

Industrial Organisation

Topic 7: Advertising

Tom Holden

<http://io.tholden.org/>

Outline

- ▶ Why does advertising work? Three views:
 - Persuasive.
 - Informative.
 - Complementary
- ▶ More on advertising:
 - Models.
 - Welfare.
 - Empirics.
- ▶ Additional reference for the advertising material: [Bagwell \(2005\)](#)

Advertising (OZ 11)

- ▶ Do you think adverts work?
- ▶ How do you think they work?
- ▶ Why might economists be interested in advertising?

The persuasive view (OZ 11.1)

- ▶ Advertising changes people's preferences.
 - Advertising makes people less willing to substitute between the advertised good and its rivals.
 - Makes demand less elastic, meaning higher prices.
 - Also creates barriers to entry.
 - “I don't want a trainer, I want an Addidas trainer.”
- ▶ Suggests advertising is anti-competitive.
 - But how can we analyse welfare if preferences change?

The informative view (OZ 11.2)

- ▶ Advertising provides information about products (e.g. existence, price and quality).
 - Thus mitigates search and experimentation costs.
 - “The advert says Ariel cleans better than its competitor.”
 - May also provides indirect information.
 - “If Virgin were not a respectable airline they would not be able to afford to produce adverts such as these, as no one would fly with them more than once.”
 - Also helps entry, since entrants may ensure consumers know they have entered.
- ▶ Suggests advertising is pro-competitive.

The complementary view Bagwell (2005)

- ▶ Advertising provides a complementary good to the product it advertises.
 - Adverts for hybrid cars make a big deal out of the cars green credentials.
 - Thus if you own a hybrid car, and you care about the environment, seeing an advert for the car you bought may make you feel “smug”, i.e. increase your utility.
 - Adverts for Porsches feature people who are beautiful and/or rich and/or successful.
 - Thus when you see a Porsche you are inclined to assume the driver has high social status.
 - If the driver values being considered “high status”, then seeing a Porsche advert may be a complementary good to owning a Porsche for her. Once s/he’s seen the Porsche advert she knows that others who have seen it will see her as high status.
- ▶ Clearly related to the persuasive view.
 - But if advertising is a complementary good, then the welfare implications may be drastically different.

Advertising under monopoly (1 / 4)

(OZ 11.1.1)

- ▶ Temporarily abstract from questions about how advertising works, and assume that demand is some concave function of advertising, $Q(P, A)$.
- ▶ One firm.
- ▶ Production has constant MC of c , advertising has constant MC of r .
- ▶ Following [Dorfman and Steiner \(1954\)](#).

Advertising under monopoly (2 / 4)

- ▶ Profits: $(P - c)Q(P, A) - rA$
- ▶ FOC P : $0 = Q(P, A) + (P - c) \frac{\partial Q(P, A)}{\partial P}$.
 - So: $0 = P + (P - c) \frac{P}{Q(P, A)} \frac{\partial Q(P, A)}{\partial P}$
 - from multiplying both sides by $\frac{P}{Q(P, A)}$.
 - $\frac{P}{Q(P, A)} \frac{\partial Q(P, A)}{\partial P} < 0$ is the price elasticity of demand, which we will call ϵ_P .
 - Thus $0 = P + (P - c)\epsilon_P$, so $\frac{P - c}{P} = -\frac{1}{\epsilon_P}$.

Advertising under monopoly (3 / 4)

▶ Profits: $(P - c)Q(P, A) - rA$

▶ FOC A : $0 = (P - c) \frac{\partial Q(P, A)}{\partial A} - r$.

◦ So: $0 = (P - c) \frac{A}{Q(P, A)} \frac{\partial Q(P, A)}{\partial A} - \frac{A}{Q(P, A)} r$

• from multiplying both sides by $\frac{A}{Q(P, A)}$.

◦ $\frac{A}{Q(P, A)} \frac{\partial Q(P, A)}{\partial A}$ is the advertising elasticity of demand, which we will call ϵ_A .

• Thus $0 = (P - c)\epsilon_A - \frac{A}{Q(P, A)} r$, so $\frac{P - c}{P} = \frac{1}{\epsilon_A} \frac{rA}{PQ}$.

Advertising under monopoly (4/4)

- ▶ Equating the two conditions for $\frac{P-c}{P}$ gives: $\frac{1}{\epsilon_A} \frac{rA}{PQ} = -\frac{1}{\epsilon_P}$, i.e. $\frac{rA}{pQ} = \frac{\epsilon_A}{|\epsilon_P|}$ (as long as $\epsilon_P < 0$).
 - Known as the Dorfman–Steiner condition.
- ▶ So, advertising expenditure will be high relative to sales revenues when:
 - The advertising elasticity of demand is high.
 - I.e. advertising results in large demand increases.
 - The price elasticity of demand is close to zero.
 - So firms can charge a high mark-up without quantity falling too much.
- ▶ Finally, recall $\frac{P-c}{P} = -\frac{1}{\epsilon_P}$. So advertising only affects price through its (ambiguous) effect on the P.E.D..

Effect of advertising on price (1 / 2)

- ▶ Persuasive and complementary advertising may be modelled as shifting the demand curve.
- ▶ Suggests $Q(P, A) = F(A) + G(P)$.
 - With this specification, it may be shown (tedious!) that a sufficient condition for $\frac{dP}{dA} > 0$ is $G''(P) \leq 0$.
 - True for linear demand, but not true for isoelastic demand.
 - Possible to construct plausible examples in which advertising decreases price.

Effect of advertising on price (2 / 2)

- ▶ Informative advertising may be modelled as scaling the demand curve.
- ▶ Suggest $Q(P, A) = F(A)G(P)$.
 - Then the price elasticity of demand does not depend on A , so advertising will have no effect on the price.
 - Proof: $\frac{\partial Q(P,A)}{\partial P} = F(A)G'(P)$, so $\frac{P}{Q(P,A)} \frac{\partial Q(P,A)}{\partial P} =$
 $\frac{P}{F(A)G(P)} F(A)G'(P) = \frac{P}{G(P)} G'(P)$

Welfare: Dixit and Norman (1978) (OZ 11.1.2)

- ▶ Suppose we measure welfare relative to a fixed standard.
 - E.g. either their preferences pre-advertising or their preferences post-advertising.
 - Let $S(P)$ be consumer surplus, then our assumption just means that $S(P)$ does not depend directly on A .
 - Let $V(Q)$ be the maximum consumers would be prepared to pay to purchase a quantity Q .
 - Equivalently, $V(Q)$ is the area under the demand curve to the left of Q , so $V'(Q(P)) = P$.
 - Then $S(P) = V(Q(P)) - PQ(P)$, so
$$S'(P) = V'(Q(P))Q'(P) - Q(P) - PQ'(P) = -Q(P)$$

Welfare: Dixit and Norman (1978)

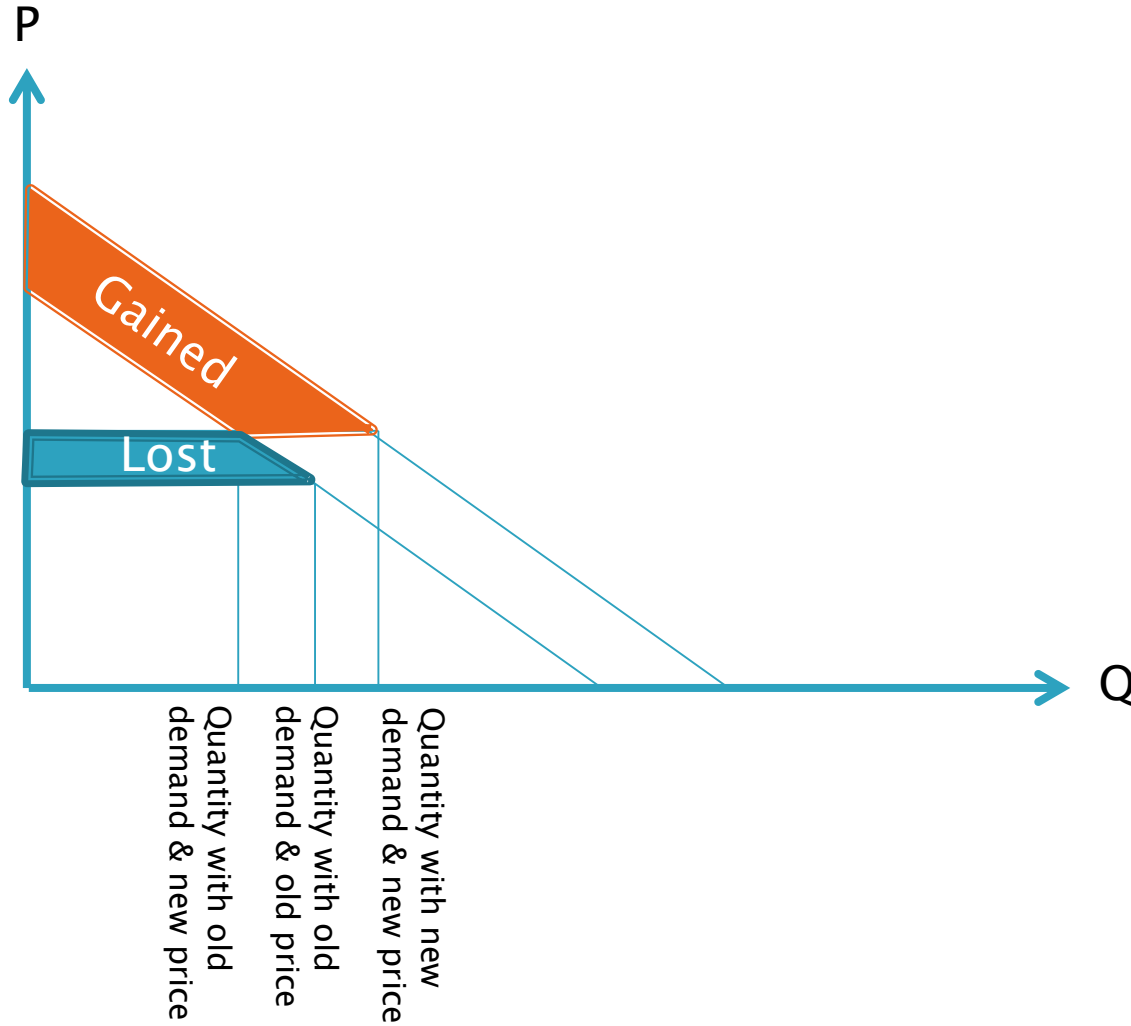
Continued

- ▶ Let:
 - $W(A)$ be total social welfare when an amount A of advertising is performed,
 - $P(A)$ be the price as a function of the amount of advertising performed, and
 - $\Pi(P, A)$ be profits at a price P after performing advertising A .
- ▶ Then $W(A) = S(P(A)) + \Pi(P(A), A)$.
- ▶ So, $W'(A) = S'(P(A))P'(A) + \frac{\partial \Pi(P, A)}{\partial P} P'(A) + \frac{\partial \Pi(P, A)}{\partial A}$.
 - But price was profit maximising before, meaning $\frac{\partial \Pi(P, A)}{\partial P} = 0$, and the advertising level was also profit maximising, so $\frac{\partial \Pi(P, A)}{\partial A} = 0$.
 - Hence: $W'(A) = -Q(P(A))P'(A)$.
 - Thus decreasing advertising would increase welfare at the margin providing $P'(A) > 0$.
 - Stated another way: there is excessive advertising if and only if cutting advertising would decrease prices.

Does a fixed standard make sense?

- ▶ If advertising genuinely acts by changing people's preferences, surely it is wrong to use a fixed standard.
- ▶ Standard alternative is to use valuations before and after.
 - Even this is only valid if the advert has not changed the value they put on other goods.
- ▶ Fits in naturally with the complementary and informative views.

Non-fixed standards (1 / 3)



Non-fixed standards (2/3)

- ▶ Non-fixed standards will moderate results about excess advertising, since there is an additional positive effect to counteract the negative Dixit-Norman effect.
 - Hence when prices don't change there will always be insufficient advertising.
 - It may be shown (see Bagwell) that there may be insufficient advertising even when increasing advertising would push up prices.
 - Sufficient conditions are that 1) when quantities are higher, the effect of advertising on prices is smaller and 2) increasing advertising increases quantities.
 - These conditions mean that the marginal consumer gets the least benefit from increased advertising, so the firm provides too little.

Non-fixed standards (3 / 3)

- ▶ An example with informative advertising:
 - $Q(P, A) = F(A)G(P)$ as we had before.
 - Then consumer surplus at the optimal price P^* is
$$\int_{P^*}^{\infty} Q(P, A) dP = \int_{P^*}^{\infty} F(A)G(P) dP = F(A) \int_{P^*}^{\infty} G(P) dP$$
 - So total surplus is given by: $W(A) = F(A) \int_{P^*}^{\infty} G(P) dP + \Pi(P^*, A)$.
 - Hence, $W'(A) = F'(A) \int_{P^*}^{\infty} G(P) dP + \frac{\partial \Pi(P^*, A)}{\partial A}$
 - But when A is chosen optimally, (i.e. $A = A^*$), $\frac{\partial \Pi(P^*, A)}{\partial A} = 0$ (from the firm's FOC).
 - So $W'(A^*) = F'(A) \int_{P^*}^{\infty} G(P) dP > 0$ (as advertising increases demand, and demand is always non-negative).
 - So there is too little advertising.

Advertising summary so far

- ▶ Three different views about how advertising works.
 - Read the Bagwell paper (or at least its introduction and conclusion) to get a wider picture.
- ▶ Advertising is not always bad.
- ▶ With persuasive advertising, welfare measures are ambiguous.

Informative advertising with free entry: Butters (1977) (1 / 3)

- ▶ There are a large number of firms, each of which can produce at most one instance of the same good, for a cost of c .
- ▶ There is no entry cost, but no one will buy from a firm unless they receive an advert from them.
- ▶ Sending an advert to one random consumer costs a . Each advert lists the firm's price.
- ▶ Consumers will buy from any firm that sends them an advert with a price below their valuation v .
- ▶ Consumers who receive adverts from multiple firms buy from the cheapest.

Informative advertising with free entry: Butters (1977) (2/3)

- ▶ If a firm sends an advert listing a price P , with some probability $X(P)$ it will be the cheapest advert that consumer receives, and they will make profits of $P - c$.
 - Thus total expected profits from sending an advert are $(P - c)X(P) - a$.
- ▶ Because there are a large number of firms (equivalently, no entry costs), each firm must make zero profits.
 - If there was a firm making positive profits, then I would want to send out adverts offering a price just below the one it had chosen.
 - But then my rival faces a lower probability of selling at his posted price, so must be making lower profits.
- ▶ Hence: $a = (P - c)X(P)$ for all P firms set, so $X(P) = \frac{a}{P - c}$.
 - Since $X(P)$ is a probability the price can never be below the level at which $1 = X(P) = \frac{a}{P - c}$, i.e. $P \geq a + c$.
 - Since no one will buy if $P > v$, no firm will advertise a price above v . But since $X(v) = \frac{a}{v - c} > 0$ there must be a probability $\frac{a}{v - c}$ that a consumer will only receive one advert, meaning firms can still sell at v .
 - Indeed, in equilibrium, there are firms setting a price at every point between $a + c$ and v .

Informative advertising with free entry: Butters (1977) (3 / 3)

- ▶ $X(P)$ looks a lot like the demand curve faced by each firm.
- ▶ Intuitively then, we might expect monopolistic-competition style distortions.
- ▶ In fact, this is efficient (welfare optimal).
 - Price is a transfer, so it's irrelevant.
 - The social benefit to reaching a new consumer (for sure) is $v - c$.
 - Thus the social benefit from sending another advert is $v - c$ times the probability that the consumer had not received any other adverts. But this probability is $\frac{a}{v-c}$, in equilibrium.
 - So social benefit to another ad equals the cost!
 - However, when consumers have heterogeneous valuations it may be shown that advertising is inadequate.

Advertising in oligopoly: Grossman and Shapiro (1984) (1 / 3)

- ▶ Two firms, Hotelling set-up, fixed locations (0 and 1), linear transport cost t , zero MC.
- ▶ Firm A (B) sends adverts to a proportion z_A (z_B).
- ▶ This costs them $\frac{r}{2}z_A^2$ ($\frac{r}{2}z_B^2$), where $0 < r < \left(\frac{3}{2} - \sqrt{2}\right)t$.
- ▶ Adverts are randomly distributed over consumers so, e.g. a proportion $(1 - z_A)(1 - z_B)$ receive no ads so do not buy.
- ▶ As in the standard Hotelling model, of those consumers who received two ads, the indifferent one is located at $x^* = \frac{1}{2} + \frac{p_B - p_A}{2t}$.
- ▶ Demand faced by firm A is then: $z_A(1 - z_B) + z_A z_B x^*$.

Advertising in oligopoly: Grossman and Shapiro (1984) (2/3)

- ▶ So firm A's profits are: $z_A \left[(1 - z_B) + z_B \left(\frac{1}{2} + \frac{p_B - p_A}{2t} \right) \right] p_A - \frac{r}{2} z_A^2$.
- ▶ FOC z_A : $0 = \left[(1 - z_B) + z_B \left(\frac{1}{2} + \frac{p_B - p_A}{2t} \right) \right] p_A - r z_A$.
 - i.e. $z_A = \frac{p_A}{r} \left[(1 - z_B) + z_B \left(\frac{1}{2} + \frac{p_B - p_A}{2t} \right) \right]$.
- ▶ FOC p_A : $0 = z_A \left[(1 - z_B) + z_B \left(\frac{1}{2} + \frac{p_B - p_A}{2t} \right) \right] - \frac{z_A z_B}{2t} p_A$.
 - i.e. $p_A = \frac{2t}{z_B} \left[(1 - z_B) + z_B \left(\frac{1}{2} + \frac{p_B - p_A}{2t} \right) \right]$.
- ▶ Solution must be symmetric, with $p := p_A = p_B$ and $z := z_A = z_B$. Hence:
 - $z = \frac{p}{r} \left(1 - \frac{z}{2} \right)$ and $p = \frac{2t}{z} \left(1 - \frac{z}{2} \right)$.
 - i.e. $\frac{pz}{2t} = \frac{rz}{p}$. So $p = \sqrt{2tr}$ and $z = \frac{\frac{p}{r}}{1 + \frac{1p}{2r}} = \frac{2p}{2r+p} = \frac{2\sqrt{2tr}}{2r+\sqrt{2tr}} = \frac{2}{1 + \sqrt{\frac{2r}{t}}}$.
 - For this to be valid we need $z < 1$. $r > \frac{t}{2}$ is necessary and sufficient for this.
 - Profits then are: $\frac{2}{1 + \sqrt{\frac{2r}{t}}} \left[1 - \frac{1}{2} \frac{2}{1 + \sqrt{\frac{2r}{t}}} \right] \sqrt{2tr} - \frac{r}{2} \left[\frac{2}{1 + \sqrt{\frac{2r}{t}}} \right]^2 = \frac{2\sqrt{2tr} \left(1 + \sqrt{\frac{2r}{t}} \right) - 2\sqrt{2tr} - 2r}{\left(1 + \sqrt{\frac{2r}{t}} \right)^2} = \frac{2r}{\left(1 + \sqrt{\frac{2r}{t}} \right)^2}$

Advertising in oligopoly: Grossman and Shapiro (1984) (3 / 3)

▶ So...

- Price is higher than without the need for advertising. ($r > \frac{t}{2}$ implies $P = \sqrt{2tr} > t$.)
- When products are more differentiated (t is high), there is more advertising.
 - So even if we observe higher differentiation in industries with a lot of advertising, it does not mean that advertising caused the differentiation.
- Expensive advertising actually increases profits.
 - High costs reduce the amount of advertising performed, reducing the proportion of consumers who see two adverts, pushing up prices.
- Advertising cost and differentiation have the same (positive) effect on profits, but opposite effects on the amount of advertising performed.
 - Thus we should not be surprised by finding either a positive or a negative correlation between advertising and profits.
- There may be too much or too little advertising.
 - If extra advertising reaches a new consumer, then the social benefit exceeds the private benefit to the firm (non-appropriability).
 - But firm A has an incentive to advertise more in order to expand its market share (business stealing).

Complementary advertising

- ▶ A model of complementary advertising will begin with specifications for agent's utility functions under which viewing adverts (or others viewing adverts) is a complement for the good.
- ▶ A very simple model is the following.
 - If I have not seen an advert, then I value the good at zero.
 - If I have seen an advert, then I value the good at v .
- ▶ Thus every model of informative advertising may be reinterpreted as a model of complementary advertising.

Empirics

- ▶ Read [Bagwell \(2005\)](#)!
 - Conclusion is that different views are valid in different industries.
- ▶ Consistent with the informative/search view.
 - [Benham \(1972\)](#) found eyeglass prices were higher where advertising was banned.
 - [Kwoka \(1984\)](#) found a similar result for optometry.
 - [Milyo and Waldfogel \(1999\)](#) look at the end of a ban on liquor price advertising and find firms cut the prices of only those goods that either they advertise or their rival does.
- ▶ Other important papers:
 - [Comanor and Wilson \(1967\)](#) find profits, advertising and differentiation move together. (Possible in [Grossman and Shapiro \(1984\)](#) model.)
 - [Nelson \(1974\)](#), [Porter \(1974\)](#), [Esposito et al. \(1990\)](#) – product characteristics are important. Experience goods different to search goods etc. Some evidence for an inverse-U relationship between concentration and advertising (but e.g. [Willis and Rogers \(1998\)](#) find the opposite result.)

Summary

- ▶ Advertising is not unambiguously bad.
- ▶ All three views (persuasive, informative, complementary) have something going for them.
 - But the persuasive view is unpopular these days for methodological reasons.
- ▶ Empirical evidence is hard to interpret, since differentiation, entry, advertising and profits are all endogenous.

Advertising exercises

- ▶ OZ Ex. 11.7
 - Question 1, 2

- ▶ OZ Extra exercises:
 - <http://ozshy.50webs.com/io-exercises.pdf>
 - Set #16