

# Industrial Organization, Week 6

## Advertising

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# Agenda

- 1 Big picture
- 2 Monopoly
- 3 Oligopoly

# Advertising plan

- ▶ Plan: We look at advertising today
- ▶ This is more of applied IO, we have the main theory under our belts
- ▶ Persuasive model and informative model under monopoly
- ▶ Competition with advertising

## How do we model advertising?

$$Q_p \equiv \frac{\partial Q}{\partial p} < 0; Q_p \equiv \frac{\partial Q}{\partial A} > 0 \quad (1)$$

$$\Pi(p, A) = pQ(p, Q) - C(Q(p, A)) - A \quad (2)$$

$$\frac{\partial \Pi}{\partial p} = (p - C')Q_p = 0 \Leftrightarrow \frac{p - C'}{p} = -\frac{Q}{pQ_p} = \frac{1}{\eta_{Q,p}} \quad (3)$$

$$\frac{\partial \Pi}{\partial A} = (p - C')Q_A - 1 = 0 \Leftrightarrow \frac{p - C'}{p} = \frac{1}{Q_A} \frac{1}{P} = \frac{Q}{AQ_A} \frac{A}{PQ} = \frac{1}{\eta_{Q,A}} \frac{A}{pQ} \quad (4)$$

$$\frac{1}{\eta_{Q,p}} = \frac{1}{\eta_{Q,A}} \frac{A}{pQ} \Leftrightarrow \frac{A}{pQ} = \frac{\eta_{Q,A}}{\eta_{Q,p}} \quad (5)$$

So the monopolist sets their advertising expenditure as a function of the ratio advertising elasticity of demand and price elasticity of demand.

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# Interpreting Advertising: Persuasive

- ▶ We can use hotelling to represent different valuations. Consumers on the hotelling map with the firm at 1.
- ▶ We can boost everyones valuation by advertising, let the willingness to pay be:  $g(A)x$
- ▶  $Q(p, A) = 1 - \frac{p}{g(A)} \leftrightarrow \eta_{Q,p} = \frac{p}{g(A)-p}$
- ▶ Can also be interpreted as complementary

# Interpreting Advertising: Informative

- ▶ The firm randomly sends advertising to  $N$  consumers hoping to inform them.
- ▶ The firm sends  $A$  messages, the consumers who have not received an ad is  $(1 - \frac{1}{N})^A \approx e^{-\frac{A}{N}}$
- ▶  $Q(p, Q) = N(1 - e^{-\frac{A}{N}})d(p) \equiv G(A)d(p)$
- ▶ First derivative is positive, second derivative is negative.
- ▶ The price is not affected in this view.

## Interpreting Advertising: Informative 2

- ▶ Information does not have to be about the product, it can be about the firm
- ▶ Signalling theory tells us it can also just be about costs.
- ▶ If the good product and bad product look identical, then a firm may advertise to differentiate.



# The welfare effects are difficult

- ▶ Result 1: If price is not increasing in advertising, too little advertising is supplied by monopolist.
- ▶ Result 2: If the price is increasing in advertising, ambiguous welfare effects.

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## Hotelling with three types of consumers

- ▶ Fully informed consumers  $\lambda_1\lambda_2$ . Informed only about firm 1  $\lambda_1(1 - \lambda_2)$
- ▶  $Q_1(p_1, p_2, \lambda_1, \lambda_2) = \lambda_1[(1 - \lambda_2) + \lambda_2\bar{x}(p_1, p_2)]$
- ▶ If the good product and bad product look identical, then a firm may advertise to differentiate.
- ▶ To simplify assume that the advertising cost function is:  $A(\lambda_i) = a\frac{\lambda_i^2}{2}$
- ▶ with  $a > \frac{\tau}{2}$  to ensure not everybody is informed at equilibrium

## Hotelling with three types of consumers 2

$$\Pi = (p_1 - c)Q_1(p_1, p_2, \lambda_1, \lambda_2) - A(\lambda_1) \quad (6)$$

$$\rightarrow \lambda_1 = \frac{1}{a}(p_1 - c)\left[1 - \lambda_2 + \lambda_2 \frac{1}{2\tau}(p_2 - p_1 + \tau)\right] \quad (7)$$

$$\rightarrow p_1 = \frac{p_2 + c + \tau}{2} + \frac{1 - \lambda_2}{\lambda_2}\tau \quad (8)$$

$$\rightarrow p = c + \frac{2 - \lambda^*}{\lambda^*}\tau \quad (9)$$

$$\rightarrow \lambda^* = \frac{2}{1 + \sqrt{\frac{2a}{\tau}}} \quad (10)$$

$$\rightarrow \pi_1 = \frac{2a}{(1 + \sqrt{\frac{2a}{\tau}})^2} \quad (11)$$

# Hotelling with three types of consumers 3

- ▶ There is a zero sum aspect to advertising competition.
- ▶ Higher advertising costs lead more market power
- ▶ Firms prefer there to be higher advertising costs

# Conclusion

- ▶ The effect of advertising is ambiguous
- ▶ It is difficult to know if advertising informative or persuasive