Part III. Sources of market power

Chapter 6. Advertising and related marketing strategies
Chapter 6. Learning objectives

• Understand to what end and to what effect firms devote resources to advertising.

• Be able to distinguish between the different views on advertising: informative, persuasive and complementary advertising.

• Understand how a monopolist chooses advertising expenditures and how this choice affects welfare.

• Understand how advertising decisions are made in oligopoly settings and how they affect price competition.
Case. U.S. media spending on advertising

(Data from AdvertisingAge, July 2009)
Case. U.S. media spending on advertising

(From AdvertisingAge)
Why do firms advertise?

• ...

• ...

• ...

• ...

• ...
Why do consumers respond to advertising?

• **1\textsuperscript{st} view: advertising is persuasive**
  • It alters consumers’ tastes.
  • It ↑ product differentiation & consumers’ loyalty.
  • **Likely effects** (to be confirmed)
    • Demand becomes less elastic; prices ↑; entry becomes more difficult; welfare ↓.

• **2\textsuperscript{nd} view: advertising is informative**
  • It conveys information about existence, prices and characteristics of products (directly or indirectly).
  • **Likely effects** (to be confirmed)
    • Demand becomes more elastic; prices ↓; welfare ↑.
Why do consumers respond to advertising? (cont’d)

• 3rd view: advertising is complementary
  • Complementary to the advertised product.
  • It enters into the consumer’s utility function, in complement with the product itself.
    • Idea: consumers consumes ‘social images’ by combining products and advertising.
  • Likely effects (to be confirmed)
    • Similar to persuasive view.
    • Yet, it may be beneficial through its direct valuation by the consumers.

Having a Louis Vuitton bag may allow you to look as cool as Sean Connery if (1) you actually possess such a bag and (2) the ad links the bag to the cool attitude that you want to project in your relevant peer group.
How to distinguish the 3 views empirically?

• Classify advertising spots
  • Possible to identify directly informative advertising.
  • Much harder to separate indirectly informative and persuasive advertising.

• Find industries subject to a shock and analyze the effect of advertising on market outcomes
  • E.g., a certain type of advertising becomes (il)legal

• Look at implied purchasing behavior
  • Informative advertising is valuable for inexperienced consumers but not for experienced consumers.
  • Persuasive & complementary advertising affect both types in the same way.

• Testable hypothesis: informative advertising affects demand of inexperienced consumers more strongly.
Case. Yoplait 150

• Data
  - Yoplait 150: 1st low calorie, low fat yogurt, introduced into the US market in 1987.
  - Scanner data collected at Sioux Falls, South Dakota and Springfield, Missouri (about 4,000 households)
  - Weekly prices at drugstores and supermarkets over three years (1986-1988).
  - A.C. Nielsen TV meters: household TV advertisement exposures.

• Main result
  - Advertisement affects initial purchases much more than repeat purchases.
  - Supports the view that advertising was predominantly informative in the Yoplait 150 case.
Price and non-price strategies in monopoly

- Dorfman-Steiner model

  - Include non-price variable into monopoly problem: firm chooses price, $p$, and advertising expenditure, $A$.
  - Demand: $Q(p,A)$ with $Q_p < 0$ and $Q_A > 0$ (consumers respond to more advertising by increasing demand)

  - Monopoly’s problem: choose $p$ and $A$ to maximize

\[
\Pi(p,A) = pQ(p,A) - C(Q(p,A)) - A
\]

\[
\frac{\partial \Pi}{\partial p} = (p - C')Q_p + Q = 0 \iff \frac{p - C'}{p} = -\frac{Q}{pQ_p} = \frac{1}{\eta_{Q,p}}
\]

\[
\frac{\partial \Pi}{\partial A} = (p - C')Q_A - 1 = 0 \iff \frac{p - C'}{p} = \frac{1}{Q_A} \frac{1}{p} = \frac{Q}{AQ_A} \frac{A}{pQ} = \frac{1}{\eta_{Q,A}} \frac{A}{pQ}
\]

with $\eta_{Q,A} = \text{advertising elasticity of demand}$
Price and non-price strategies in monopoly (cont’d)

• Dorfman-Steiner model (cont’d)
  • Equating the 2 previous values:

\[
\frac{1}{\eta_{Q,p}} = \frac{1}{\eta_{Q,A}} \frac{A}{pQ} \iff \frac{A}{pQ} = \frac{\eta_{Q,A}}{\eta_{Q,p}}
\]

• Lesson: A monopoly sets its advertising intensity to the ratio of the advertising elasticity of demand over the price elasticity of demand.
Closer look at how advertising affects demand

- Persuasive advertising
  - Continuum of consumers of mass equal to 1
  - Each consumer buys at most 1 unit of the product
  - Heterogeneous valuation: $\theta$ uniformly distributed on $[0,1]$
  - Persuasive advertising ‘inflates’ consumers’ valuations → willingness to pay: $g(A)\theta$, with $g(0) = 1$ and $g'(A) > 0$
  - At $p$, consumers who buy are such that $\theta \geq p / g(A)$
  - Hence, demand is $Q(p,A) = 1 - p / g(A)$
  - Price-elasticity: $\eta_{Q,p} = p / (g(A) - p)$
  - ↓ with $A$ as $g'(A) > 0$: more advertising makes demand less elastic, as predicted by persuasive view.
Closer look (cont’d)

• Informative advertising
  • $N$ consumers, with decreasing demand function, $d(p)$
  • Initially, all consumers are unaware of the product; they are made aware if they receive an ad.
  • Monopolist sends $A$ advertising messages.
  • Same probability for each consumer to receive an ad
  • Probability of not receiving an ad (for $N$ large): $e^{-A/N}$
  • Hence, demand is $Q(p,A) = N(1 - e^{-A/N}) d(p) \equiv G(A)$
  • Note: $G'(A) > 0 > G''(A)$
  • Price-elasticity: $\eta_{Q,p} = p \frac{d'(p)}{d(p)}$, insensitive to the number of advertising messages: more advertising does not make demand less elastic, as predicted by informative view.
Some welfare effects of advertising

- Is advertising socially desirable?
- We study the issue in the previous monopoly model
  - Starting point: monopoly solution, \((p_m, A_m)\)
  - Change advertising to some nearby level \(A\)
  - Monopolist reacts with profit-maximizing price \(p_m(A)\)
  - Compute change in welfare, where welfare is defined by

\[
W(p, A) = \Pi(p, A) + \int_{p}^{r(A)} Q(p, A) dp,
\]

with \(r(A)\) satisfying \(Q(r(A), A) = 0\).
Some welfare effects of advertising (cont’d)

• We want to evaluate

\[
\frac{dW(p_m(A), A)}{dA} \bigg|_{A=A_m} = \left\{ \frac{d\Pi(p_m(A), A)}{dA} + Q(r'(A), A) r'(A) \right\} - Q(p_m(A), A) p'_m(A) + \int_{r(A)}^{r(A_m)} Q_A(p, A) \, dp \bigg|_{A=A_m}
\]

= 0

If advertising ↑ monopoly price, it ↓ consumer surplus and thus, welfare.

Additional consumer surplus that advertising generates on the infra-marginal units because of the demand shift.

Negative or positive effect

Positive effect

Net effect?
Some welfare effects of advertising (cont’d)

• **Lesson**: If additional advertising does not cause the monopolist to raise its price, then the monopolist will supply too little advertising. But if it does, then it induces 2 conflicting effects on welfare and the net effect is ambiguous.

• **Effect of additional advertising on price?**
  • Depends on the nature of advertising and on the monopolist’s cost function.
    • Informative advertising: monopoly advertising is socially insufficient if marginal cost is constant or decreasing.
    • Persuasive advertising: even if advertising ↑ monopoly price, monopolist may provide too little advertising.
Does advertising toughen or soften competition?

• Advertising can play 2 roles
  • “Constructive” role
    • Informs consumers about existence, characteristics and price of products
      → ambivalent effect on price competition
    • Or: ↑ perceived differences between brands
      → likely to soften price competition
  • Combative role
    • Helps firms steal each other’s business
      → likely to toughen price competition

• This general intuition needs to be confirmed by looking at specific market settings.
Typologies of advertising

<table>
<thead>
<tr>
<th>Effect on consumers?</th>
<th>Effect on rival firms?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informative</strong></td>
<td>Constructive role (Positive effect)</td>
</tr>
<tr>
<td></td>
<td>Promote a whole category of products</td>
</tr>
<tr>
<td><strong>Persuasive</strong></td>
<td>Increase perceived differentiation</td>
</tr>
</tbody>
</table>
Informative advertising

• Intuition
  • In monopoly, more informative advertising $\rightarrow$ more informed consumers $\rightarrow$ more profits
  • In oligopoly, more informative advertising $\rightarrow$ more informed consumers about several products $\rightarrow$ more intense competition $\rightarrow$ more or less profits?

• Model: extension of Hotelling model
  • 2 firms located at extreme points of $[0,1]$
  • Mass 1 of consumers uniformly distributed on $[0,1]$
  • Utility of consumer $x$ (assuming linear transport costs):

$$r - \tau x - p_1 \text{ if she buys 1 unit of good 1,}$$
$$r - \tau(1 - x) - p_2 \text{ if she buys 1 unit of good 2.}$$
Informative advertising (cont’d)

• Demands
  • Only a share $\lambda_i$ of consumers know about the existence of product $i$.
  • Probability of being informed: independent of location
  • 3 types of consumers
    • Fully informed $\rightarrow$ share $\lambda_i \lambda_j$ $\rightarrow$ indifferent consumer:
      \[ r - \tau \hat{x} - p_1 = r - \tau (1 - \hat{x}) - p_2 \iff \hat{x} = \frac{1}{2} - \frac{1}{2\tau} (p_1 - p_2) \]
    • Partially informed (know good $i$ only) $\rightarrow$ share $\lambda_i (1 - \lambda_j)$ $\rightarrow$ buy if
      \[ r - \tau - p_i \geq 0 \text{ (suppose } r \text{ large enough, so OK)} \]
    • Uninformed $\rightarrow$ share $(1 - \lambda_i)(1 - \lambda_j)$ $\rightarrow$ don’t buy
Informative advertising (cont’d)

- Demands (cont’d)

\[ Q_1(p_1, p_2, \lambda_1, \lambda_2) = \lambda_1 (1 - \lambda_2) + \lambda_2 \hat{x}(p_1, p_2) \]
\[ = \lambda_1 [(1 - \lambda_2) + \lambda_2 \frac{1}{2\tau}(\tau - p_1 + p_2)] \]

More informative advertising from both firms → larger share of fully informed consumers → larger price elasticity of demand
Informative advertising (cont’d)

• Equilibrium analysis
  • Firms simultaneously set prices and number of ads
    • To inform share $\lambda_i$ of consumers (about existence, price, characteristics of good $i$), firm incurs
    \[
    A(\lambda_i) = a\lambda_i^2 / 2
    \]
  • Firms’ program
    \[
    \max_{p_1,\lambda_1} (p_1 - c)Q_1(p_1, p_2, \lambda_1, \lambda_2) - A(\lambda_1); \text{ similarly for firm 2}
    \]
  • FOCs
    \[
    \frac{\partial \pi_1}{\partial p_1} = \lambda_1 \left[ (1 - \lambda_2) + \lambda_2 \frac{1}{2\tau} (\tau - 2p_1 + p_2 + c) \right] = 0
    \]
    \[
    \Leftrightarrow p_1 = \frac{p_2 + c + \tau}{2} + \frac{1 - \lambda_2}{\lambda_2} \tau
    \]
  Higher price than under full information
Informative advertising (cont’d)

• Equilibrium analysis

  • FOCs

\[ \frac{\partial \pi_1}{\partial \lambda_1} = (p_1 - c) \left[ (1 - \lambda_2) + \lambda_2 \frac{1}{2\tau} (\tau - p_1 + p_2) \right] - a\lambda_1 = 0 \]

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

• Symmetric equilibrium

\[ p^* = \frac{p^* + c + \tau}{2} + \frac{1 - \lambda^*}{\lambda^*} \tau \iff p^* = c + \frac{2 - \lambda^*}{\lambda^*} \tau \]

\[ \lambda^* = \frac{1}{a} (p^* - c) \left[ (1 - \lambda^*) + \lambda^* \frac{1}{2} \right] = \frac{1}{a} \frac{2 - \lambda^*}{\lambda^*} \tau \left[ (1 - \lambda^*) + \lambda^* \frac{1}{2} \right] \]

\[ \lambda^* = \frac{2}{1 + \sqrt{2a / \tau}}, \ p^* = c + \sqrt{2a \tau}, \ \pi^* = \frac{2a}{\left(1 + \sqrt{2a / \tau}\right)^2} \]
Informative advertising

• Observations
  • Higher price than under full information
    \( (a > \tau/2 \implies p^* > c + \tau) \)
    • Why? Lower elasticity of demand \( \rightarrow \) higher markup
  • More product differentiation \( (\tau \uparrow) \rightarrow \) higher prices
    • Stronger effect than under full information
  • Lower advertising cost \( (a \downarrow) \rightarrow \) lower prices
    • Why? \( a \downarrow \rightarrow \) advertising \( \uparrow \rightarrow \) more informed consumers
      \( \rightarrow \) more competition \( \rightarrow \) prices \( \downarrow \)
  • Amount of advertising \( \uparrow \) when \( a \downarrow \) or \( \tau \uparrow \)
  • Profits increase as advertising becomes more costly
    • Why? Negative direct effect (higher costs) more than compensated by positive strategic effect (lower share of informed consumers \( \lambda \rightarrow \) less intense competition)

\[ \lambda^* = \frac{2}{1 + \sqrt{2a/\tau}}, \quad p^* = c + \sqrt{2a\tau}, \quad \pi^* = \frac{2a}{(1 + \sqrt{2a/\tau})^2} \]
Informative advertising (cont’d)

• **Lesson**: Due to strategic effects of informative advertising, higher advertising costs translate into more market power → Firms’ profits can be higher in a market with higher advertising costs.

• **Applications**
  - **Testable hypothesis**: Internet search engines → lower advertising costs → lower profits?
  - Industry lobbying in favor of advertising restrictions?
    - High \(\alpha\) seen as collusive device
    - Advertising restrictions self-imposed by certain professions (e.g., lawyers, accountants)
Persuasive advertising

• Intuition
  • In **monopoly**, more persuasive advertising $\rightarrow$ outward shift of demand $\rightarrow$ more profits
  • In **oligopoly**, does the increase in one firm’s demand come at the expense of another firm’s demand?
    • **Yes** $\rightarrow$ shift of demand between brands $\rightarrow$ business stealing $\rightarrow$ advertising may be excessive (prisoners’ dilemma)
    • **No** $\rightarrow$ global demand expansion $\rightarrow$ advertising may be insufficient (public good nature)

• Modelling: 3 extensions of Hotelling model
  • Advertising increases willingness to pay
  • Advertising changes distribution of consumer tastes
  • Advertising increases perceived product differences
Persuasive advertising (sketch; see details in book)

- Advertising ↑ willingness to pay
  - Utility of consumer $x$ (with $\lambda_i =$ advertising intensity)
    
    $r + \beta \lambda_1 - \tau x - p_1$ if she buys 1 unit of good 1,
    
    $r + \beta \lambda_2 - \tau (1 - x) - p_2$ if she buys 1 unit of good 2.

- Advertising changes distribution of tastes
  - Symmetric distribution function
    
    $F(x; \lambda_1, \lambda_2) = (1 + \lambda_1 - \lambda_2)x - (\lambda_1 - \lambda_2)x^2$

- Lesson: In both cases, advertising expenditures are simply a form of wasteful competition: if firms could cooperate, they would agree not to advertise.
Persuasive advertising (sketch cont’d)

- Advertising ↑ perceived product differences
- Advertising intensities affect degree of product differentiation (i.e., transport cost):

\[ \tau(\lambda_1, \lambda_2) = \tau + \beta\lambda_1 + \beta\lambda_2 \]

- **Lesson**: Here, firms invest in advertising to relax price competition and, thereby, achieve higher profits. Because advertising is a public good, firms would even be better off by coordinating their advertising decisions.
Review questions

• Which industries advertise a lot? Give two examples and discuss the likely reasons for high advertising expenditures.

• Discuss the difference between persuasive advertising and advertising as a complement.

• Consider informative advertising about a product’s existence. Does an increase in the advertising cost function necessarily lead to lower profits? Discuss.

• Discuss possible effects of persuasive advertising under imperfect competition.