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Topic 9: Advertising

- 1. Informative and pervasive advertising
- 2. Optimal advertising expenditure for a monopolist
- 3. Market structure and advertising: in n-firms oligopoly

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Tema 9. Introducción

- There exist many industries where:
 - Advertising expenditures are more important than R&D expenditures.
 - Example: Pharmaceutical industry
 - ✓ Advertising competition is more important than price competition
 - Example: some non-alcoholic drinks.
- In this topic we consider firms' advertising expenditure as an strategic investment.
- Main aim of this topic: analysis of the relationship between price competition and advertising expenditure.

9.1 Informative and pervasive advertising

Depending of its nature and aim, we can distinguish two types of advertising:

1. Informative advertising

✓ It informs on the existence of the products and/or the place to purchase it, price and other characteristics (e.g. weight, size or processor speed in a laptop PC).

2. Pervasive advertising

✓ Its aim is to persuade consumer that the product is better of different to the other products in the market → its aim is to influence consumers' preferences.

Effect on price competition:

- 1. Informative advertising \rightarrow increases intensity of competition
- 2. Pervasive advertising

 $\rightarrow \nabla$ price elasticity of demand and increases market power.

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9.1 Informative and pervasive advertising

Important question:

- ✓ Which type of advertising is more important?
 - Empirical evidence suggest that both types of advertising are important, and makes difficult its.
 - If advertising were mainly informative → we will associate advertising to "search goods"...
 - ... however, empirical evidence shows that the <u>ratio</u> <u>advertising/sales</u> is 3 times bigger for "**experience goods**" (products for which pervasive advertising is more important)

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- There exist arguments related to efficiency that defend the existence of pervasive advertising →
 - **Pervasive advertising** in "**experience goods**" signals the quality of the product (so it is advertising that at least indirectly informs).

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/niversitat Deliversitat 9.2 Optimal advertising expenditure (advertising intensity) for a monopolist

- Empirical evidence shows that advertising intensity (advertising intensity/sales) differs among industries (products).
 - \checkmark Which factors do explain these differences?
 - \checkmark In this section
 - We do not discuss if the advertising is mainly informative or pervasive.
 - We assume that advertising investment produces a parallel shift of the demand curve.

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9.2 Optimal advertising expenditure (advertising intensity) for a monopolist

Supuestos:

1) Monopolist demand function:

$$q = q(p, A)$$
 p.- price; A.- advertising expenditure
 $\frac{\partial q}{\partial p} < 0$
 $\frac{\partial q}{\partial A} > 0 \rightarrow$ advertising expenditures have a psoitive effect on D

- 2) Marginal cost of production is constant and equal to c. Advertising expenditure is a fixed cost \rightarrow A
- 3) The monopolist choose both price and advertising expenditure to maximize profits:

$$Max_{p,A}\Pi = (p-c) \cdot q(p,A) - A$$

9.2 Optimal advertising expenditure (advertising intensity) for a monopolist

$$Max_{\rho,A}\Pi = (\rho - c) \cdot q(\rho, A) - A$$

. FOC_p
$$\rightarrow \frac{\partial \Pi}{\partial p} = q + (p - c) \frac{\partial q}{\partial p} = 0$$

$$p - c = -q \frac{\partial p}{\partial q} \left(\frac{p}{p}\right) \rightarrow \frac{p - c}{p} = \frac{1}{\eta}$$

 η .- price elasticity of demand

2. FOC_A
$$\rightarrow \qquad \qquad \frac{\partial \Pi}{\partial A} = (p-c)\frac{\partial q}{\partial A} - 1 = 0$$

$$p-c = \frac{\partial A}{\partial q} \rightarrow \frac{p-c}{p} = \frac{\partial A}{\partial q}\frac{1}{p} \rightarrow \frac{p-c}{p} = \frac{\partial A}{\partial q}\frac{q}{A}\frac{A}{q}\frac{1}{p}$$

$$\frac{p-c}{p} = \frac{A}{\eta_A R} \rightarrow donde \quad \eta_A = \frac{\partial q}{\partial A}\frac{A}{q} \quad y \quad R = pq$$

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9.2 Optimal advertising expenditure (advertising intensity) for a monopolist

From 1) (FOC_p) y 2) (FOC_A), we can obtain the **Dorfman-Steiner** relationship:

$$FOC_{\rho} \rightarrow \frac{p-c}{\rho} = \frac{1}{\eta}$$

$$FOC_{A} \rightarrow \frac{p-c}{\rho} = \frac{A}{\eta_{A}R}$$

$$\Rightarrow \frac{1}{\eta} = \frac{A}{\eta_{A}R} \Leftrightarrow \frac{\eta_{A}}{\eta} = \frac{A}{R}$$

- 1. The more sensitive the demand to the advertising expenditure, the higher the advertising intensity (ratio advertising/sales).
- 2. The less sensitive the demand to price changes, the higher the advertising intensity.

- How does advertising intensity change with market structure (number of firms)?
- ✤ Suppose that:
 - \checkmark The price of the product is given and it is the same for all firms.
 - ✓ Firm I demand function is:

 $q_i = q_i(p, A_i, A_r)$

- A_i.- Firm I advertising intensity
- A_r.- Rivals' advertising intensity
- $A = A_i + A_r$
- ✓ Null conjectural variations: each firm take as given (makes a conjecture) the advertising expenditures of other firms.

$$\frac{\partial A_r}{\partial A_i} = 0 \; ; \; \mathbf{i} \neq \mathbf{i}$$

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Each firm has to choose the level of advertising expenditure that maximizes its profits taken as given the advertising expenditures of the other firms:

$$Max_{A_i} \Pi_i = (p - c_i) \cdot q_i (p, A_i, A_r) - A_i$$

$$FOC: \frac{\partial \Pi_i}{\partial A_i} = (p - c_i) \cdot \frac{\partial q_i}{\partial A_i} - 1 = 0 \rightarrow (p - c_i) \cdot \frac{\partial q_i}{\partial A_i} = 1$$

multiplying both sides of the equation by $\left(\frac{1}{\rho}\frac{A_i}{q_i}\right)$

$$\frac{\left(p-c_{i}\right)}{p} \cdot \frac{\partial q_{i}}{\partial A_{i}} \cdot \frac{A_{i}}{q_{i}} = \frac{A_{i}}{pq_{i}}$$
$$\frac{\left(p-c_{i}\right)}{p} \eta_{Ai} = \frac{A_{i}}{R_{i}} \quad ; \text{ where } \eta_{Ai} = \frac{\partial q_{i}}{\partial A_{i}} \cdot \frac{A_{i}}{q_{i}}$$

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$$\frac{\left(p-c_{i}\right)}{p}\eta_{Ai}=\frac{A_{i}}{R_{i}}$$

- Therefore, the advertising intensity (ratio advertising expenditures over sales) depends on:
 - ✓ Price-cost margin.
 - ✓ Sensitiveness of firm i demand to advertising expenditures (η_{Ai}).
- Analogously, the advertising expenditures A_i affect firm i demand (q_i) in a double way:

 \checkmark Through the firm market share (s_i).

- \checkmark Through the total market demand (Q).
- In order understand it, recall that firm i market share is s_i=(q_i/Q) [→ q_i=s_iQ], and decompose η_{Ai} as follows (sum):

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$$\eta_{Ai} = \frac{\partial q_i}{\partial A_i} \cdot \frac{A_i}{q_i} = \frac{\partial (S_i Q)}{\partial A_i} \cdot \frac{A_i}{q_i}$$

$$\eta_{Ai} = \frac{\partial S_i}{\partial A_i} \cdot \frac{A_i Q}{q_i} + \frac{\partial Q}{\partial A_i} \cdot \frac{S_i A_i}{q_i} \to \eta_{Ai} = \frac{\partial S_i}{\partial A_i} \cdot \frac{A_i Q}{S_i Q} + \frac{\partial Q}{\partial A_i} \cdot \frac{S_i A_i}{S_i Q}$$

$$\eta_{Ai} = \frac{\partial S_i}{\partial A_i} \cdot \frac{A_i}{S_i} + \frac{\partial Q}{\partial A_i} \cdot \frac{A_i}{Q}$$

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✓ As $A = A_i + A_r$, when A_r changes $A_i (∂Q/∂A_i) = (∂Q/∂A)$ does not change. . Besides, multiplying and dividing the second part of the sum by A:

$$\eta_{Ai} = \frac{\partial S_i}{\partial A_i} \cdot \frac{A_i}{S_i} + \frac{\partial Q}{\partial A_i} \cdot \frac{A_i}{Q}$$
$$\eta_{Ai} = \frac{\partial S_i}{\partial A_i} \cdot \frac{A_i}{S_i} + \frac{\partial Q}{\partial A} \cdot \frac{A}{Q} \cdot \frac{A_i}{A} \to \eta_{Ai} = \eta_s + \partial_i \eta_A$$

where
$$\eta_s = \frac{\partial s_i}{\partial A_i} \cdot \frac{A_i}{s_i} \rightarrow \text{elasticity of } s_i \text{ with respect to } A_i.$$

 $a_i = \frac{A_i}{A} \rightarrow$ firm i market share.

 $\eta_A = \frac{\partial Q}{\partial A} \cdot \frac{A}{Q} \rightarrow \text{elasticity of the market D with respect to A (total advertising)}$

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9.3 Market structure and advertising intensity. N-firms oligopoly

✤ Therefore:

$$\eta_{Ai} = \eta_s + \partial_i \eta_A$$

$$\frac{(\rho - C_i)}{\rho} \eta_{Ai} = \frac{A_i}{R_i}$$

$$\rightarrow \qquad \frac{(p-c_i)}{p} (\eta_s + a_i \eta_A) = \frac{A_i}{R_i}$$

- ✤ Advertising intensity depends on:
 - ✓ Firm price-cost margin
 - ✓ Sensitiveness of a firm market share to its advertising expenditures.
 - \checkmark Sensitiveness of the market demand to general advertising.

- ✤ How does the number of firms affects to advertising intensity?
 - ✓ Suppose that price is given and the market share of firm i depends on its advertising expenditure

$$S_{i} = A_{i} = \frac{A_{i}}{A} \Rightarrow \eta_{s} = \frac{\partial S_{i}}{\partial A_{i}} \frac{A_{i}}{S_{i}} = \begin{cases} \frac{\partial S_{i}}{\partial A_{i}} = \frac{\partial \left(\frac{A_{i}}{A}\right)}{\partial A_{i}} = \frac{A - A_{i}}{A^{2}} \\ \frac{A_{i}}{S_{i}} = \frac{A_{i}}{\left(\frac{A_{i}}{A}\right)} = A \end{cases} = s$$

$$\eta_s = \frac{A - A_i}{A} = 1 - S_i$$

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Thus, we can rewrite the equation that determines the advertising intensity of firm i as

$$\frac{(\rho-c_i)}{\rho}(\eta_s+a_i\eta_A)=\frac{A_i}{R_i}\rightarrow\frac{(\rho-c_i)}{\rho}(1-s_i+\eta_As_i)=\frac{A_i}{R_i}$$

Suppose that c_i=c para todo i (all firms have identical marginal costs, i.e symmetric firm).

$$S_i = \partial_i = \frac{q_i}{Q} = \frac{1}{N}$$

From the Cournot model with N-symmetric firms

 $\frac{p-c}{p} = \frac{1}{N\eta}$; where η is the price elasticity of demand

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And so the equation that determines firm i advertisin intensity can be rewritten as:

$$\frac{\left(p-c_{i}\right)}{p}\left(1-s_{i}+\eta_{A}s_{i}\right) = \frac{A_{i}}{R_{i}} \rightarrow \frac{1}{N\eta}\left(1-\frac{1}{N}+\eta_{A}\frac{1}{N}\right) = \frac{A_{i}}{R_{i}}$$
$$\rightarrow \frac{\left(N-1\right)+\eta_{A}}{N^{2}\eta} = \frac{A_{i}}{R_{i}}$$

- The advertising intensity (ratio avertising expenditures over sales) depends on:
 - ✓ The number of firms.
 - ✓ Price elasticity of demand (η).
 - ✓ Elasticity of total demand with respect to total advertising expenditure (η_A).
- * To analyse the effect of N on advertising intensity, we have to fix the values of η and η_A y explore what happens for different

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Empirical evidence:

- \checkmark It is ambiguous:
 - It has not been found any monotonic relationship between advertisin q intensity and number of firms (A_i/R_i-N relationship).
- \checkmark However, it seem to appear a regularity:
 - From a starting point of high concentration, when concentration decreases (ex. Monopoly \rightarrow oligopoly, with a few firms) advertising intensity increases.
 - From a starting point of low levels of concentration, advertising intensity decreases as concentration increases (ex. From a large number of firms to oligopoly).



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9.3.1 Empirical evidence

✤ Advertising: optimal values and values observed in Australia.

market	ղ _A /ղ	A/R
Instantaneous coffee	0,019	0,020
Beer	0,008	0,011
Tobacco	0,019	0,046
Soap	0,013	0,012
Detergents	0,019	0,030
Toothpastes	0,024	0,059
Paints	0,009	0,019
Fuel	0,017	0,016