = m/N$ for equally sized firms. The second indicator is the Herfindahl index, H, that is the sum of the market shares squared:

$$H \equiv \sum_{j=1}^{N} \left(\frac{q_j}{Q}\right)^2 = \sum_{j=1}^{N} s_j^2$$

Hence, $H = 1$ for monopoly and $H = 1/N$ for N equally sized firms.

Empirical Evidence: Bain 1951

THE
QUARTERLY JOURNAL
OF ECONOMICS

Vol. LXV August, 1951 No. 3

RELATION OF PROFIT RATE
TO INDUSTRY CONCENTRATION:
AMERICAN MANUFACTURING, 1936–1940

By JOE S. BAIN

I. The concentration-profits hypothesis, 294. — II. Industry definition, measure of concentration, and selection of sample, 297. — III. Character and limitations of profit data, 305. — IV. Calculation of accounting profit rates, 310. — V. Association of industry profit rates and concentration, 311. — VI. Asso-

Bain 1951

TABLE II

AVERAGE OF INDUSTRY AVERAGE PROFIT RATES WITHIN CONCENTRATION DECILES, 1936–1940, FOR 42 SELECTED INDUSTRIES

Concentration Range (Per Cent of Value Product Supplied by Eight Firms)	Number of Industries	Average of Industry Average Profit Rates[1]
90–100	8	12.7
80– 89.9	11	10.5
70– 79.9	3	16.3
60– 69.9	5	5.8
50– 59.9	4	5.8
40– 49.9	2	3.8
30– 39.9	5	6.3
20– 29.9	2	10.4
10– 19.9	1	17.0
0– 9.9	1	9.1

"..A tentative conclusion is thus that industries with an eight-firm concentration ratio above 70 per cent tended, in 1936-40 at least, to have significantly higher average profits rates than those with a ratio below 70 per cent. The evidence available does not seem to warrant other than this dichotomous distinction."

Empirical Evidence of SCP

The main regressions for industry i, and time t are as follows:

$$\Pi_{it} = \alpha + \beta_{it} H_{it} + \gamma'_{it} X_{it} + \varepsilon_{it}$$

where Π_{it} is a measure of profits and H_{it} is a measure of market structure (usually concentration index like Herfindahl), and X is other controls. ε_{it} is the random term.

What are the OLS assumptions over this error?

We have a severe endogeneity issue. Can you tell us why?

Empirical Evidence: Schmalensee (Ch16) and Bresnahan (Ch17)

The main assumptions:

1. Assumption 1: Price-Cost margins (performance) can be directly observed in accounting data.
2. Assumption 2: Cross-section variation in industry structure could be captured by a small number of observable measures.
3. Assumption 3: Empirical work should be aimed at estimating the reduced-form relationship between structure and performance.

Empirical Evidence: Schmalensee (Ch16) and Bresnahan (Ch17)

Handbook provide an excellent survey, with criticisms and agreements. The author came up with a large set of stylized facts of the overall results in the topic. In general the endogeneity problem is intrinsic to the field, long-run equilibrium, entry-exit and endogenous barrier entry are the most difficult task to overcome...

NEIO

Can the data tell us the degree of competition?

Can we treat the costs as unobservable?

That was the aim in the 80's, when the New Empirical Industrial Organization arises. Bresnahan was a pioneer...

Conjectural Variations in Cournot case

Back to the Cournot FOC:

$$P - \frac{\partial C_i(q_i)}{\partial q_i} = -q_i \frac{\partial P(Q)}{\partial q_i}$$

We can decompose the last terms as follows:

$$\begin{aligned} \frac{\partial P(Q)}{\partial q_i} &= \frac{\partial P(Q)}{\partial Q}\frac{\partial Q}{\partial q_i} = \frac{\partial P(Q)}{\partial Q}\frac{\partial [q_i + \sum_{j\neq i} q_j]}{\partial q_i} \\ &= \frac{\partial P(Q)}{\partial Q}\left[1 + \underbrace{\frac{\partial \sum_{j\neq i} q_j}{\partial q_i}}_{\text{Conjectural Variation}}\right] \end{aligned}$$

How much would change my competitors' quantity if I increased my production in one unit?

Conjectural Variations in the Cournot case

$$P - \frac{\partial C_i(q_i)}{\partial q_i} = -q_i \frac{\partial P(Q)}{\partial Q} \frac{\partial Q}{\partial q_i} = -q_i \frac{\partial P(Q)}{\partial Q} \left[1 + \underbrace{\frac{\partial \sum_{j \neq i} q_j}{\partial q_i}}_{\text{Conjectural Variation } \lambda} \right]$$

In general conjectural variations refers to the change of all the other player's action due to a marginal change of a given player's action.

- If $\lambda = -1$ then perfect competition $\Leftrightarrow$ Price=Mg Cost.
- If $\lambda = 0$ then Cournot outcome $\Leftrightarrow$ Price $>$ Mg Cost.
- If $\lambda > 0$ some degree of collusion $\Leftrightarrow$ Price $>>$ Mg Cost.

GOAL: To estimate λ from the data, without observing actual costs in a particular industry.

Conclusion

We have seen the origins of Industrial Organization:

- Static Competition with Homogenous Goods: Cournot vs Bertrand.
- Reduced form approach in the SCP framework.
- This reduced form approach is super helpful to understand how the markets *look* but not how the markets *work*.
- Endogeneity problem and entry-exit is the main critique to this approach. Also profits are usually unobservable.
- NEIO through conjectural variations aims at estimating the degree of competition without observable costs.